THE PRACTICUM IN INSTRUCTIONAL DEVELOPMENT

PROJECT GUIDEBOOK

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This *Project Guidebook* is designed to help you develop an effective instructional product—a set of instructional materials and procedures which if used as you intended will help a group of learners achieve some specific instructional objectives.

This *Project Guidebook* describes one approach to the process of developing instructional products. It presents that process as a set of development tasks. For each task, it provides a detailed description and suggestions of how to carry it out, examples of the work to be performed, and when appropriate, a list of other resources which can help with the task. Finally, it provides, in its appendices, materials to help with the planning, management, and evaluation of a development project.

To help you make best use of this *Project Guidebook*, we offer the following suggestions:

- Read through the introductory materials first to get an idea of the structure of the *Project Guidebook* and an overview of the development process;

- When you have an overview of the materials, increase your general understanding of the process by reading some of the articles in the list of resources at the end of "Introduction to Instructional Development;"

- As you begin work on your own project, consider the suggestions in Appendix A on how to plan and manage a development project;

- As you start a task for your project, refer to the detailed description of that task and the examples presented. To increase your understanding of what you are doing and why you are doing it, explore the resources suggested for each task;

- As you complete work on each task, use the appropriate review sheet in Appendix B to check your work, and, if possible, have the instructor or a fellow student make an independent assessment of your work, again using the review sheet as a guide.
INTRODUCTION
TO INSTRUCTIONAL DEVELOPMENT
This Guidebook shows you one way to describe the process of instructional development. It is based on procedures identified by developers of programmed instruction and by developers of more complex instructional systems. These procedures have been redefined and organized to help the developer of small-scale instructional products.

The concept of instructional development followed in the Guidebook asks that students be committed to:

- the idea of objectives-based instruction--that is, to the belief that any instruction worthy of development should be directed towards specific purposes or ends.

- the value of empirically-validated instruction--that is, to the idea that instruction should be tried out and revised until there is substantial empirical evidence that it helps learners achieve the ends.

To help you to get an overview of the instructional development process, you should know what an "instructional product" actually is, understand the phases that organize the development process, and be familiar with some of the materials that have been written about instructional development. The three remaining sections of this introduction cover these needs.
"Instructional product" can refer to a wide range of materials. Regardless of their form, instructional products have three essential characteristics:

1. **INSTRUCTIONAL PRODUCTS ARE DESIGNED TO ACHIEVE SPECIFIC OBJECTIVES.** These objectives describe what will be learned as a result of using the product. Objectives are usually selected to meet a demonstrated need of a group of learners.
2. INSTRUCTIONAL PRODUCTS ARE DESIGNED TO OFFER REPLICABLE INSTRUCTION. By replicable, we mean that the product can be used by people other than the developers to provide instruction in a specified way.

3. INSTRUCTIONAL PRODUCTS ARE DESIGNED SO THAT THEIR EFFECTIVENESS CAN BE TESTED AND DEMONSTRATED. They are tried out with representative samples of the intended learners, and a description of their instructional effectiveness during these tryouts is made available to users of the product.
THE PROCESS OF INSTRUCTIONAL DEVELOPMENT

In the Project Guidebook, the process for developing instructional products is organized into three phases.

**PHASE I: PREPARE SPECIFICATIONS**

In this phase, a proposal for an instructional product is developed into a set of specifications for the product. To prepare specifications, a developer states the objectives of the product and gathers information that verifies the need for the product and establishes its design requirements.

 TASK 1: PREPARE A PROPOSAL FOR AN INSTRUCTIONAL DEVELOPMENT PROJECT

 TASK 2: DEVELOP OBJECTIVES AND PROCEDURES FOR MEASURING THEIR ACHIEVEMENT

 TASK 3: TRY OUT THE MEASURES AND DETERMINE THE LEARNER POPULATION'S LEVEL OF PERFORMANCE ON THE PROPOSED OBJECTIVES

 TASK 4: IDENTIFY RELEVANT LEARNER EXPERIENCES AND REQUIREMENTS FOR THE DESIGN OF THE PRODUCT
PHASE II: DESIGN A PROTOTYPE

In this phase, a prototype of the instructional product is designed and developed. A prototype is a low-cost mock-up of the instructional product and may be in the form of a script, storyboard, or simple paste-up. The prototype is then tried out with a small group of learners to determine its instructional effectiveness. The results of these tryouts are used to redesign and improve the prototype.
PHASE III: DEVELOP THE PRODUCT

In this phase, the prototype is developed into a refined and finished instructional product. This development may require audio tapes, filmstrips, and manipulative and printed materials, as well as directions for teachers and administrators who will use the product. The finished product is tried out with substantial numbers of learners to determine its effectiveness when it is used as intended. The results of such tryouts may require revision of the product.

TASK 8: DEVELOP INSTRUCTIONAL PRODUCT FROM THE PROTOTYPE

TASK 9: TRY OUT THE FINISHED INSTRUCTIONAL PRODUCT AND DETERMINE ITS INSTRUCTIONAL EFFECTIVENESS AND USABILITY
FOLLOWING THESE PHASES IN THE DEVELOPMENT OF AN INSTRUCTIONAL PRODUCT WILL HELP INSURE THAT THE PRODUCT MEETS THREE ESSENTIAL CRITERIA:

- it has been designed to achieve specific objective(s).
- it has been designed to provide replicable instruction apart from the developer.
- it is accompanied by evidence as to its instructional effectiveness.
Each of the phases described involves developmental and empirical tasks. Each phase should therefore be seen as part of a dynamic cycle of development, testing, and revision.

In carrying out the tasks associated with each of the phases, you will sometimes be working as a planner, at other times as a developer, and on still other occasions as an evaluator. For example:

- as a planner, you will clarify objectives, prepare designs, and plan tryouts.

- as a developer, you will develop measures and prototypes, and make revisions, until the refined and finished product is completed.

- as an evaluator, you will assess the measures, the learner’s need to achieve the objectives, and the effectiveness and usability both of the prototype and of the finished product.
Resources on Instructional Development

To help you become more familiar with the instructional development process, we suggest that you take a look at some of the materials in the following groups of resources. Group 1 suggests a number of general articles on the process of development. Each presents a useful perspective; they are strongly recommended to all students. Group 2 lists books and periodicals that describe some of the existing instructional products; they are useful references for all students. Group 3 is a list of more specialized works that are best considered after a student has had some experience with development work.

1. Introductory Articles on Product Development


Each of these articles describes the general characteristics of instruction and of instructional design and development. Each article presents a somewhat different perspective. The first is written by a professor interested in programmed instruction, the second by a leading researcher interested in instructional conditions required for different types of learning, the third by a director of a research and development center concerned with individualization of instruction, and the last by a director of an educational laboratory committed to large scale instructional development of consequence for primary education across the nation.

2. Descriptions and Reviews of Instructional Products


This sourcebook is in the form of a catalog describing available elementary-level instructional products. Information provided includes goals, time required, instructional approach, tests, cost, and availability.


This is a periodical report describing instructional products. The report initially focused on educational hardware (tape cassettes, filmstrip projectors, movie screens); more recently it has provided analytical reviews of instructional programs and products.


American Institutes for Research has recently completed 21 short product development reports for the U. S. Office of Education. Each report documents the development of an instructional product which has or is expected to have an impact on educational practice. Each report describes the product, the origins of the product, the process followed in developing the product, current evidence regarding its effectiveness and use and what appears to have been the most critical decisions made during its development. These reports provide a valuable perspective on the current state of instructional development.
3. Descriptions of The Process of Instructional Development


This chapter in the Second Handbook of Research on Teaching is a comprehensive review of the state of instructional development. After a short discussion of the historical background to instructional development, the review considers each of the major stages of the development process, the procedures used at each stage, and the status of research in those procedures. The chapter concludes with discussions of development in a variety of fields, and provides an excellent bibliography.


This book discusses the tasks of planning, developing, evaluating, disseminating, and managing large-scale development programs. It presents examples drawn from the programs of the Far West Laboratory for Educational Research and Development.
THE TASKS OF PHASE I:

PREPARE
SPECIFICATIONS
PHASE I: PREPARE SPECIFICATIONS

Phase I of the instructional development process involves the preparation of a project proposal and the development of that proposal into specifications for an instructional product. Specifications describe what an instructional product is to achieve, with whom, and under what conditions.

Specifications serve two general purposes: they provide empirically-based information to guide the design of a prototype product, and they suggest the standards of instructional effectiveness that can be used to evaluate a product. In addition, if the developer is working with a product sponsor, specifications can help the developer to clarify the sponsor's instructional intentions.

In preparing specifications for your product, you will undertake four tasks:

- prepare a proposal for an instructional development project;
- develop objectives and procedures for measuring learner achievement of them;
- try out the measures and determine the learner population's level of performance on the proposed objectives;
- identify relevant learner experiences and requirements for the design of the product.
A preferred sequence for undertaking these four tasks is suggested in the figure below:

SEQUENCE OF THE TASKS OF PHASE I

After preparing your proposal, work is generally initiated on both Tasks 2 and 4. When work on these tasks has reached the point where empirical evidence is needed, Task 3 is initiated along with the data collection step of Task 4. The results of these data-gathering activities may require revision of Task 2 objectives and measures and a new tryout of the measures. When Phase I work is completed, it is summarized in a "Specifications" document.

The work of Phase I primarily involves clarifying your intentions and gathering information that will help you design your product. Complete this work as rapidly as possible so that you can proceed to design and develop your product.
TASK 1

PREPARE A PROPOSAL FOR AN INSTRUCTIONAL DEVELOPMENT PROJECT

In this task, you will select a goal for your project and determine if there is a group of learners who need to achieve your goal and are willing to use your product. The result of the task is a project proposal.
DESCRIPTION OF TASK 1

This task involves three steps:

1. **Identify a goal for your project.** On the basis of your knowledge and experience, select a goal for a short (1 to 3 hour) instructional product. State that goal in terms of what you would want the learners to be able to do as a result of using your product.

2. **Determine if there is a group of learners interested in and willing to use your product.** Discuss with learners, and with teachers, administrators, or other potential users, your interest in developing an instructional product. Determine if they would find such a product useful and if they are willing to serve as a tryout group. You will need
   - 15 to 30 learners to take your measures (Task 3)
   - a sample of users to provide information about instructional requirements and preferences (Task 4)
   - two groups of learners, 3 to 8 in number, to work through your prototype (Task 7)

3. **Prepare a proposal.** Your proposal should include:
   - a brief rationale explaining why your proposed product may be needed
   - a statement of the goal for your product
   - a description of the learners who will use your product
   - a description of the instructional setting in which your product may be used
RESOURCES FOR
TASK 1

The following resource material will help you to select a goal and prepare a proposal. These materials are intended to:

- clarify what is meant by "instructional goal"
- describe the types of learning your goal might represent
- suggest where you might get ideas for goals
- provide some questions to help you critique your ideas for goals
- provide you with an example of a project proposal

Each section also gives examples of goals which other Practicum students have pursued.
I. DEFINITION OF AN INSTRUCTIONAL GOAL

An instructional goal is a general statement describing what a group of learners will be able to do as a result of using an instructional product. Rather than thinking about goals in these terms, however, developers often think in terms of topics or content they want their product to present, such as:

- Einstein's Theory of Relativity
- Stock Market Crash of 1929
- Themes of Red Badge of Courage
- Purchasing a House
- Tuning a Volkswagen

Similarly, instead of thinking about what the learners will do after using the product, developers may start by describing what their product will do for the learners, such as:

- demonstrate Ohm's Law
- stimulate inquiry into the causes of World War I
- present examples of metaphors
- describe the clauses that might appear in a lease
- illustrate the steps for cleaning a 22 rifle

Although ideas generated by these approaches suggest possible goals, none of the statements above is a goal statement that describes what learners will be able to do as a result of using an instructional product. Examples of goal statements formulated by previous Practicum students are these:

- 7th-grade geography students will read and interpret topographical maps.

- 4th-grade mathematics students will measure objects using units of the metric system.

- Job Corpsmen will supply requested information by using a standard telephone directory.

- Pregnant women, visiting the clinic, will follow a specified diet.

When you are developing goal statements, keep in mind these ideas:

- Use language that you understand and are comfortable with. The time for clarifying the goal and stating it more precisely comes after you have found an appropriate goal for your project.

- Be sure that the goal describes what the learners will be able to do as a result of using the product.
II. TYPES OF PROJECT GOALS

Many attempts have been made to classify the types of learning towards which instruction can be directed; each has its value and limitations. One classification that the Fractium has found useful has been formulated by Robert Gagné.* He describes five major classes of learning: motor skills, verbal information, intellectual skills, cognitive strategies, and attitudes. A definition of each of these types of learning along with several examples for each type appear below:

MOTOR SKILL:

The learning of physical skills and manipulations. Examples of this type of learning are:

- The learner will tie his own shoelaces.
- The learner will correctly sing vowel sounds.
- The learner will print all of the letters of the alphabet.

VERBAL INFORMATION:

The learning of facts and generalizations. This learning is observed when learners can recall or restate the information previously presented. Examples of this type of learning are:

- The learner will list the names of at least five journals in which educational results are reported.
- The learner will recall the boiling temperature of water in Centigrade degrees.
- The learner will restate the cost of mailing first class letters.

INTELLECTUAL SKILLS

Gagné describes three types of intellectual skills:

1. **Concepts**: Learning to classify persons, objects, actions, or ideas, and to indicate why the items are so classified. This learning is observed when learners, who are presented with a set of new examples, can identify which are positive and which are negative examples of the concept. Usually, the learners state the definition of the concept in the process and indicate how they classified the examples. Examples of concept learning are:

   - The learner will classify any tree into its appropriate genus.
   - The learner will correctly label each part of a business letter.

2. **Rules**: Learning the relationship existing between or among two or more concepts. This learning is observed when learners can solve problems by applying the rule. Examples of rule learning are:

   - The learner will solve word problems involving the volume, mass, and pressure of a gas.
   - The learner will supply capitals, end punctuation, and internal punctuation where needed in a 100-word paragraph.

3. **Procedures**: Learning a specific sequence of steps that will consistently yield a desired outcome. This learning is observed when learners produce a product or answer by applying a procedure. Examples of this type of learning are:

   - The learner will solve division problems involving four-digit numbers and resulting in only whole numbers.
   - The learner will correctly use a spectrophotometer.
COGNITIVE STRATEGIES

Learning to solve problems, where there is no formal procedure consistently leading to a solution, but where approaches to the problem have a probability of being successful. Examples of this type of learning are:

- The learner will generate three techniques for reducing smog.

- The learner will design an experiment to test the value of vitamin pills for household pets.

ATTITUDES

An attitude is a predisposition to act in relation to some "object." It is best observed in a free-choice situation where the learner says or does something to approach or avoid the object. Examples of this type of learning are:

- The learner may demonstrate interest in mathematics by signing up for a summer mathematics course.

- The learner may demonstrate concern for the educationally deprived by volunteering for a weekend tutorial program.

- The learner says that he supports legislation to control pollution.

You will generally find goals directed toward intellectual skills both challenging and feasible for short instructional products. You will generally find goals directed toward acquisition of verbal information are not very challenging and that goals directed toward attitudes or cognitive strategies are too ambitious for short instructional products.
III. SOURCES OF IDEAS FOR PROJECT GOALS

Ideas for project goals should come from your own experience as a student, teacher, employee or employer, or member of the community. Of course, in on-the-job development, goals are usually determined by collaborative effort or through the use of some "needs assessment" procedure.

From your experience as a student, you may recall important topics which you felt were poorly taught. For example,

- one student remembered difficulty in reading and interpreting topographical maps and set out to develop a product to teach these concepts,
- another recalled his own problems in a poetry class and decided on a product instructing students in poetry writing.

From your experience as a teacher, you may recall lessons which gave some students a great deal of difficulty. For example,

- a teacher-developer chose the length measurements of the metric system—a topic she had difficulty teaching the previous year,
- a science instructor wanted help in demonstrating how seasons are dependent on the relationship between the earth and sun.

From your experience as an employee or employer, you may identify needs for on-the-job or in-service training. For example,

- one developer, who supervised secretaries and clerk-typists, decided that she could use a product to train new employees for their job. She began by designing a product on telephone skills (e.g., answering the telephone, taking messages, using the directory, obtaining information from operators).

From your experience in the community, you may have noticed needs which could be alleviated by the availability of instructional products. For example,

- one developer, concerned about the way people are exploited by loan sharks, decided to prepare a product on when, where, and how to obtain a loan.

If you find it difficult to come up with ideas for project goals, turn to your instructor, other teachers, employers, or community workers for ideas. For example,

- an obstetrician in a community clinic suggested a product that would detail nutritional needs for the clinic's pregnant patients,
- a professor instructing student teachers asked for a product to assist young teachers in identifying emotionally disturbed children in the classroom.
IV. CRITERIA FOR SELECTION OF A PROJECT GOAL

Several worthy goals may occur to you. To help you make a final choice, consider your goals in the light of these questions:

1. **Is the goal sufficiently worthwhile to warrant the development of an instructional product?**

   Since you will be spending many hours on your project (individually or as part of a team), you will want your effort to be spent on a project of some importance. Students in product development have found that it is often more interesting and rewarding to focus on a product that teaches conceptual or intellectual skills rather than simple verbal information or rote learning. For example,

   a counselor wanted student teachers to go into job interviews knowing what information they should present about themselves and what information they should get from the interviewers. In discussing his idea, a developer suggested that the counselor should add instruction on how to present themselves and how to request information from the interviewer.

2. **Can the goal be achieved by a small instructional product?**

   During a one-semester course, you will have approximately 30 to 50 hours of preparation time to devote to your project. It is estimated that this would allow you to produce one to three hours of instruction for the product user. In a product of such limited size, you cannot undertake a goal of great scope; however, your goal can be integral to a large-scale program. For example,

   an elementary school teacher came to class with the goal of developing a product to enable her 5th-grade students to write good descriptive compositions. After a great deal of discussion, her goal was narrowed to a more feasible objective directed toward increasing student use of descriptive verbs in their written work. (During the school year, she would fit her product into her larger scheme involving composition writing.)
3. Do you have knowledge of the goal's subject matter?

Do not commit yourself to hours of research by choosing a topic that you are not familiar with. The effort involved in developing a valuable product is considerable in itself without the added burden of acquiring knowledge about a new area. There is simply not enough time for you to learn the subject matter and to develop a product to teach it. For example,

A student in a development class was convinced of a need for a product dealing with nutrition. However, she severely underestimated the time needed to investigate all the latest findings in this area. As the course neared an end, she found that she had little time for the design and development of the product—all her efforts had gone into background research.

4. Do you have personal experience with the learner population?

Although experience with the learner population is not essential (the Practicum recommends that a developer gather information from the learner group in Tasks 3 and 4), such experience can be particularly valuable in the design and development of the product. In these tasks, a developer can work far more efficiently if he knows the pace at which learners work, the vocabulary they can handle, and what they find interesting and humorous. For example,

a student decided to develop a product to teach 4 and 5 year olds about geometric shapes, even though she had never worked with that age group. She quickly discovered that her materials did not even capture the attention of the young children.
To give you an idea of what a product proposal might look like, the following example is furnished.

PROPOSAL FOR AN INSTRUCTIONAL PRODUCT
ON MENU SELECTION AND FOOD PURCHASING FOR
THE MENTALLY HANDICAPPED

Rationale:

The special education program of the local community has created a half-way house where the mentally handicapped can acquire the skills they would need to be able to live in the community (e.g., rent and take care of an apartment; shop for food, clothing, and other necessities; prepare meals; use the public transportation system to get from their apartment to work and back; use leisure time). The half-way house has a great need for instructional materials that would help the mentally handicapped acquire these skills.

Goal:

Given a fixed budget, students will be able to choose a set of menus and purchase the food required by those menus.

Learner Population:

Mentally handicapped people living at the half-way house. These people have employment in the community, can read 3rd to 4th grade level, and are interested in living on their own in small groups in the community.

The director of the half-way house is willing to use any product developed. The members of the half-way house are available any evening.

Instructional Setting:

Half-way house presents an instructional program for its members lasting for one hour every evening. The program also involves field trips on the weekends. During the program, members work on their own or with a volunteer tutor.
In this task you will clarify what you want learners to be able to do as a result of using your instructional product and develop measures to determine if learners can, indeed, do it. The result of this task is a set of instructional objectives and procedures to measure learner achievement of the objectives. The objectives may be differentiated into three groups:

- "terminal objectives:" precise statements of the goal of the product
- "sub-objectives:" those other objectives for which instruction must be provided before the learners can achieve the terminal objectives
- "entry skills:" those objectives which describe what you assume learners must know or be able to do before they use your product
DESCRIPTION OF TASK 2

This task involves three steps:

1. Clarify the instructional goal. In this step, describe precisely the learner behaviors implied by the goal; describe the content referred to in the goal; select procedures for measuring learner achievement of the goal; and establish standards for assessing learner performance on the measures. The clarified goal may be summarized in expanded objective form or by one or more terminal objective statements.

2. Identify possible sub-objectives and entry behaviors. In this step, define what the learners must know or be able to do in order to achieve the goal. You will be concerned with identifying both:

   - entry behaviors--the knowledge, skills, and attitudes that you assume learners will bring to your product, and

   - sub-objectives--the knowledge, skills, and attitudes that you will provide instruction on.

After identifying the sub-objectives, clarify the content and behavior of each and select appropriate procedures for measuring their achievement.

Of course, you will not be able to make a final decision on which objectives should be considered "sub-objectives" and which "entry behaviors" until you have collected empirical evidence for that decision in Task 3.
3. Generate the measures required for each objective. The clarification of each objective has described one or more measurement procedures and the standards to be used to assess learner performance on those measures. Using these procedures and standards as guidelines, generate the items required. These items should sample the full range of behaviors and content identified for that objective. Be sure to generate a large enough number of items for each objective so that if some are eliminated in Task 3, there will still be a sufficient number to assess learner achievement.

NOTE

In carrying out this task, you may have trouble distinguishing Step 1 from Step 2 of the task. Remember that Step 1 involves taking a given goal or objective statement and clarifying its intent, whereas Step 2 involves taking a goal or objective and asking what other objectives must be included in the product before learners can achieve the terminal ones.

Sometimes you will discover that in trying to rewrite a goal as a precisely-worded objective, you may fail to communicate the goal's full intent. In such a case, see if several objectives may be required to express the goal's intent.
RESOURCES FOR
TASK 2

The following resource materials will help you with
Task 2. They describe:

- the steps to follow in clarifying an instructional
goal
- a strategy for identifying possible sub-objectives
- guidelines for writing each of the major types of
test items: true-false, multiple-choice, matching,
completion, short-answer, and essay

An example of a clarification of an instructional
goal from elementary mathematics is provided.
I. CLARIFYING AN INSTRUCTIONAL GOAL

Most development projects begin with a general goal describing what learners will be able to do as a result of instruction. Clarifying that general goal helps developers to determine what specific outcomes the instruction is designed to achieve and how to judge whether a learner has achieved these outcomes.

The process of clarifying a goal can be organized as follows:

- describing the learner behavior implied by the goal
- describing the content of the goal
- selecting a procedure for measuring learner achievement of the goal
- establishing standards against which to assess learner performance on the measures

Describing Learner Behavior

Describing learner behavior involves clarifying a goal's statement by choosing behaviors that describe more precisely the intention of instruction. For example, in the goal "Job Corpsman will supply requested information by using a standard telephone directory," describing learner behavior means to specify what is meant by "will supply information." In the goal "Pregnant women will follow a specified diet," describing learner behavior means stating exactly what is meant by "will follow a specified diet."

To describe precisely the learner behavior implied by a goal, some developers attempt to identify a single action verb to substitute into the goal statement. Though this strategy will result in a more precisely-worded statement, it frequently fails to convey the full intent of the goal, for most goals imply a complex of behaviors.

A better strategy is to brainstorm the full range of behaviors implied by a goal, noting both overt and covert behaviors (the list below presents some of the verbs used to describe these behaviors), then to select from those possible descriptions of learner behavior the ones that best convey the intent of the goal, and finally, to rewrite the goal into one or more terminal objectives that use these descriptors.
Some Verbs Developers Use to Describe Overt Behaviors

read  talk  group  name
write discuss assemble describe
draw debate disassemble order
touch perform demonstrate construct

Some Verbs Developers Use to Describe Covert Behaviors

recall compare predict invent
identify analyze apply synthesize
classify infer evaluate discriminate

Example

Goal: "The learner can find areas of polygons."

Describing learner behavior for this goal involves describing what is meant by "can find areas." One developer might decide that the goal means only "to be able to compute an area." Another might decide that computing an area and writing the appropriate formula is the goal's intention. Thus, two terminal objectives corresponding to this goal might be:

- The learner will select the appropriate formula for computing the area of a polygon.

- Given the appropriate formula and dimensions of a polygon, the learner will compute the area of a polygon.
Describing Content

Describing content involves either listing or stating rules for listing the content that learners will encounter during instruction and respond to in test situations. In your description, you define the domain of content that you consider essential for the mastery of your goal and its terminal objectives.

Example

Terminal Objectives:

The learner will select the appropriate formula for computing the area of a polygon.

Given the appropriate formula and the dimensions of a polygon, the learner will compute the area of a polygon.

With these objectives, the developer needs to describe what polygons will be included in instruction, how the formulas may be expressed, what dimensions may be used, and how they should be labeled. The resulting description of content limits might be:

- only the following polygons will be used: squares, rectangles, triangles, parallelograms
- formulas will be expressed in terms of base and height or "b" and "h"
- dimensions will be stated as whole numbers of no more than two digits (no fractions or decimals)
- dimensions will be labeled as meters or centimeters

Selecting Measurement Procedures

The selection of a procedure for measuring learner achievement of an objective may require two decisions. At one level, your decision is whether learner achievement can best be determined by observing and rating some sample of learner behavior or by assessing some work a learner has prepared or produced. For example, objectives directed toward such motor skills as driving an automobile would require an observation and rating procedure whereas objectives related to the understanding of a concept or the application of a rule might best be assessed through some work a learner produced.
If your decision is to assess, or measure, some work a learner has produced, you must then decide upon the best way of assessing that work. In making this decision, you will consider different item formats and try to select the ones most appropriate for sampling work reflecting the behavior and content of the objective. Item formats appropriate for assessing work produced by the learner may be described in terms of three categories: selected response items, constructed response items, and items that combine selected and constructed response formats. Selected response items include true-false, multiple-choice, and matching items. Constructed response items include completion, short-answer, and essay items. Combination items ask learners to select an alternative (using a selected response item format) and to explain the reason for that choice (using a constructed response item format).

In making these decisions, you should see if it is feasible to use several measurement procedures to assess learner achievement of an objective. If you use different procedures and obtain similar results, you will have greater confidence in the conclusions you draw from those measures about the learners' performance.

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**Example**

For the goal, "The learner can find areas of polygons," a constructed response item might be used:

Find the areas of these polygons:

a. \[ \begin{array}{c} 1 \text{ m} \\ 1 \text{ m} \end{array} \]  
Area =

b. \[ \begin{array}{c} 2 \text{ cm} \\ 6 \text{ cm} \end{array} \]  
Area =

---

For the objective, "The learner will select the appropriate formula for computing the area of a polygon," a selected response item might be used:

Which formula would you use to find the area of a

a. bh  
b. 1/2 bh  
c. 1/3 bh

If the dimensions of a triangle are b=5 and h=6, what does 1/2bh equal?

a. 15  
b. 30  
c. 56
Establishing Performance Standards

Performance standards are the criteria you will use to decide if a learner has or has not achieved an objective. The standards you set depend on the measurement procedures you have selected.

If you decided to observe learner behavior, then your standards for an acceptable learner performance may specify:
- that a particular behavior occur during a specific time period
- that a particular behavior occur at a certain frequency during a specific time period
- the quality that should be displayed in the behavior

If you decided to assess some work produced by the learner and opted for using a constructed response measure (e.g., essay item, term paper, project), then your standards for acceptable learner performance may include:
- a list of substantive points to be made in the essay or paper
- a checklist for the form in which a paper or project is to be presented
- a rating scale for judging more abstract qualities (e.g., writing style)

If you decided to assess some work produced by the learner and opted for using a selected response measure (e.g., true-false, multiple-choice, matching items), then your standards may include:
- the correct learner response for each item
- the proportion of items for an objective which a learner needs to get correct

In establishing performance standards, the issue of a group performance standard (what proportion of a group must meet the standards for each objective) is sometimes considered; however, usually an empirical tryout is required to set realistic group standards.

Example

For test items like: "Find the area of this polygon:"

\[
\begin{array}{c}
5 \text{ meter} \\
\downarrow \\
1 \text{ meter} \\
\downarrow \\
4 \text{ meter}
\end{array}
\]

performance standards might include:
- the learner presents the correct formula \( A = 1/2 \times b \times h \)
- the learner correctly substitutes the values of the dimensions in the formula \( A = 1/2 \times 4 \times 1 \)
- the learner computes the correct answer \( A = 2 \)
- the learner correctly labels the answer \( A = 2 \text{ sq. meters} \)
Summary

To summarize the results of clarifying a goal and to facilitate review of your work, a summary is prepared. This summary may follow the format illustrated below:

Example

Goal: The learner can find areas of polygons.

Terminal Objectives:
- The learner will select the appropriate formula for computing the area of a polygon.
- Given the appropriate formula and the dimensions of a polygon, the learner will compute the area of a polygon.

Content Limits:
- only the following polygons will be used: squares, rectangles, triangles, parallelograms
- formulas will be expressed in terms of base and height or "b" and "h"
- dimensions will be stated as whole numbers of no more than two digits (no fractions or decimals)
- dimensions will be labeled as meter or centimeters

Measurement Procedure:

Constructed response items will be used for the goal and selected response items for terminal objectives. See sample items below:

1. Find the areas of this polygon:

   \[
   \begin{align*}
   2 \text{ cm} & \quad \text{Area} = \quad 6 \text{ cm} \\
   \end{align*}
   \]

2. Which formula would you use to find the area of a ?

   \[
   \begin{align*}
   \text{a. } bh & \\
   \text{b. } 1/2 bh & \\
   \text{c. } 1/3 bh & \\
   \end{align*}
   \]

3. If the dimension of a triangle are \( b = 5 \) and \( h = 6 \), then what does \( 1/2 \ bh \) equal?

   \[
   \begin{align*}
   \text{a. } 15 & \\
   \text{b. } 30 & \\
   \text{c. } 56 & \\
   \end{align*}
   \]

Performance Standards:

For constructed response items:
- correct formula must be presented
- values must be correctly substituted in the formula
- computations must be correct
- areas must be expressed in square units

For selected response items, 10 out of 12 items must be correct.
II. IDENTIFYING SUB-OBJECTIVES

Before learners can achieve most terminal objectives, they will first have to acquire other knowledge and skills. These prerequisite knowledges and skills should be identified so that you can decide which you will include in your product as sub-objectives.

To identify possible sub-objectives, consider using the following general question as a guide:

What do learners need to be able to do before they can perform the task stated in the objective?

To make this question more useful, you should substitute in terms drawn from the specific objective of interest.

---

**Example**

To identify sub-objectives for the terminal objectives of the goal "finding areas of polygons," the following questions might be asked:

What do learners need to be able to do before they can identify the appropriate formula for area of a polygon?

Possible answers (sub-objectives)

- learner can define the concept of area
- learner can identify different polygons
- learner can describe what dimensions of each polygon are used to determine its area
- learner can name what arithmetic operation is performed to determine area of a particular polygon
- learner can state the operations for finding area of a polygon as a formula \( A = b \times h \)

What do learners need to be able to do before they can use a formula to control the area of a polygon?

Possible answers (sub-objectives)

- learner can substitute the values of the correct dimension of a polygon into the formula
- learner can multiply the values of the dimensions of a polygon
The process of asking appropriate questions for each terminal objective can now be repeated for each sub-objective until the developer feels that all important sub-objectives have been identified. The sub-objectives actually used in your product will depend on the empirical evidence you will collect in Task 3.

After each sub-objective has been identified, it should be clarified in the same way that the goal was—that is, the learner behaviors, content, measurement procedures, and performance standards should be described and summarized in a manner similar to the example below.

---

**Example**

**Sub-Objective:** The learner can substitute the values of the correct dimension of a polygon into the formula.

**Content Limits:**
- only base and height or "b" and "h" will be included in formulas
- meters or centimeters will be used as units of measurement

**Measurement Procedure:** constructed response items; for example:

Rewrite the formula \( A = bh \), using numbers from the rectangle below:

\[
\begin{array}{c}
1 \text{ m} \\
5 \text{ m}
\end{array}
\]

**Performance Standard:** 5 out of 5 items correct.
III. GENERATING TEST ITEMS

The principal guidelines for generating measures is your clarification of each objective. However, if you will be writing traditional test items (e.g., true-false, multiple-choice, matching, completion, short-answer, and essay items), you may find helpful some of the guidelines test item writers use.*

TRUE-FALSE ITEMS

The true-false item can be used to determine a student's ability to judge the correctness of statements of facts, principles, and definitions. True-false items should consist of statements that can be answered correctly by the learner who is knowledgeable in the subject matter, but incorrectly by the learner who relies on superficial knowledge or on simple logic.

Guidelines

1. Each statement should avoid ambiguity and be unequivocally true or false.
   - If you can think of an exception or qualification to the statement, the item may be ambiguous.
   - If the statement is one of opinion rather than fact, regardless of how widespread you feel the opinion to be, the item may be ambiguous.

2. Each statement should embody only one idea.
   If the statement contains many dependent clauses, or if it contains a compound idea, the learner may not be able to determine what element of the statement is to be judged.

3. The item should be worded in clear and precise language.
   The knowledgeable learner should not be misled or confused by imprecise language. Similarly, a naive learner should not be cued to the correct answer by the language of the statement.

4. Statements to be avoided include those containing
   - specific determiners (words such as "all," "none," or "only"),
   - indefinite degrees or amounts (such as "more" or "few"),
   - words that are unfamiliar to the learner, and
   - statements that are presented in negative rather than positive terms.

*The material in this section is, in part, drawn from the Constructing Test Items to Measure Instructional Objectives Workshop, developed by the Center for the Study of Evaluation, University of California at Los Angeles.
MULTIPLE-CHOICE ITEMS

Multiple-choice items may be written in two forms. In one form, an incomplete statement is presented in the stem of the item and requires the learner to select the phrase that best completes the statement. In the other form, items pose a question in the stem and require the learner to select the best answer from a set of alternatives. In both cases, the learner must identify the correct response from among a set of alternatives, all of which should appear reasonable to the naïve learner but only one of which is recognized as correct by the knowledgeable learner.

Guidelines

1. The stem should embody a complete idea that formulates the "problem" in its entirety.
   It should not be necessary for the learner to read the alternatives as well as the stem to be able to determine the question being asked.

2. The alternatives should represent competing resolutions to the "problem" posed in the stem and should be equally reasonable to the uninformed learner.
   - Alternatives should be logically related to the stem of the item.
   - Alternatives should be consistent with the grammatical and syntactical construction of the stem.
   - Alternatives should generally be of similar length.
   - The correct alternative should not complete a cliché or a phrase frequently used during instruction.

3. Both stem and alternatives should be written so that the language is precise and contains no extraneous words or information.

MATCHING ITEMS

The matching item presents a set of problems and solutions and requires the learner to relate each problem to the appropriate solution.

Guidelines

1. Directions should clearly specify the basis upon which the matching is to be performed.
   Labeling each column (such as "Poets" and "Poems") and employing homogeneous elements in each column will help to insure that the basis for matching is clear.

2. Each alternative solution should be a reasonable answer for all (or most) of the problems.

3. Terms used in the set of problems should not appear in the alternative solution.
   Avoid repetition of words, syntactical peculiarities, and other language clues that might enable the naïve learner to "guess" the correct answer.

4. To help reduce the probability of successful guessing, the number of alternative solutions should exceed the number of problem statements.

5. The statement of the problem and the solution should be as short as possible.
COMPLETION ITEMS

The completion item requires the learner to furnish a key word, number, symbol, or phrase to complete an idea.

Guidelines

1. The item should be stated so that only one brief answer can be considered correct.

2. The information to be supplied by the learner should be the key word or phrase to complete the idea.

3. No extraneous clues to the answer should be provided,
   - Use blanks of uniform length, and avoid using spaces that will indicate that more than one word is required.
   - Avoid grammatical clues, such as the use of "a" or "an" before the blank.
   - Avoid completion items that represent instructional clichés.

4. The scoring key should be developed so as to anticipate acceptable synonyms of the correct answer that would also be scored correctly.

SHORT-ANSWER AND ESSAY ITEMS

The short-answer item and the essay item are used to determine a learner's ability to supply and organize ideas and to express himself in writing.

Both these item forms may require the learner to exhibit understanding by comparing, contrasting, explaining, or summarizing. They may elicit application of a principle or problem-solving strategy, or they may elicit the learner's judgment by asking him to take a stand on an issue or to criticize a position.

Guidelines

1. The task presented to the learner should be defined as completely and specifically as possible.

   It is sometimes helpful to provide students in advance with the criteria you will use to score the essays, provided this does not overly prompt or cue the learner.

2. The question should present a novel situation or problem, and should not be a repetition of situations or problems used for instructional purposes.

3. You should decide upon a detailed scoring key before you administer the item. The key might include a model of an acceptable essay in addition to the criteria that student responses are to meet.

4. If the learner behavior you are trying to assess could be observed from his performance on selective-type items, it would generally be more efficient to use those item types.
OTHER RESOURCES FOR TASK 2

1. Using and Writing Objectives

If you have not used and written instructional objectives, you should explore a few of the many resources now available on the topic of objectives; for example:


2. Problems in Measuring Achievement of Objectives

The following three resources consider the problem of measuring objectives from different, but useful perspectives.


This provocative essay discusses the problem in constructing questions to ascertain what a person has learned from instruction. It considers test questions for measuring the learning of verbal information, concepts, and principles. It comments on the use of objectives, of recognition and recall type items, and of test-like events in text materials. It concludes with a critical assessment of the way tests used in research and development are described in most journal articles.


This chapter is a useful introduction to a procedure for generating test items that measure an objective.


This book provides a useful collection of articles presenting the idea of criterion-referenced measures and describing the differences between them and norm-referenced measures.

Note: In 1974, there will be an issue of the periodical Educational Technology devoted to articles related to this topic.

3. Performance Standards and Test Length

These two articles discuss the complex problem of setting performance standards; they will be of most interest to persons with a background in measurement and statistics.


This article reviews "procedures for establishing standards and determining the number of items needed in criterion-referenced measures...." It includes a discussion of passing scores "organized around five factors: performance of others, item content, educational consequences, psychological and financial costs, and errors due to guessing and item sampling."


This difficult article discusses important issues in and procedures for determining the shortest, yet acceptable accurate test for use as a criterion-referenced measure.

4. Identifying Sub-Objectives

The following resources discuss the problem of identifying sub-objectives.


This article describes a simple procedure for identifying critical enroute behaviors for a terminal objective.


This article describes a procedure for determining empirically the subordinate intellectual skills which must be acquired before a learner can achieve a higher order intellectual skill such as use of a concept, rule, or problem-solving strategy.


This article discusses definitions relevant to the topic of learning hierarchies, procedures for developing hierarchies, and validation techniques which have been applied in learning hierarchy research.
In this task you will try out the measures you developed with a sample of the learner population. The tryout provides you with information on how well the measures are assessing the objectives and how well the learner population performs on them.
DESCRIPTION OF TASK 3

This task involves four steps:

1. Select a sample of learners and determine the conditions for the tryout. Decide on the size of the sample and how it will be selected, as well as the setting and time limits under which the tryout will take place.

2. Prepare measures. Using the items you have generated, develop an instrument(s) to assess learner performance on the objectives, prepare directions for the learner and administrator, and establish criteria for analyzing the tryout results.

3. Administer the measures and record any problems encountered.

4. Analyze the results of the tryout. Summarize the data on appropriate graphs and tables. Identify items which should be revised or eliminated and decide which objectives are appropriate for instruction. If appropriate, identify subgroups of learners who may need specialized instruction. At the completion of this task, you may wish to summarize your results in a report.

NOTE

Sometimes you may undertake a project directed toward objectives which you are certain that learners have not achieved. You will still want to carry out a tryout of measures to determine the entry skills of the learner population. In addition, locate some people you feel have achieved the objectives to work through your measures, so that you can determine if your measures will help you identify who has achieved or not achieved the objectives.
RESOURCES FOR TASK 3

The following resources will help you make preparations for the tryout of measures and do the analysis of the results of your tryout. They provide suggestions on:

- selecting a sample of learners
- determining the conditions for the tryout
- preparing measures to be used in the tryout
- arranging and summarizing the data from the tryout

There is also an example of what a report of a tryout of measures might look like.
I. PRELIMINARY PREPARATIONS FOR TRYOUT OF MEASURES

To prepare for a tryout of measures, you will first need to select a sample of learners who will participate in the tryout, and determine the conditions under which the tryout will take place.

Selecting a Sample of Learners

In selecting a sample, you are interested in obtaining 15 to 30 learners which may include "achievers" and "non-achievers" of the proposed objectives. Ideally, you should try to use a random sampling technique in selecting your sample. If it is not feasible to use this technique, try to select a group that includes the range of skills you can expect to find in the learner population.

Determining Conditions for the Tryout

You will next need to decide where the tryout will take place and how much time will be available for it.

Tryouts are often conducted in the classroom. However, some Practicum students have used both individual and home settings. Determining where the tryout will take place will help you to decide what directions will be needed to accompany your measures.

The amount of time available for a tryout is influenced by two factors: the amount of time learners are willing to give to the tryout, and the amount of time instructors will allow for the tryout if a classroom or group setting is used. Developers find that learners and instructors are normally willing to give no more than 15 to 30 minutes of their time to the tryout. Determining how much time is available will affect how many forms of your measure you will need to prepare.
II. PREPARING MEASURES

The preparation of measures requires that you have already identified a measurement procedure, established a performance standard, and generated the test or questionnaire items you need for each objective. The actual preparation of measures for the tryout can involve six activities.

Deciding the Number of Instruments Required

Sometimes you will be able to administer all of your items to the learners in the time available for the tryout. However, frequently there is not enough time for each learner to work through all of your items. In this case, decide how many items a learner can be expected to complete in the time available and use that to determine the number of instruments which will be required to utilize all of your items. To prepare these instruments, randomly assign your items to each of these instruments.

Note: If, in your tryout, you then randomly assign these instruments to learners, you will be able to combine data across all of the instruments to make decisions about the quality of your test items and the level of performance of the learner population (See articles on "Sampling Techniques" cited in "Other Resources for Task 3").

Ordering Items in a Measure

You can order items in one of four ways:

- Ordering items randomly is usually used when all items are related to the same objective and the developer is not concerned with the effect one item may have on other items.

- Ordering items in terms of their difficulty, from easier to harder, insures that learners will not get "bogged down" with difficult items early in the test. The learners will be able to complete most of the items they are capable of completing.

- Ordering items by topic or objective allows the learner to concentrate on one topic at a time.

- Ordering items by their format insures that the learner will not be distracted by different item formats. This order is particularly appropriate for young learners.
Preparing Directions

You should prepare two sets of directions to help insure that your measures are administered as intended and in a consistent manner.

Directions to learners should describe the purpose of the measure, how to record their answers, and how to make best use of the available time. They should be written in a way to reduce learner anxiety.

Directions to the administrator should describe the setting required for the test, what materials should be distributed to the learners and in what order, how time should be allotted, and what instructions should be given to the learners before, during, and after the test.

Preparing a Scoring Key

To facilitate scoring of learner performance on the measure, you should prepare a scoring key which gives, as appropriate, correct answers for selected response items, lists of criteria for constructed response items, and a description of how learner performance should be summarized.

Setting Criteria to Guide the Analysis

You will analyze the data from the tryout to determine the quality of the test items and to make decisions about which objectives to include in your product. To make these decisions, you will need criteria to help you interpret the data. These criteria should answer questions like:

- what learner performances will require elimination of particular test items?
- what level of performance must be exhibited on an objective to decide it has been achieved and therefore can be eliminated as an instructional objective for the product?
- what differences in performance by subgroups in the learner population will require specialized instruction?
- what differences in performance by subgroups will require a re-definition of the learner population?

To understand how to set these criteria, examine the analysis process outlined in Step 4.

Obtaining a Review of Your Measures

Finally, review the measures once more to try to find any flaws in the layout, directions, and items. You might ask other people to examine the measures for errors and to suggest improvements.
III. ANALYZING THE RESULTS OF THE TRYOUT

Analyzing data from a Tryout of Measures involves arraying the data, summarizing it on graphs and tables, and interpreting these summaries. The procedures presented in this section will be most relevant if your Tryout of Measures involved a group of test items to measure the population's performance on each objective, test items that can be scored either as "correct-incorrect" or as "meeting the performance standard-not meeting the performance standard," and a sample from the learner population of 15 to 30 subjects.

This section describes four steps to follow when you analyze the results of the Tryout:

1. Array the Data in a Subject-by-Item Table

2. Determine Which Test Items are Working Consistently

3. Determine the Population's Level of Performance on Each Objective Assessed by the Test

4. Describe the Performance of Particular Subgroups in the Learner Population

Your use of these steps will depend on the nature of the data you gathered.

Note: This section is geared toward the developer with limited knowledge of statistics and measurement. If you do have experience in statistics and measurement, you can use the procedures in this section as a framework for applying other procedures for item analysis and testing of group differences.
1. ARRAY THE DATA IN A SUBJECT-BY-ITEM TABLE

To make it easier to analyze test results, the data should be transferred from the learner answer sheets and presented in a format that will allow you to examine all of the results together. One format that you might use is a subject-by-item data array (See Table 1 for an example).

To construct a subject-by-item data array:

- List the numbers of the test items across the top of the table. The items may be listed in the order they were presented on the test (see Table 1) or may be grouped by objective (see Table 2).

- List the learners in the left-hand column, usually in an order determined by their total test score (high scorer to low scorer).

- Complete the cells of the table in the following manner:
  
  use a "1" to signify either a correct learner response or a response meeting the criterion for the item

  use a "0" to signify an incorrect response or a response not meeting the criterion for the item

  use a "-" or blank to signify items not attempted by a learner

- Calculate total item scores by adding all of the correct responses for each item (adding the "1"'s found in each column).

- Finally, place total subject scores in the right-hand column.
### Table 1

<table>
<thead>
<tr>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>SUBJET SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrie</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Betsy</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Earl</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Donald</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Alfred</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Faith</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL ITEM SCORE</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

The total correct responses for each item is shown in the bottom row of the table. In this example, items 3 and 7 appear to be the most difficult items with item scores of 0 and 1, while item 2 appears to be the easiest item with an item score of 6.

The number of correct responses obtained by each subject appear in the right-hand column. Carrie obtained the highest score, 6. Donald, Alfred, and Faith obtained the lowest scores, 3.

The table also shows that Alfred and Faith did not complete items 7 and 8. Thus, Alfred and Faith's scores of 3 may mean something different than Donald's score of 3.
2. DETERMINE WHICH TEST ITEMS ARE WORKING CONSISTENTLY

To insure that the test items which are supposed to be measuring learner achievement of an objective are measuring their achievement consistently

- rearrange Table 1 so that items measuring the same objective are grouped together

- then, calculate the subject scores separately for each group of items.

EXAMPLE

If items 1, 3, 5, 6, 7, 9, 11, 12, and 13 on Table 1 measure Objective I and items 2, 4, 8, 10, and 14 measure Objective II, the data arrays would appear as in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Subject-by-Objective Data Array</th>
<th>Objective I</th>
<th>Objective II</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM   SUBJECT</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Cynthia</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Erroll</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Verg</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shana</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>David</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Lester</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Allen</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ITEM SCORE</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

- finally, ask these three questions of your data to determine which test items are working consistently:
ARE THE ITEM SCORES CONSISTENT FOR THE ITEMS WHICH MEASURE AN OBJECTIVE?

To answer the first question, examine the performance by the learners as a group on each test item measuring a particular objective.

Since each item is measuring the same objective, the learners as a group should get approximately the same total score on each item. The total item scores for each item should thus be similar.

When a particular item appears much more difficult or easy than the rest of the items, that item may not be measuring the same objective. Data from such deviant items should be excluded from the analysis. (Note: You may want to examine these items for deficiencies and revise them for use in subsequent tryouts.)

When the group of learners performs erratically on a set of items measuring the same objective, the developer must question the entire set of items.

Example
Most Item Scores for Objective I are 4 or 5, suggesting that most items are measuring the same objective.

| Item Scores | 4 | 5 | 4 | 5 | 4 | 4 | 7 | 4 |

Example
Item 12 appears easier than the other items measuring Objective I.

| Item Scores | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 7 | 4 |

Example
Item Scores for Objective II vary a great deal, suggesting that the items may not be measuring the same objective.

| Item Scores | 5 | 7 | 2 | 6 | 3 |
DO INDIVIDUAL SUBJECTS PERFORM CONSISTENTLY ON ALL ITEMS MEASURING THE SAME OBJECTIVE?

To answer this question, examine the performance of individual learners on all items measuring an objective.

If all items are measuring the same objective, individual learners should score consistently across all items. Those who have achieved the objective should get most of the items correct, and those who have not achieved the objective should get most of the items incorrect.

Example

<table>
<thead>
<tr>
<th>Subj. Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

When a learner obtains a moderate score, it is not clear where he stands in relation to the objective. When many learners perform in this manner, the developer must consider that some of the test items are not measuring the same objective.

Example

<table>
<thead>
<tr>
<th>Subj. Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>
If subject scores are not clearly high and/or low, the following question should be considered:

**DOES EACH ITEM HELP DISCRIMINATE BETWEEN THOSE WHO HAVE ACHIEVED AN OBJECTIVE (HIGH SCORERS) AND THOSE WHO HAVE NOT (LOW SCORERS)?**

To help identify items that do not discriminate between achievers and nonachievers of an objective, the developer analyzes each item to see how it contributes to the subject score. To perform this analysis, a developer calculates an "index of discrimination"* for each item.

\[
\text{Index of Discrimination for an Item} = \frac{a - b}{c}
\]

"a" is the number of students in the group of high scorers getting the item correct.

"b" is the number of students in the group of low scorers getting the item correct.

"c" is the total number of students in either group.

*The size of Top and Bottom Groups should be the same. Each group can equal 25% to 40% of the total test population.

An item with a discrimination index greater than zero tends to discriminate between high and low scorers. The closer the index approaches 1, the better discriminator the item is.

An item with a discrimination index of zero or less does not discriminate between high and low scorers. Such items do not appear to measure the same objective, and should generally be excluded from further analyses and revised before they are used again.

**Example**

For Item 5, Index of Discrimination = \( \frac{3 - 0}{3} = 1 \)

**Example**

For Item 9, Index of Discrimination = \( \frac{2 - 2}{3} = 0 \)

*The index of discrimination is used in classical test construction to determine which items discriminate between high and low scorers with respect to their total test scores. In the context of a try-out of measures, it is suggested that the index only be used to compare the performance of individuals on items measuring the same behavior.*
On the basis of these analyses of the subject-by-objective data, you will eliminate test items that do not appear to measure the same objective—either because they are relatively more difficult or easy than the other items, or because they fail to discriminate between high and low scorers on the objective. You will then recalculate the subject scores for each objective.

Example

For example, as a result of the analysis of Objective I data, item 9 has been eliminated because it fails to discriminate between those who did well on the objective and those who did not. Item 12 has been eliminated because its difficulty indicated that the item was measuring something different from the other items. New subject scores have been calculated and summarized in Table 3. This table now shows consistent item scores for Objective I and a high degree of consistency in subject scores (i.e., either very high scores or very low scores).

Table 3

<table>
<thead>
<tr>
<th>Revised Subject-by-Item Data for Objective I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Subjects</td>
</tr>
<tr>
<td>Cythia</td>
</tr>
<tr>
<td>Erroll</td>
</tr>
<tr>
<td>May</td>
</tr>
<tr>
<td>Verg</td>
</tr>
<tr>
<td>Shana</td>
</tr>
<tr>
<td>David</td>
</tr>
<tr>
<td>Lester</td>
</tr>
<tr>
<td>Alon</td>
</tr>
<tr>
<td>ITEM SCORE</td>
</tr>
</tbody>
</table>
3. DETERMINE THE POPULATION'S LEVEL OF PERFORMANCE ON EACH OBJECTIVE ASSESSED BY THE TEST

To determine the learner population's level of performance on each objective assessed by the test, you will summarize subject scores from the revised subject-by-objective data array. These summaries may take the form of a graph, summary table, or, in special cases, a mean score and standard deviation for the distribution of scores.

To illustrate how subject scores may be summarized, the following set of subject scores for Objective III will be used (See Table 4:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sam</td>
<td>5</td>
</tr>
<tr>
<td>Judy</td>
<td>5</td>
</tr>
<tr>
<td>Louis</td>
<td>5</td>
</tr>
<tr>
<td>Peter</td>
<td>3</td>
</tr>
<tr>
<td>Phyllis</td>
<td>3</td>
</tr>
<tr>
<td>Skip</td>
<td>2</td>
</tr>
</tbody>
</table>

These data may be summarized in the three following ways:

a. a histogram. This kind of a graph consisting of bars drawn in intervals for each possible subject score, with the height of each bar representing the number of learners obtaining that particular total score. A histogram graphically illustrates whether the population tends to obtain the same total score or to divide itself into 2 or more groups indicating different levels of competence on the set of test items presented.
b. a table of proportions. This kind of table shows the proportion of students obtaining each score for an objective. It is prepared as follows:

- list the possible scores along the top of the table
- enter the number of learners receiving each score in the second line of the table
- convert the number of learners to percentages of the total number of learners taking the items for an objective

To make data interpretation more simple, possible total scores can be grouped so as to provide fewer intervals for analysis.

c. a mean score and standard deviation. A mean score and a standard deviation can be used to summarize subject scores if the distribution of scores approximates a normal curve, for then you can use these statistics to make an approximate reconstruction of that distribution.
To interpret the learners' level of performance on an objective after it has been described in graphic or tabular form, you will need to use the performance standard you set for the objective in Task 2. The following two examples illustrate how to summarize and interpret learner performance.

Example 1

The table below presents subject scores on an objective.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Score</th>
<th>Subject</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael</td>
<td>8</td>
<td>Evan</td>
<td>3</td>
</tr>
<tr>
<td>Nester</td>
<td>7</td>
<td>Brian</td>
<td>2</td>
</tr>
<tr>
<td>Ginger</td>
<td>7</td>
<td>John</td>
<td>2</td>
</tr>
<tr>
<td>Cathy</td>
<td>6</td>
<td>Jennifer</td>
<td>1</td>
</tr>
</tbody>
</table>

The subject scores may be summarized in either a histogram or table of proportions.

If the performance standard for the objective was at least 5 items out of 8 correct, the developer can conclude from the summaries that approximately 50% of the sample had achieved the objective.
Example 2

The table below presents subject scores on an objective.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Score</th>
<th>Subject</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janet</td>
<td>4</td>
<td>Gloria</td>
<td>2</td>
</tr>
<tr>
<td>Don</td>
<td>3</td>
<td>Debbie</td>
<td>2</td>
</tr>
<tr>
<td>Betsy</td>
<td>3</td>
<td>Ken</td>
<td>1</td>
</tr>
<tr>
<td>Harry</td>
<td>2</td>
<td>James</td>
<td>1</td>
</tr>
</tbody>
</table>

The subject scores may again be summarized in a histogram to find out what the distribution looks like. If the distribution approximates a normal curve, as in the histogram below, the mean score and a standard deviation may also be used to summarize the distribution.

The histogram and summary statistics suggest that the entire sample performed at approximately the sample level: 2 items correct out of 8. If the performance standard for the objective was at least 5 items out of 8 correct, the developer can conclude from the summaries that the sample had not achieved the objective.
4. DESCRIBE THE PERFORMANCE OF PARTICULAR SUBGROUPS IN THE LEARNER POPULATION

If you find that the pattern of subject scores on each objective is consistent (generally high or low), then there may be little reason to explore the performance of subgroups of the learner population. However, if you note considerable variation in subject scores or if you suspect differences in performance of certain subgroups, you should further analyze the tryout data. These differences may have important consequences for the design of an instructional product.

To analyze the performance of subgroups, you must first define possible subgroups. There are three general ways in which a subgroup can be defined:

Subgroups defined by their test performance. Sometimes a developer wants to find out if those subjects who scored high on an entire test and those who scored low on the entire test also scored consistently high and low on each part of the test. Sometimes he wants to compare the performance of high and low scorers on one objective with their performance on other objectives. Sometimes he wants to compare learners who completed the test with those who completed only part of the test.

Subgroups defined by their experience. Sometimes a developer wants to compare the performance of groups who attended different schools or had different teachers. Sometimes he wants to compare the performance of groups in different major fields of study or in different instructional programs.

Subgroups defined by other characteristics. Sometimes a developer wants to compare the performance of persons of different sex or socio-economic background. Sometimes he wants to compare the performance of persons with different interests. Sometimes he wants to compare the performance of groups defined by their scores on other tests or by grades previously received.
The procedures used in analyzing subgroup data are basically the same as those described in the previous section. Use graphs and tables to summarize the scores of each subgroup, then compare the performance of the subgroups to each other or to some established performance standard.

EXAMPLE

The analysis of the performance of subgroups begins with the array of subject scores for an objective.

<table>
<thead>
<tr>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmine</td>
<td>8</td>
</tr>
<tr>
<td>Fred</td>
<td>8</td>
</tr>
<tr>
<td>Linda</td>
<td>7</td>
</tr>
<tr>
<td>Susan</td>
<td>7</td>
</tr>
<tr>
<td>Delmar</td>
<td>5</td>
</tr>
<tr>
<td>Howard</td>
<td>4</td>
</tr>
<tr>
<td>Sean</td>
<td>3</td>
</tr>
<tr>
<td>Jane</td>
<td>1</td>
</tr>
</tbody>
</table>

Data array is rearranged so that scores for subgroups are grouped together.

<table>
<thead>
<tr>
<th>T1</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmine</td>
<td>8</td>
</tr>
<tr>
<td>Linda</td>
<td>7</td>
</tr>
<tr>
<td>Susan</td>
<td>7</td>
</tr>
<tr>
<td>Howard</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T2</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred</td>
<td>8</td>
</tr>
<tr>
<td>Delmar</td>
<td>5</td>
</tr>
<tr>
<td>Sean</td>
<td>3</td>
</tr>
<tr>
<td>Jane</td>
<td>1</td>
</tr>
</tbody>
</table>

Using histograms and percentages as appropriate, the performance of each subgroup is summarized. In the present example, either a histogram or percentage table would be appropriate.

<table>
<thead>
<tr>
<th>Interval</th>
<th>0-3</th>
<th>4-6</th>
<th>7-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Group</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>T2 Group</td>
<td>50%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>
The summary of the performance of the two groups can be further compared in terms of the performance standard. In this example, a standard of 7 out of 9 has been set as a minimum acceptable score.

<table>
<thead>
<tr>
<th>Proportion of Subjects Above and Below Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval</td>
</tr>
<tr>
<td>Group T₁</td>
</tr>
<tr>
<td>Group T₂</td>
</tr>
</tbody>
</table>

On the basis of these summaries, the developer might conclude that the performance of T₁ and T₂ groups appears to be substantively different. If the developer is familiar with inferential statistics and if the assumptions of these methods are met by the data, he can carry out appropriate statistical tests to confirm these apparent differences.
IV. SAMPLE REPORT OF THE RESULTS OF A TRYOUT OF MEASURES

When the data have been analyzed, the developers may want or need to report their conclusions. Such a report may contain:

- a brief description of the purpose of the test, the learners used in the test, and the conditions under which the test was administered

- a summary of the data for each decision, the criteria for that decision, and the actual decision made

- complete data summaries

The body of the report may be organized by objective or by the different decisions to be made. An example of a report having the latter structure follows:

EXAMPLE
REPORT OF TRYOUT OF MEASURES

This report summarizes the results of a tryout of measures and the decisions made on the basis of the tryout. The report is divided into three sections: (1) description of the purpose of the tryout, the learner population used and conditions under which the tryout was administered; (2) decisions made as a result of the tryout with accompanying data arrays and summaries; and (3) a complete set of the data collected.

INTRODUCTION TO THE TRYOUT:

Description of the Proposed Product. Recent concern of an urban school district over the quality of science instruction has prompted plans for the development of a new science curriculum. Among the elements of the new curriculum is a biology unit dealing with butterflies.

Three objectives dealing with knowledge of the butterfly life cycle and observation and recording skills have been proposed for the unit. This tryout is intended to determine the appropriateness of these objectives for the district.

Measures. 24 multiple-choice items were prepared for this tryout; 8 items for each proposed objective.

Learner Sample. The learner population for this unit is the sixth grade classes of the school district. A sample of 15 students was randomly drawn from two of the district's elementary schools. One school used a traditional science program and the other had participated in a field test of a NSF-sponsored science curriculum.

Test Administration. The 15 students were bused to the curriculum center. The test was administered between 10:15 and 10:50. Instructions for the test were read by the administrator; no questions were raised. Several students were apparently confused by problem 19 and asked the administrator for assistance.
DECISIONS:

This section deals with decisions regarding: (a) the quality of the measure, (b) the population's level of performance on the three objectives, and (c) the performance of two subgroups.

Quality of Measures. It was decided, prior to the test administration, that items that did not meet the following two criteria would be eliminated from further analysis:

Within an objective, all items that differ by more than 3 points from the mean number of correct responses per item will be eliminated.*

All items that discriminate negatively will be eliminated.*

On the basis of these criteria, items 4, 6, 19, and 24, circled on tables 1 and 3 on following pages, have been eliminated.

Population's Level of Performance. It was decided, prior to the test administration, that if at least 2/3 of the population scored below 70% correct on items for one objective, that objective would be appropriate for the product.*

To facilitate identification of objectives appropriate to the product, the following table of proportions showing the performance of the entire population was prepared:

Table A: Performance of Sample Population on Items Measuring Three Objectives

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>Objective I</th>
<th>Objective II</th>
<th>Objective III</th>
</tr>
</thead>
<tbody>
<tr>
<td># of STUDENTS</td>
<td>0-1</td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>% of STUDENTS</td>
<td>13</td>
<td>60</td>
<td>13</td>
</tr>
</tbody>
</table>

The table indicates that Objectives I and III are appropriate for the population since more than 2/3 of the students scored below criterion. However, Objective II may not be appropriate, since 40% of the students scored at or above criterion.

*These criteria are tentative and somewhat arbitrary. If the data suggest that small changes in the criteria would result in different, less costly decisions, they should be considered.
Subgroup Performance. Further examination of these data revealed that four of the six students* scoring above criterion on Objective II were from the school that had helped test the NSF science curriculum. Consequently, the data were rearranged to show these two subgroups (group A is composed of students using the traditional science instruction and group B is composed of students from the field-test school using the NSF curriculum):

Table B: Performance of Group A on Items Measuring Three Objectives

<table>
<thead>
<tr>
<th>Objective I</th>
<th>Objective II</th>
<th>Objective III</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERVAL</td>
<td>0  1-2  3-4  5-6</td>
<td>0-2  3-5  6-8</td>
</tr>
<tr>
<td># of STUDENTS</td>
<td>1  6  2  1</td>
<td>6  2  2</td>
</tr>
<tr>
<td>% of STUDENTS</td>
<td>10  60  20  10</td>
<td>60  20  20</td>
</tr>
</tbody>
</table>

Table C: Performance of Group B on Items Measuring Three Objectives

<table>
<thead>
<tr>
<th>Objective I</th>
<th>Objective II</th>
<th>Objective III</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERVAL</td>
<td>0  1-2  3-4  5-6</td>
<td>0-2  3-5  6-8</td>
</tr>
<tr>
<td># of STUDENTS</td>
<td>1  3  0  1</td>
<td>0  1  4</td>
</tr>
<tr>
<td>% of STUDENTS</td>
<td>20  60  0  20</td>
<td>0  20  80</td>
</tr>
</tbody>
</table>

Table B indicates that all three objectives are appropriate for the subgroup of learners using the traditional science program.

Table C indicates that Objective II is inappropriate for students from the field-test school, and that these students score just below criterion on Objective III. Instead of providing instruction on all three objectives, instruction on Objective I and review sessions on Objective II and III may be sufficient for this group.

*The number of students involved in this test is so small that only the most tentative conclusions can be drawn regarding the performance of the two groups.
### Table 1
Objective I - Data Array

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total Per Person Item</th>
<th>Total Minus Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Gilli</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Henry</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Peggy</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>David</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Steve</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Sally</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cindy</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Hector</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rizza</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sarah</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Karen</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| Total Correct Per Item | 6 | 5 | 6 | 5 | 4 | 5 | 5 | 5 |
| Index of Discrimination | 4/5 | 3/5/5/5 | 5/5 | 2/5 | 7/2/5 | 2/5/5 |

Underlined individuals were placed in Group B.

### Table 2
Objective II - Data Array

<table>
<thead>
<tr>
<th>Item</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peggy</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Mike</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Sarah</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Sally</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Karen</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

| Total Correct Per Item | 6 | 5 | 6 | 5 | 4 | 5 | 5 | 5 |
| Index of Discrimination | 3/5 | 3/5/5 | 5/5 | 2/5 | 7/2/5 | 2/5/5 |

Underlined individuals were placed in Group B.

### Figure 1
Objective I - Histogram

![Histogram](image)

### Figure 2
Objective II - Histogram

![Histogram](image)
TABLE 3
Objective III - Data Array

<table>
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<th>Item</th>
<th>17</th>
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<td>2/5</td>
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<td>2/5</td>
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</table>

Underlined individuals were placed in Group B

Figure 3
Objective III - Histogram

# of Students

Score

72
### Table 4
**Group A Scores**

<table>
<thead>
<tr>
<th>Score</th>
<th>Objective I</th>
<th>Objective II</th>
<th>Objective III</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>0</td>
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<td>0</td>
<td>1</td>
</tr>
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</table>

### Table 5
**Group B Scores**

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<th>Objective III</th>
</tr>
</thead>
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<tr>
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<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

### Figure 4
**Group A - Histograms**

- Objective I
- Objective II
- Objective III

### Figure 5
**Group B - Histograms**

- Objective I
- Objective II
- Objective III

73
1. Sampling Techniques

These two resources explain a technique that you can use to obtain useful data from a try-out when there is not enough time for every learner to try every item of a test.

  This article is a general introduction to the topic of matrix sampling.

  This report is a comprehensive handbook on the uses, procedures, and formulas for matrix sampling.

2. Preparing Measurement Instruments

The following handbook is a useful overview of the steps to follow in preparing an instrument to measure the achievement of a set of objectives.


3. Needs Assessment

These two resources describe a procedure closely related to Tasks 3 and 4 which is used to find out if learners need to act a set of objectives. These resources are suggested for those who are interested in exploring needs assessment procedures in depth.

  This chapter discusses the rationale for the procedure and provides specific guidelines for conducting a needs assessment.

  This kit provides elementary school priests with the materials needed to involve students, teachers, and parents in a needs assessment. The procedure has four steps: (a) determine the range of possible objectives; (b) establish the relative importance of objectives; (c) collect information as to which objectives are being achieved and which are not being achieved; and (d) use decision rules for combining value information and achievement information to determine the objectives for which instruction needs most to be improved.
In this task you will gather information from potential users of your instructional product. You will use this information to help you design a product that meets the requirements of the learners and builds on whatever relevant experiences they may have had.
This task is usually performed in three steps.

1. **Determine the information required.** This information is needed to help you design and develop a product that will be valuable and useful for the learners. Because learners will value a product that acknowledges and builds on their interests and experiences, you should gather information about those learner interests and experiences relevant to the skills and content of product's goals and objectives. Similarly, because learners, instructors, and administrators are more likely to use a product that fits the requirement of their instructional setting, you should gather information about those requirements.

2. **Gather information from potential product users.** This information will usually be gathered by interview or questionnaire. If you use a questionnaire, consider administering it along with the measures you use in Step 3 of Task 3.

3. **Summarize information from potential product users.** Tally the answers to each of the questions, summarize them in tables or graphs, and on the basis of these summaries prepare a set of statements to guide your design of the product.

**NOTE**

You may feel that you know the learners, their experiences, preferences, and requirements. Take the time to confirm your knowledge so that you will design a product which is, indeed, relevant and usable by the learners.
RESOURCES FOR
TASK 4

The following resource material will help you with the first step of this task. It suggests the kind of information that you may want to gather. For example, you may want:

- information about the experiences and interests of learners which are relevant to the product's goal
- information about possible requirements for the design of the product given the setting in which the product will be used
- information about the instructional preferences of learners and instructors

It also suggests the types of questions you can ask to obtain each kind of information. Modify these questions to fit the requirements of your project.
I. EXPERIENCES AND INTERESTS OF LEARNERS

For most instructional goals that a developer might select, the learners will have had some experiences that have implications for the design of the prototype. Depending on the goal of your product, you may find that the following questions for learners would be useful in identifying relevant experiences:

What interest do you have in learning this skill or in knowing this content? How would you rate your current skill? Which of the following can you do? Which of the following do you want to be able to do?

Have you received any training (instruction) on the following skills and content? What kind of instruction was it? Did you like it? Why or why not?

Have you worked on any of the following problems? If yes, in what kind of situation did you work on them? Do you expect to encounter those problems again? Do you need some training on how to solve those problems?

Answers to these questions may provide you with information which will help you decide:

- how to orient learners to your product
- what kinds of examples and practice problems to present
- what kinds of motivation you may need to provide
- what instructional activities you should consider or avoid
II. POSSIBLE REQUIREMENTS FOR THE PRODUCT

Learners, instructors, and administrators may all have requirements for the product. If these requirements are not met, then it is probable that the product will not be used. Depending on the product's objectives and the site where the product will be used, you may want to ask questions related to six kinds of requirements:

1. **Place in the Curriculum**

   Will the product be used in the context of an ongoing program? If so, what content and skills will have been taught prior to the use of the product? What content and skills will be taught following the use of the product? What content and skills must be covered by the product? (The product's objectives may have to be revised as a result of the information gathered from such questions.)

2. **Setting**

   Where will the product be used? Does that setting place any restrictions on the kinds of materials learners could be using, on the kinds of activities they could engage in, or on how learners can be organized?

3. **Forms of Presentation**

   Who will administer the product? Do they have the knowledge about and skills in instruction (e.g., can they orient learners, guide learners, provide practice opportunities, give feedback and knowledge of results, motivate learners)?

   What audiovisual equipment is available (e.g., tape players, phonographs, overhead projectors, slide projectors, and movie projectors)?

4. **Learner Activities**


5. **Instructional Time**

   What time is available for the learners to use the product? How long will the learners be willing or be able to attend to the product?

6. **Costs**

   How much can the product cost and still be purchasable by learners, schools, or industry? How great a maintenance cost can they afford?
III. INSTRUCTIONAL PREFERENCES

The previous section outlined possible user requirements on a product. These requirements may act as constraints or limitations on the design of the product. Besides such requirements, you may want to ask questions about the instructional preferences of learners, instructors, and administrators. To help you weigh these preferences, you may also want to explore the reasons for them. These preferences can be organized under three headings:

1. Learner Activities

   What activities do learners prefer to engage in? Why? What activities do instructors believe are most beneficial? Why?

2. Forms of Presentation

   How do learners like to have content presented to them? Do they prefer to learn by using audio, visual, or tactile senses?

   What instructional roles do the instructors prefer to play? Why? Do they like to use audiovisual materials?

3. Setting

   In what kinds of social setting do learners prefer to work: alone? in teams? in small groups? as a whole class? How does the instructor like to organize the students for learning? Why?
SUMMARY OF TASKS 1-4:

SPECIFICATIONS FOR THE INSTRUCTIONAL PRODUCT

For review of Phase I work and in preparation for the tasks that will be involved in Phase II, you may summarize the results of tasks 1 through 4 in a specifications document. A list of possible contents for such a document appears below:

Possible Contents for Specifications

1. An introduction orienting the reader to your development project and the specifications document.

2. A description of the goal, terminal objectives, and sub-objectives of the product, along with a summary of evidence regarding the learners' need to achieve these objectives.

3. A description of the learner population--particularly the knowledge, skills, attitudes, and experiences relevant to the proposed objectives of the product.

Copies of your clarifications of the objectives, the measures used to assess the achievement of these objectives, and the analysis of the results of the tryout of measures may be included in appendices to the specifications document.
INTRODUCTION

A large city school district asked a company to develop a unit to teach first and second grade inner-city children the concepts of "left" and "right." The development team analyzed the concepts of left and right, formulated specific objectives, measured achievement of these objectives on an appropriate sample of children, and revised the objectives accordingly.

This report to the school district is organized in three sections and three appendices. The sections are: Instructional Objectives, Learner Population, and Requirements for the Design of the Product. The appendices consist of a clarification of each objective, measures used, and the analysis of the data collected to assess the student population's performance.

I. Instructional Objectives

A. Goal: The school system requested a module "to enable students to distinguish between left and right."

B. Objectives: The goal was refined into four possible objectives:

Objective A The student will identify parts of his own body as being left or right.

Objective B Given directions to place an object to his left or right, the student will correctly perform the task.

Objective C Given a person or object that has a recognizable front and back, the student will identify his left and right features.

Objective D Given directions to place an object to another person's or object's left or right, the student will correctly perform the task.

A clarification of each of these objectives appears in Appendix A.
C. Population's Performance on Objectives: The four objectives were assessed using a sample of 10 students from the target population. The following table summarizes the performance on each objective:

<table>
<thead>
<tr>
<th>Objectives</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total points obtained</td>
<td>40</td>
<td>36</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Total points possible</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Percentage correct</td>
<td>88%</td>
<td>80%</td>
<td>37%</td>
<td>13%</td>
</tr>
</tbody>
</table>

These results indicate that the target population performs at criterion level or better on objectives A and B, but that there are performance deficiencies on objectives C and D. The results suggest that objectives C and D should be selected for the product, and that students using the product should first demonstrate competence on objectives A and B.

II. Learner Population

A. The learner population for which the product is designed consists of: six- and seven-year old, first and second grade inner-city school children.

B. The learner population for the product should be able to:

1. identify parts of their bodies as being left and right.
2. place an object, when requested, to their left or right.

III. Requirements and Preferences for the Design of the Product

A. The module is to be used in classrooms consisting of 18 to 25 students.

B. The module may require participation of a teacher and a paraprofessional. Sixty percent of the teachers responding to a telephone interview said that they would like only one paraprofessional at a time to be working in their classrooms.

C. The module may require up to two hours of class activity either in a single time block or over several days. Seventy-five percent of the teachers responding preferred a one-day module.

D. Duplication facilities and material are available through the school system.
APPENDIX A

CLARIFICATION OF EACH OBJECTIVE

Objective A

Objective Statement: the student will verbally discriminate parts of his body as being left or right when pointed to by the test administrator.

Content Limits: parts of the student's body that can be classified as being left or right are: eye, ear, arm, leg.

Measurement Procedure: a one-to-one testing situation in which the test administrator points to the student's body part, directs the student to respond, and records the response.

Performance Standard: the student will correctly designate 4 out of 5 body parts as left or right.

Objective B

Objective Statement: the student moves an object to his left or right according to discrimination of verbal directions.

Content Limits: noninjurious, unbreakable objects of one pound or less in weight.

Measurement Procedure: a one-to-one testing situation in which the test administrator gives verbal instructions and records the student's manipulative response.

Performance Standard: the student will move 5 out of 5 objects to the designated side.

Objective C

Objective Statement: the student will verbally discriminate parts of an object as being left or right.

Content Limits: objects that have a recognizable front and back: doll, boat, car, iron.

Measurement Procedure: a one-to-one testing situation in which the test administrator points to parts of an object, directs student to respond, and records the response.

Performance Standard: the student will correctly identify 4 out of 5 parts of an object as left or right.

Objective D

Objective Statement: the student moves an object to the left or right of a specified person or object according to verbal directions.

Content Limits: non-injurious, unbreakable objects of one pound or less to be moved in relation to a stationary person or object with a recognizable front and back.

Measurement Procedure: a one-to-one testing situation in which the test administrator gives verbal directions and records the student's manipulative response.

Performance Standard: the student will move 4 out of 5 objects to the designated side.
APPENDIX B

MEASURES USED TO ASSESS PERFORMANCE ON OBJECTIVES

Objective A

Sample Directions: "When I point to a part of your body, tell me if it is left or right. Is this your left ___ or your right ___?"

The following body parts were used: eyes, ears, arms, legs, hands, and feet.

Objective B

Sample Directions: "Put this ___ on your ___ side."

The following objects were used: rubber ball, doll, styrofoam beverage cup, and apple.

Objective C

Sample Directions: "When I point to a part of this ____, tell me if it is a left part or a right part."

The following objects were used: doll, teddy bear, and toy car.

Objective D

Sample Directions: "Put this ___ to the ____ of the ____ over there."

The following were used as manipulated objects: rubber ball, doll, styrofoam beverage cup, and apple. The test administrator was used as the stationary person/object.
## APPENDIX C

### ANALYSIS OF PERFORMANCE DATA FROM TRYOUT OF MEASURES

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<th>Student</th>
<th>Objective</th>
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<th>B</th>
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<td><strong>Percentage Correct</strong></td>
<td><strong>88%</strong></td>
<td><strong>80%</strong></td>
<td><strong>37%</strong></td>
<td><strong>13%</strong></td>
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</tbody>
</table>

These data suggest that instruction is primarily needed on objectives C and D. Objectives A and B could be reviewed, but can be considered prerequisite behaviors. Students like Jonathan and Charles should have special help before being given the module. A special pretest should be developed to identify students who need this preinstruction.
THE TASKS OF PHASE II:
DESIGN PROTOTYPE
Phase II of the development process involves designing an instructionally effective prototype of the product. A prototype is a low-cost mock-up of the product that can be used by a group of students. An instructionally effective prototype is one that meets the specifications prepared during Phase I.

You will undertake three tasks while designing a prototype:

- prepare a design for the instructional product
- develop a prototype of the instructional product
- try out the product and determine its instructional effectiveness

The sequence for undertaking these tasks is suggested by the figure below.

A design is prepared to guide the development of the prototype, the prototype is tried out to determine its effectiveness, and the results are used to improve the design and the prototype. The cycle is repeated until the prototype is instructionally effective with a small group of students.

Since it is difficult to develop an instructionally effective prototype on a one-shot attempt, plan your Phase II effort so that you can work through the three tasks at least twice.
In this task you will prepare a design for the instructional product on the basis of your specifications. The design will describe the instructional components which will help a learner achieve the objectives of the product and the sequence in which these components will occur. The design guides the development of the product and provides a framework for planning prototype tryouts and for deciding where and how a prototype should be revised.

As you prepare the design, the choice of a particular instructional component may suggest additional objectives or changes in the product's objectives. This may lead to modification of the original set of specifications.
DESCRIPTION OF TASK 5

The task can be performed in two steps:

1. Generate ideas for instructional components. For each objective generate a number of possible instructional components. For each component, describe the content, the form used to present the content, the learner activity, and the setting for the activity. It is advisable to brainstorm freely in this step and to be as inventive as possible.

2. Prepare one or more designs for the product. Preparing a design is essentially a process of selecting and ordering instructional components that will help learners achieve one or more instructional objectives. The instructional components should be selected and ordered so that the resulting design meets the following requirements:

- It follows from the specifications for the product. The components are relevant to the objectives and respect the experience of the learners; the forms of presentation and settings used in the components meet the requirements and preferences of the learners and other users.

- It takes into account the instructional functions any product must perform (e.g., orient and arouse learner interest, provide the learner with guidance, practice, and feedback, and maintain learner interest and motivation).

- It follows suggestions from learning research as to the instructional conditions which contribute to different types of learnings.

If you prepare several designs, you will have others to turn to for revision ideas if one does not prove to be effective.
NOTE

You may discover while generating ideas for instructional components that you feel obligated to propose one component per objective. Remember that some objectives may require several components before there will be sufficient instruction for learners to achieve those objectives. Remember also that a single component can contribute to the achievement of several objectives. Therefore, use not only the objectives as a starting point for your ideas, but also the information you have about learner interests and preferences.

You may find that the first design you prepare presents instruction mechanically—learners are given some information, asked some questions to help them process the information, and then provide the correct answers for those questions. While these factors may serve as a nucleus for some designs, make sure that your design will arouse and maintain learner attention and interest. Also, take time to consider other designs, based on suggestions in the following resource materials.
RESOURCES FOR
TASK 5

These resource materials begin with an example of a design in order to give you an image of how a design might look. Use it as a reference as you consider the remaining materials. These describe:

- some ways of organizing instruction
- the elements of an instructional component
- the instructional functions any product should perform
- suggestions for designs for four types of learning: the learning of procedures, principles, concepts, and verbal information

Together, these materials should help you both generate ideas for a design and revise particular designs to insure that they are instructionally complete.
I. AN EXAMPLE OF A DESIGN

A design is a "blueprint" for the instructional product to be developed. In a design, a developer:

- describes the instructional components into which the product will be organized
- presents the sequence in which the learner will work through these components
- describes how the instructional functions of the product will be incorporated into the components and the sequence to be followed.

Each of these aspects of a design are more fully described by the remaining sections of this resource material. However, before studying these sections, it may be helpful to look at an example of a design.

On the next page, there is a summary of the specifications for an instructional product on observation and inference for use with elementary school children. Then, on the following two pages is an example of a design for such a product. This design is presented so that you can examine all aspects of the design at once:

- the general overview of the organization of the design and of the relationship of the components to each other and to the objectives of the product.
- a description of each of the six instructional components which make up the design.
- an analysis of how five instructional functions are incorporated into the design.
EXAMPLE

SPECIFICATION FOR AN INSTRUCTIONAL PRODUCT*
ON OBSERVATION AND INFERENCE

Instructional Objectives

- Terminal Objective: Given an object in a closed box or cloth sack, and the opportunity to handle it in any way as long as the box is not opened, the learner will list observations and inferences that can be made about the object.

- Sub-Objectives:

  1. The learner will list observations organized by sense.

  2. The learner will list inferences consistent with the observations made.

  3. The learner will distinguish between observations and inferences.

Learner Population

Fourth-grade students will generally use this product. These students should have successfully completed instructional products on "naming and describing objects."

Requirements

This product is to be used in 25 to 30-pupil 4th-grade classrooms by teachers with no specialized training in how to present instruction on skills like "observing" and "inferring."

*This product is, in part, based on the unit "Inferring the Characteristics of Packaged Articles." In Science: A Process Approach, Part C. Washington, D. C.: American Association for the Advancement of Science, 1967.
EXAMPLE: DESIGN FOR AN INSTRUCTIONAL

Organization of the Design: This design follows a problem-based sequence. In Component 1, the problem of how to make good guesses (inferences) is introduced. Components 2 and 3 provide students instruction and practice on skills which should help students make good inferences. Component 4 reintroduces the problem of Component 1.

Component 1: Introduction

**Learner Activities:** Guessing what is in mystery boxes (boxes with unknown objects inside) and listening to tape introduction.

**Content:** Concepts of observation and inference.

**Form of Presentation:** Tape with read-along workbook.

**Setting:** Self-instructional.

**Description:** The tape will ask learners to guess what objects are in each box and to list their guesses in the workbook. The purpose of the science kit will then be described—to help learners make better guesses. Finally, the concepts of "observation" and "inference" will be introduced.

Component 2A: Making Observations

**Learner Activities:** Listing observations which can be made about given objects.

**Content:** Observing by systematically using the senses.

**Form of Presentation:** Tape with read-along workbook.

**Setting:** Self-instructional.

**Description:** The tape will ask learners to take each object and to list all of the observations they can about that object. For the first two or three objects, guiding questions will be provided, encouraging learners to use each of their senses (e.g., how does it smell?) to make observations. Some possible observations will be presented after time has been allowed for learners to write their own observations in the workbook.

Component 2B: Making Observations

**Learner Activities:** Listening to teacher presentation and playing observation game.

**Content:** Observing by systematically using the senses.

**Form of Presentation:** Teacher lecture.

**Setting:** Groups of 8 to 12 learners.

**Description:** The teacher will review the five senses and discuss how observations can be made using senses other than sight and taste. The observation game, seeing who can list the most observations about a hidden object presented by the teacher, will be introduced. The teacher will expand and guide learners as needed.

INSTRUCTIONAL FUNCTIONS INCORPORATED INTO THE DESIGN

**Orientation and Interest:** The introductory component informs learners that the goal of the kit is to make them better "guessers." Initial interest should be gained by the presentation of the sealed mystery boxes.

**Guidance:** Guidance is provided on tape and in the workbooks or by the teacher. In Component 2A, learners are asked guiding questions about whether they use each of their senses to make observations. In Component 3A, fictitious characters will discuss how observations can be used to help draw inferences. Components 3B and 4 will ask questions to ensure that observations are sensory based and that inferences follow from observations. Guidance will be strongest in initial cases and reduced for the last few objects dealt with in each component. In Component 4, learners will be encouraged to prompt each other.
PRODUCT ON OBSERVATION AND INFERENCE

and asks students to utilize the skills they have acquired during Components 2 and 3. Component 2 focuses on observation skills while Component 3 focuses on inference skills. For each of these components, there is an "A" and a "B" alternative. These alternatives may be used selectively to fit the interests and needs of the learners.

Component 3A: Drawing Inferences

Learner Activities: Guessing objects, given a list of observations.
Content: Drawing inferences based on observations.
Form of Presentation: Tape with read-along workbook.
Setting: Two learners working together.
Description: The tape presents a series of observations about unknown objects in several fictitious settings. Learners will be asked to be detectives trying to guess what is inside each sealed container.

Component 3B: Drawing Inferences

Learner Activities: Guessing what objects are hidden in boxes or sacks.
Content: Drawing inferences based on observations.
Form of Presentation: Tape with read-along workbook.
Setting: Self-instructional.
Description: The tape will have learners put objects, about which they have already made observations, into identical boxes and have learners ask friends to mix up the boxes. Guided by taped questions, learners will then make observations about the objects and draw inferences based on these observations.

Component 4: Guessing Contents of Mystery Boxes

Learner Activities: Guessing what is in mystery boxes, negotiating with partners on what are appropriate observations and inferences.
Content: Concepts of observation and inference, observing with senses and drawing inferences.
Form of Presentation: Tape with read-along workbook.
Setting: Two learners working together.
Description: The tape will ask learners, as partners to reconsider mystery boxes presented in Component 1, to list appropriate observations, and to draw inferences about what is in each box. Possible observations about each mystery box will be given. Emphasis will be placed on distinguishing between observations and inferences by stressing that observations are sensory based.

Practice: Practice in making observations is provided in Components 2A, 2B, 3B, and 4. Practice in drawing inferences is provided in Components 3A, 3B, and 4. The range of objects used will result in the use of learners' audio, tactile, and olfactory senses.

Feedback: Model observations are given in Components 2A through 4. In Components 3A and 4, partners will provide some feedback. All feedback in Component 2A will be provided by the teacher.

Motivation: The materials used in the prototype will be motivating for most learners; the use of unknown objects, the use of different foods as unknowns, and the inclusion of fictitious, comic-book style characters. Two socially motivating settings are used: a competitive situation in Component 2B and partners who may encourage and assist each other in Component 3A.
II. ORGANIZATION OF INSTRUCTION--POSSIBLE SEQUENCES

Most designs organize their instructional components in one of four ways. More complex designs may use several of these sequences together.

Sequence Based on Task Analysis

This sequence is based on the premise that what a learner is to be able to do as a result of instruction can be analyzed into a set of specific tasks which then can be ordered from the simplest to the most complex. A product following this sequence will introduce learners to one task at a time until they have acquired all the knowledge and skills necessary to achieve the product's goal. This sequence is found in many of the early forms of programmed instruction.

Problem-Based Sequence

A product using this sequence begins by posing the learners a question, problem, or puzzle. The product then supplies instruction on the knowledge and skills which will help the learners to be able to solve the question or problem. Usually, the final component of the product will have the learners demonstrate to themselves that they are now better equipped to solve problems like the initial one. The design in Section I uses this sequence.

Whole-Part-Whole Sequence

A product using this sequence begins by providing the learners with a broad overview of content and skills to be learned. Then, it systematically provides instruction on logical parts of that content. Finally, it concludes by integrating the parts into a conceptual whole. Most textbooks use this sequence over and over again: first, for the book as a whole, then for each section of the book, and finally for each chapter.

Learner-Controlled Sequence

A product may also be designed so that the learners decide which components they will do and in what order. This particular sequence requires that the learners already have some understanding of the content and skills represented by the product's objectives, for their decisions should be based on what they can do, what they want to be able to do, and their instructional preferences. This sequence also requires each component to be designed so that it is an instructionally self-contained unit.
III. THE ELEMENTS OF AN INSTRUCTIONAL COMPONENT

An instructional component is a unit of instruction that will help a learner achieve one or more objectives. The description of an instructional component includes:

- the activities in which the learner will be engaged
- the names of the content to be presented
- the form in which the content will be presented
- the setting for the learner's activity

Although this discussion will consider the elements of an instructional component separately, the generation of an idea for one element can affect the choice of the other elements. For example, the choice of a learner activity can influence choice of setting; the content to be presented can influence the choice of the form of presentation.

Learner Activities

Learner activities are the first element of an instructional component. They are derived from the statements of objectives prepared in Task 2. In generating ideas for components, consider all of the activities in which a learner could be engaged that would help him to practice and acquire the behaviors described in the objectives.

Content

The content is the second element of an instructional component. It is derived from the statements of objectives. The content to be included in the instructional design has usually been fully described during the performance of Task 2. In generating ideas for components, consider logical groupings of content that can be presented to learners at any one time.

Form of Presentation

The form of presentation is the third element of an instructional component--that is, the media and modes that can be used to present the content and guide the learner activities. In generating ideas for components, consider the range of available media and modes of presentation. The range of possible media and modes is suggested by the two following classification schemes. The first considers media and modes in terms of their degree of abstractness from experience; the second in terms of their use of the senses.
Degrees of Abstractness

This continuum suggests one way a developer can vary the presentation of content during a sequence of instructional activities—namely, in terms of degree of abstractness from direct experience. Many instructional products will use several modes of presentation to help a learner master the content being presented.

<table>
<thead>
<tr>
<th>VERBAL SYMBOLS</th>
<th>VISUAL SYMBOLS</th>
<th>STILL PHOTOGRAPHS</th>
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<tr>
<td></td>
<td></td>
<td>MOTION PICTURES</td>
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<td>TELEVISION</td>
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<td>DIRECT EXPERIENCE</td>
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</tbody>
</table>

Use of the Senses

This classification helps a developer consider the senses which may be used for a given content and the variety of media which can be used to stimulate a particular sense or group of senses.

<table>
<thead>
<tr>
<th>VISUAL (STILL)</th>
<th>VISUAL (MOTION)</th>
<th>VISUAL (TACTILE)</th>
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</thead>
<tbody>
<tr>
<td>chalk board</td>
<td>silent motion picture (live action, animation)</td>
<td>paper and pencil puzzle</td>
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<tr>
<td>chart, graph, map</td>
<td></td>
<td>specimen</td>
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<td>poster</td>
<td></td>
<td>game</td>
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<tr>
<td>display, exhibit model</td>
<td></td>
<td>construction materials</td>
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<tr>
<td>photograph</td>
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<tr>
<td>slide, filmstrip</td>
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<td>opaque projector</td>
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<tr>
<td>overhead projector</td>
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<td>print</td>
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<th>AUDIO</th>
<th>AUDIOVISUAL</th>
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<tr>
<td>records</td>
<td>videotape with sound</td>
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<tr>
<td>tape recordings</td>
<td>sound movies</td>
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<td>radio</td>
<td>discussion</td>
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<td>telephone</td>
<td>debate</td>
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<td>puppets</td>
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<td>drama</td>
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<td>role play</td>
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<td>demonstration</td>
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<td>field trip</td>
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</tbody>
</table>
Setting

The setting to be used is the fourth element of an instructional component. In generating components, consider the social and physical setting for instruction.

Social Settings: There are group settings, one-to-one settings, and self-instructional settings. Within these types, developers can consider a variety of options:

- a group setting can vary in terms of the size of the group, the nature of its membership, and the roles to be played by the group members

- a one-to-one or tutorial setting can involve a peer, parent, supervisor, or teacher as the tutor. The roles of tutor and student can be precisely or loosely defined

- self-instructional settings are favored by developers, as in this setting, the effects of the product are most clear

Physical Setting: When deciding about the physical setting, the developer should consider:

- the location or type of place where the instructional activity would be conducted: indoors or outdoors, at home, school, or place of work

- specialized equipment and resources of the setting: laboratory with water and gas available at each desk; a workshop with power saws, drill presses, jointers, lathes; a stage large enough for scenery changes and equipped for various lighting effects

- arrangement of the space and equipment to facilitate the activity, whether it involves discussions, experiments, or simply reading a text

Decisions about social and physical setting are intimately related, since physical setting can either encourage or prevent certain social relations. Similarly, the decisions of setting are closely related to those about learner activities, since the setting can either support a particular activity or restrict it.
IV. INSTRUCTIONAL FUNCTIONS A PRODUCT MUST PERFORM

For a product to be instructionally complete, it must perform certain functions for the learner. It must orient, arouse interest, guide the learner toward the behavior desired, provide practice and feedback, and maintain learner interest throughout.

This section suggests ways each of these functions can be met. The suggestions can be used to help generate your design or to review one you have prepared.

Orienting Learners

To help orient learners, your product may:

- present the objectives of the instruction
- present a conceptual overview that organizes the content to be presented
- describe the major activities in which learners will be engaged
- describe the rationale for the instructional activities and the sequence in which they will be presented

Arousing Learners' Interest

As part of the orientation for learners, a product may also need to capture their interest or attention. Your product may:

- discuss the value, importance, or relevance of the objectives to a learner now and in the future
- present a question or problem that will capture a learner's interest and attention
- create a learning environment whose materials, displays, and arrangement arouse learner curiosity
- have learners participate in decisions about how instruction will occur
Guiding Learners Toward Achievement of the Objective

To guide learners to their achievement of your product's objectives may:

- present descriptions and explanations to the learners

- offer models of the behaviors desired of learners

- provide explicit directions of what learners are to do

- use questions, hints, and prompts to help learners in their work

Whatever guidance is provided will need to be withdrawn before a learner can demonstrate mastery of an objective. Therefore, your product should provide only as much guidance as is necessary for a learner to experience success and progress in achieving the objective, but not so much that the learner feels he does not control or is not responsible for his learning.

Providing Learners with Practice on Desired Behavior

To insure that learners achieve your product's objective, it should provide learners opportunity to practice the behaviors desired. Be sure your product provides:

- opportunities to practice on the full range of content of the objective

- opportunities to practice the full range of behaviors of the objective

- practice in a way that learners do not experience recurring failure

- practice in a way that when learners have mastered the objective, they are not required to continue with more practice

- sufficient variation in the practice opportunities so that learners will not find them repetitious or boring
Provide Learners with Information on How Well They are Performing

To help learners know how well they are progressing, your product may provide information in the form of:

- correct answers to problems
- model responses to problems which reflect the process of solving the problem as well as the solution
- detailed explanations of the rationale for alternative answers

Feedback to learners is usually supplied as soon as possible after a problem, exercise, or assignment is completed. It can be supplied directly in writing, through a checking routine which learners use, by peer or instructor review.

Maintaining Learners' Interest and Motivation

To maintain learner interest and motivation, your product may employ three general techniques:

- Your product may use the instructional activities which are intrinsically rewarding by:
  using a variety of activities
  using materials that arouse learner humor, empathy, indignation
  using problems and questions that challenge learners
  using activities that insure that the learner is active
    (role play, simulation, games)
  structuring activities so that learners are successful
  structuring activities so that learners know how they are doing
  providing learners opportunities to teach others what they have learned
  enabling learners to learn from their errors

- Your product may use social reinforcement by having instructors:
  praise learners' work well done
  use learners' work as examples and models
  describe learning observed

- Your product may provide tangible rewards (e.g., menus of reinforcers, tokens, grades, records of accomplishments)
V. DESIGN SUGGESTIONS TO PROMOTE SPECIFIC TYPE OF LEARNING

On the basis of Gagné's classification of types of learning, your project will probably be directed toward objectives involving intellectual skills (the learning of procedures, principles, and concepts). These skills, in turn, may require a sub-objective involving the learning of verbal information. This section provides a short list of design suggestions for each of these types of learning. Use this list either to help you generate design ideas or to review the design you have prepared. For more detailed discussion of type of learning, see "Other Resources for Task 5."

To support the learning of formal procedures you might:

- check to see if prerequisite concepts and principles have been acquired before instruction begins

- present a wide variety of problems or situations

- have learners understand the reasons behind the sequence

- teach the sequence backward from the goal so that the learner sees the relation of each step to the goal

To support the learning of principles you might:

- check to see if prerequisite concepts have been acquired before instruction begins

- provide opportunities to apply principles learned to predict, control, or estimate outcomes of given situations (directions to learners may include "What will happen?" "Estimate..." or "What would you do?")

- provide materials that allow learners to check the correctness of their solutions on their own

- provide situations that include the full range of problem situations to which learners should be able to apply the principle learned
To support the learning of concepts you might:

- provide examples that demonstrate the entire range of attributes defining the concept
- verbalize the definition of the concept sometime during instruction
- arrange for varied practice in identifying examples of the concept
- provide both positive and negative examples in practice situations
- ask learners why an item is or is not an exemplar of a concept

To support the learning of verbal information you might:

- present information in an organized manner (i.e., organizing information logically will be more helpful to learners than a random presentation of facts).
- reinforce learners for attending to the information presented and for answering correctly
- provide a variety of contexts and a variety of statement forms (i.e., if appropriate, in his own words) for practice in recall-information.
- space review sections throughout presentations of information
- provide prompt guidance to reduce the number of student errors during question practice
1. Introductory Resources

The following three introductory resources are suggested:


This article offers a concise introduction to a model of the learning process and its implications for the design of instruction. In the light of its model, the article then examines the value and limitation of three types of media used in instruction: the book, television, and the computer.


This book can serve as a general reference. It integrates much of the material by Gagné and Briggs which is mentioned elsewhere in this section. Most relevant to Task 5 are Chapters 6, 7 and 8.


This article assesses the current state of instructional development and argues that to move instructional development beyond "raw empiricism," rules for manipulating design or "task" variables to optimize particular types of learning must be developed. The remainder of the article explores a possible taxonomy of task variables and reviews research on variables promoting higher cognitive processes.

2. Literature on Teaching

Though not directly relevant to the problem of developing a product, it can be useful to approach the task of preparing a design with some background to general models of teaching. The following resources describe alternative models of teaching.


This chapter begins with a description of contemporary practice of teaching and then explores three models of teaching: the behavior-control model, the discovery-learning model, and the rational model.


This book organizes models of teaching into four "families:" those focusing on individual development, those focusing on group processes and interpersonal skills, those representing ways to teach concepts and modes of inquiry from the disciplines, and those using models of operand conditioning. The second and third groups of models are most relevant to the design of instructional products.


This book discusses teaching from the perspectives of social interaction, logic and language, developing cognitive processes, encouraging inquiry and discovery, and encouraging the emergence of human potential. Most relevant are the chapters on cognitive processes and inquiry.

3. Reviews of Research on Instructional Techniques and Variables

There is a rapidly growing literature on instructional techniques and principles that have been identified through research. Some reviews and collections of this literature are:


This is a comprehensive article on research on programming through 1967. It discusses the technology of instruction, stimulus factors, feedback factors, and organizations and sequence of instruction. The extensive bibliography is a useful resource.


This book provides a collection of research articles reporting studies on the use of instructional objectives, prompting and fading techniques, control of student responses, reinforcement and feedback.


This article reviews research on eight major characteristics of learning events: attention techniques, learner preconditions, presentation of stimuli, prompting, conditions (overt or covert) of response, feedback, retention, and transfer.

111
4. Instructional Programs on Selected Instructional Techniques

Two instructional programs that describe specific instructional techniques drawn from the literature of research on instruction are:


  This book is a tested training guide on how to use the techniques of practice, knowledge of results, prompting, task description, and inspection in instructional products. Practice exercises are provided as well as an extensive annotated bibliography.


  This programmed text presents the principles underlying programmed instruction, distinctions about various ways to prompt, and guidelines for designing a program.

5. Conditions of Learning

A number of learning psychologists have been trying to define the conditions which contribute to certain types of learning. Some useful introductory articles by these psychologists are:


  This article broadly describes five types of learning (motor skills, verbal information, intellectual skills, cognitive strategies, attitudes) and some of the principles which encourage each type of learning.


  This book provides a collection of articles that discuss the learning of complex cognitive behaviors. Of particular interest are the articles by Robert Gagne', Pp. 102-117, 296-326; Francis Mechner, Pp. 264-63; and Susan Markle and Philip Tiemann, Pp. 284-95.

6. Review of Research on Instructional Media

For students interested in in-depth reviews of research on the media of instruction, these reviews are good places to start:


  This monograph discusses the practical problem of selecting appropriate media for instruction and proposes an objectives-based solution. Chapter 5 offers a selective review of those studies directed toward the questions of comparative effectiveness of various media and of utilization of particular media.


  This review considers research on the relative effectiveness of various instructional media in various learning contexts. It emphasizes research on pictorial media and its use in instruction directed toward various cognitive objectives.


  This chapter provides a comprehensive review of research on the media of instruction conducted prior to 1965. It covers a wide range of topics including types of instructional media, factors involved in research on media, instructional techniques, and methodological problems facing the researcher interested in media.


  This book reviews information-processing models of learning and discusses the implications of this research for the design of instructional materials. Chapters on the nervous system, analysis of perceptual information, the capacity of the human information system, attention, characteristics of auditory and visual educational materials, and memory are included.

7. Review of Research on the Sequence of Instruction

For students interested in in-depth reviews of research on the sequence of instruction, two reviews to begin with are:


  This review considers various meanings attached to the concept of "sequence" and groups the studies into nine types. Of most interest are the studies directed toward sequences established in accordance with hierarchies of competence and those which consider the degree to which the learner controlled the sequence.


  This review examines studies investigating the role of sequence in relation to specific types of learning and the goal of transfer of learning. It brings together Gagne's interests in conditions for learning and empirically validating learning hierarchies.
In this task you will develop a prototype of the materials and procedures planned in the design. The prototype of your product should be sufficiently complete so that the instructional effectiveness of the product design can be determined. The prototype should also be sufficiently low-cost so that revision and improvement of the prototype are feasible. In developing the prototype, you may discover that certain aspects of the design are difficult to implement; if so, modify your design.
DESCRIPTION OF TASK 6

This task is performed in two steps:

1. Develop the instructional materials in a low-cost format. Depending on the requirements of your design, you may write directions, text materials, examples, exercises, and make simple line drawings, charts, and manipulative materials. Most of your work will be in the form of paste-ups that can be dittoed or xeroxed. If your design calls for audio tapes, your prototype will be a script; if your design calls for film, videotapes, or filmstrips, your prototype will probably be a storyboard.

There are two guidelines to follow in your development work:

   Keep it lean. Do not overwrite or over-draw. Do not provide more exercises or examples than you expect will be necessary. It is easier to revise materials by adding instruction, examples, practice, and feedback, than it is to decide what is extraneous or too complex.

   Remember the learners. They will want to work with materials that are clear, interesting, and fun.

2. Debug the instructional materials. In this step, have a learner and maybe a fellow developer work through your materials, identifying where your directions are unclear, where your vocabulary is too difficult, and where the layout of material is too complex and confusing. In effect, these reviewers will suggest the kinds of editorial, layout, and content changes that will make the prototype usable. It is essential that you find out if learners can use your materials before you try to determine the prototype's instructional effectiveness in Task 7.
NOTE

You may feel that the criteria implicit in the description of this task appear difficult to meet. On the one hand, your prototype is to be lean; on the other, it is to be both usable and interesting. One approach to meet these criteria is first to assume that your prototype will be interesting because of your choice of instructional components and their sequence, and that the motivational value of your ideas will not be lost because of a lean presentation. Then while developing your prototype, attend to the task of keeping it lean. To insure that the prototype is not too lean, get help from others as to where you need to elaborate and fill out the materials.
The following resource material provides suggestions about how to prepare a prototype in the form of a paste-up, script, or storyboard. These are low-cost formats that can be used to try out most designs for an instructional product.
I. CHARACTERISTICS OF A PROTOTYPE

A prototype may be defined as a quickly prepared, inexpensive mock-up of one or more components of an instructional product. This preliminary version of a product serves four important functions:

- it presents the instructional activities that were described in the design in a form that learners can work with.
- it can be used to try out alternative instructional ideas
- its components can easily be rearranged, repositioned, edited, or otherwise revised
- it can be scrapped if unsuccessful without serious loss of time and money

A prototype usually takes on one or more of these forms: paste-up, script, storyboard.

If your instructional product will be a form of printed material, such as a text, workbook, or single sheet lessons...

... then, your mock-up of the product will probably be a paste-up of typed text and rough visual sketches.
If your instructional product is to be a sound recording, such as a record or tape...

...then, your mock-up of the product will probably be in the form of a script.

If your instructional product is to be audiovisual such as a filmstrip, motion picture, slide series, or a series of overhead transparencies...

...then, your mock-up of the product will probably be a storyboard.
II. PASTE-UP

The paste-up technique is used primarily for mock-ups of printed materials, and includes text and illustrations. Examples of these are text, workbook, single sheet lesson, or a board game.

A paste-up is made by cutting written or typed copy into segments, making rough sketches of any visuals that you will need, and arranging the copy and sketches in different sequences and layouts. This method of development makes it easy to experiment with alternate lay-outs. When a layout is chosen, text and sketches are taped or pasted into position, and are ready for duplication.

In choosing a layout for your paste-up, consider these guidelines:

Keep materials that are related to an idea or topic together, using one or two-page spreads whenever possible.

Keep layout simple; a good proportion (50-50) of white space used to present content is advisable. Cluttered pages with too much information tend to overwhelm the learner.
Try to focus the learner's attention to the most important content and to the way the content is organized. To do this, you can use such devices as addition or change of color, size of type, or boldness of line.

When paste-ups are completed, they are usually duplicated for learner use. There are a number of "copying" processes you can use; these include xerox, ditto, mimeograph, and offset printing. The characteristics of these processes are summarized below:

<table>
<thead>
<tr>
<th></th>
<th>XEROX</th>
<th>DITTO</th>
<th>MIMEOGRAPH</th>
<th>INSTANT PRINTING (offset)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>QUALITY OF COPY</strong></td>
<td>good</td>
<td>poor</td>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td><strong>NATURE OF PROCESS</strong></td>
<td>no mess</td>
<td>somewhat messy</td>
<td>messy</td>
<td>requires outside printing service</td>
</tr>
<tr>
<td><strong>COST</strong></td>
<td>cost is approx. 6¢ per copy</td>
<td>fraction of a cent per copy</td>
<td>master can cost up to a few dollars - copies 1¢ or less</td>
<td>approx. 2-3¢ per copy for a run of 100 copies or more</td>
</tr>
</tbody>
</table>

Note: When a more elaborate mock-up is desired or when runs of 75 or more are required, if you have the necessary time and money you should consider using a commercial printer. Services offering "instant printing" are set up to provide offset reproduction at low cost, if only one color on an 8½" x 1" format is used, and black and white, camera-ready art is provided.
III. SCRIPT

The script technique is used for simulating the recorded sound or audio portion of an instructional product. A script presents the actual narration and describes any necessary music or sound effects. It can also describe such technical characteristics as volume, pitch, mixing of sounds, fade-ins and fade-outs of sounds, and the time period during which a particular sound will be presented.

AUDIO SCRIPT

<table>
<thead>
<tr>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characters:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Narration</th>
<th>Sound Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialogue</td>
<td>Music</td>
</tr>
</tbody>
</table>

In preparing a script, consider these guidelines:

Write a script so that it conveys its ideas rapidly without being wordy. Most learners can process ideas much faster than they can be spoken.

Write a script so that the structure of ideas is clear to the learners. Use introductions, reviews, summaries. Use sign words to designate major ideas (e.g., one, two, three). Use different voices to reflect different ideas and positions.
Write a script so that learners are directed toward the ideas being presented and are given an opportunity to respond to them. Consider providing learners with worksheets to encourage overt responses and feedback for their responses.

Use variation in volume, pitch, and sound to help obtain and maintain learner attention.

To try out a script, it may be read aloud to a sample of learners or it may be recorded by the developer on audio tape. To avoid needless expense, professional recordings should not be made until the instructional effectiveness of the script has been established.
IV. STORYBOARD

The storyboard technique is used for mock-ups of many kinds of visual and audiovisual products that have a fixed order: slide series, series of overhead transparencies, filmstrip, film, videotape recording.

In a series of frames, the storyboard lays out sketches reflecting each major visual idea to be presented and describes the accompanying narrative. Other information, such as transitions in a film and special sound effects may also be included on a storyboard.

There are three steps in the preparation of a storyboard:

- A preliminary storyboard can be made using index cards, with each card representing a visual or narrative idea. The cards are then laid out in an array that can be easily reordered into different idea sequences.

- The narrative ideas on the preliminary storyboard are then developed into a complete script. This script is similar to one for audio tapes or records except that it is keyed to the major visual ideas to be presented.
- The visual ideas on the preliminary storyboard are then developed more fully by preparing simple sketches or line drawings, or by taking pictures with a Polaroid camera. Preparation of a storyboard for film or videotape requires some additional considerations beyond those required for still visuals. These differences are laid out in the table on the following page.

The value of a storyboard is that it encourages a developer to relate his visual and narrative ideas. In preparing a storyboard, remember that the visual and narrative ideas should complement each other. When visual and narrative ideas are not clearly related, it is difficult for the learner to follow. On the other hand, when the same idea is presented identically by the visuals and the narrative, a learner can rapidly become bored.

In preparing your storyboard, consider these guidelines:

Present together the visual and narrative ideas which belong together

Make the organization of ideas clear to the learners facilitating their understanding and retention of those ideas

Give the learners opportunities to respond actively to what is being presented

Provide a sufficient variety of ideas to maintain learner attention and interest
Differences Between Still and Motion Media in the Preparation of a Storyboard

<table>
<thead>
<tr>
<th>STILL</th>
<th>MOTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The visuals are usually illustrated on storyboard.</td>
<td>Only the important milestones of the visual presentation are illustrated on the storyboard.</td>
</tr>
<tr>
<td>The development team generally thinks in terms of static, non-changing visuals.</td>
<td>The development team thinks in terms of camera moves (e.g., zooms, pans) and other special motion effects (e.g., dissolves, fades, superimpositions, slow motion, fast motion, stop action).</td>
</tr>
<tr>
<td>The development team thinks in terms of continuity from one idea.</td>
<td>The development team not only thinks in terms of continuity from one idea to another, but also in terms of one action to another.</td>
</tr>
<tr>
<td>Close synchronization of audio to visual is not always critical.</td>
<td>Close synchronization of audio to visual is generally required.</td>
</tr>
<tr>
<td>The development team has the option to think in terms of visual components that can be reordered by the user of the program.</td>
<td>The development team must think in terms of fixed visual components that cannot be reordered by the user of the program.</td>
</tr>
</tbody>
</table>

Other Resource for Task 6

General Reference


This text describes basic techniques for producing audiovisual materials. Although most of the techniques described involve the preparation of final product versions, the sections on scripts and storyboards are valuable for the developer of prototypes.
In this task, you will try out your prototype with a small group of learners—usually 3 to 8 in number. From this tryout, you will gather information which will help you to determine if your prototype needs to be improved. You will also use this information to decide how the prototype could be made more instructionally effective, how its value for learners could be increased, and how it could be made more easy to use.
This task may involve five steps:

1. Prepare a plan for the prototype tryout. Briefly describe the type of information to be gathered during the prototype tryout, the criteria to be used to guide analysis and interpretation of data collected, the nature of the learner sample and how it will be selected, and the conditions under which the tryout will be conducted.

2. Prepare measures. Prepare the measures needed to obtain the information required by the plan.

3. Conduct the prototype tryout. Present the prototype to the learners, observe how they work through the prototype, collect samples of learner work, and administer posttests and questionnaires.

4. Analyze the results. Organize and summarize the data collected in appropriate tables and graphs. Determine where the prototype is instructionally effective and where it needs to be revised. Recommend revisions for each ineffective or deficient instructional unit.
5. Confirm the analysis (optional). Explore your interpretations of the results and your recommended revisions with all participants in the prototype tryout.

After completing the task, many developers prepare a report summarizing the results of the tryout. Such a report may include:

- an introduction describing the product being developed and orienting the reader to the remainder of the report
- a summary of the plan for the prototype test
- a description of how the test was administered and any problems encountered
- the analysis of data available for each unit of the product, any interpretations of the data that you have made, and your decisions about which units are ineffective and which need to be revised
- a summary of recommended revisions for the product

NOTE

Since planning and conducting a prototype tryout involves other people and requires considerable effort on your part, take the time to plan your tryout to ensure that you will collect all pertinent information. Also, have any new measures you develop reviewed and tried before you use them in the prototype tryout, for then you will have confidence that these measures will, indeed, provide the information you want to obtain.
The following resource material provides suggestions on how to carry out each of the five steps of this task. Specifically, it provides:

- an example of a plan for a prototype tryout and guidelines on how to prepare one
- examples of measures which may need to be prepared for use in a tryout
- an outline of major activities involved in conducting a tryout
- an example of an analysis of data from a prototype tryout along with guidelines of how to weigh performance, value, and process information
I. PLAN A PROTOTYPE TRYOUT

A plan for a prototype tryout is organized by instructional objective and/or component. The plan summarizes what information will be collected about each component to help determine:

- whether the component is instructionally effective or needs to be revised
- whether it is valued by the learners or needs to be revised
- whether it was easy to use and was used as intended or needs to be revised

The plan also describes how the information will be collected, how the sample of learners will be obtained, and under what conditions the tryout will be conducted. An example of a plan appears below.

AN EXAMPLE OF A PLAN FOR A PROTOTYPE TRYOUT

<table>
<thead>
<tr>
<th>Performance</th>
<th>Component 1: Introduction to the Boley gauge*</th>
<th>Component 2: Interpretation of the measuring scale</th>
<th>Prototype as a whole</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trias/Visual items on parts and proper usage of Boley gauge—6 items</td>
<td>Embedded practice items on reading the scale—6 exercises</td>
<td>Posttest—Measurement of 6 objects</td>
</tr>
<tr>
<td></td>
<td>Criterion: All items must be correct</td>
<td>Criterion: All items must be correct</td>
<td>Criterion: 5 out of 6 correct</td>
</tr>
<tr>
<td>Value</td>
<td>Learners' rating on component's helpfulness in achieving objective</td>
<td>Learners' rating on component's helpfulness in achieving objective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criterion: 3.0 average on 4 pt. scale</td>
<td>Criterion: 3.0 average on 4 pt. scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learner suggestions for improvement/change</td>
<td>Learner suggestions for improvement/change</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Instructor pauses at least 10 seconds after each visual to give learners time to examine their own gauges</td>
<td>Component 2 must be presented after Component 1 is completed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>There is at least one Boley gauge for every 2 learners</td>
<td>Learners practice measuring at least one object in each of three groups of objects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learners' rating of the clarity of the visuals</td>
<td>Learners' rating on sufficiency of practice exercises</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criterion: 3.0 average on 4 pt. scale</td>
<td>Criterion: 3.0 average on 4 pt. scale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learners' rating of sufficiency of the time allowed for viewing the visuals</td>
<td>Learners' recommendation on the types of objects used for practice exercises</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criterion: 75% of learners must answer &quot;yes&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learner Sample</td>
<td>6 learners volunteering from dental technician course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conditions for Administration</td>
<td>Lab setting with overhead projector. Instructor will be present throughout and should answer all questions. Component 2 will not be distributed until after Component 1 is completed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*This plan is based on a project by Robert Thye at UCLA. A Boley gauge is a common dental measuring instrument in some respects similar to a micrometer.
The process of preparing a plan can be organized as follows:

Identifying Information To Be Gathered

For each objective and/or component, you may need to identify three kinds of information:

- information that must be collected to determine whether the objectives of the component were achieved. You may use the measures developed and tried out during Phase I. In addition, if the prototype has the learner working through practice exercises, sometimes the learners' performance on these exercises can be used to provide information regarding the component's effectiveness.

- learner value judgments about specific aspects of the instruction offered by a component. For example, you may want learners to rate the extent a component helped them to achieve that component's objective or to state whether they would have preferred other activities to achieve the component's objectives. Value judgments are usually collected by short questionnaires.

- information that will be collected to make decisions about whether the component was used as intended. For example, you may want to collect information about the way materials were distributed, the orientation provided learners, the time spent on each activity, and the content of discussions held.

whether learners found the component complete. For example, you may want to know if sufficient practice was provided, if enough time was allowed, and if materials were clear.

whether the component was easy to use. For example, you may want to know about how clear were your procedural directions and how well materials using several media worked together.

Setting Criteria

Once the information to be collected and the method of collection have been specified for a component, you may want to note the performance standards or criteria that will be used to guide the analysis of the information. Performance standards for the measures of each objective have usually been set during Phase I; if possible, these are used to guide the analysis of performance information and the decision about component effectiveness. In your plan, you will also want to set some criteria that will help in making decisions about whether the prototype was sufficiently valued or requires revision. These criteria are tentative and to some extent arbitrary, but they do provide a useful framework for doing the analysis.
Describing the Sample of Learners

Your plan should also include a statement about the sample, its size, and how it will be selected to insure that it is representative. The sample for a prototype tryout is kept small. Usually 3 to 8 persons are used, because such a group is relatively easy to acquire and it is possible to observe in detail their use of and response to the instruction offered. Even though the sample may be small, it should be representative—-one reflecting the range of abilities of the learner population. You may use the data from the tryout of measures to help you select a representative sample.

Describing Conditions for the Tryout

Finally, your plan should describe the conditions under which the tryout is to be administered. Depending on the type of prototype being used, you may need to describe the time required, the physical setting to be used, the role of the administrator, the help that the administrator can provide learners, and how the prototype will be presented.
II. PREPARE MEASURES

Once the plan has specified the information to be collected and the instruments required, you then prepare these instruments. The following suggestions and examples may help you in preparing performance measures, questionnaires, and observation forms.

Preparing Performance Measures

You generally will use performance measures developed and tried out in Phase 1; however, in designing and developing the prototype, some changes in the prototype's objectives may occur—changes that require modification, additions, or deletion of items from the previously developed measures. In making these changes, follow the suggestions provided in Phase 1 resource materials regarding selection of a measurement procedure, generation of items, review of the items, and tryout of those measures. If any new performance measures need to be developed, they should be reviewed and tried out before use.

Preparing a Questionnaire or Interview Schedule

In your prototype tryout, you will use questionnaires and interviews to collect learner value judgments and data about how the prototype was used. An example of a questionnaire follows:

<table>
<thead>
<tr>
<th>QUESTIONNAIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>for &quot;How to Use a Boley Gauge&quot;</td>
</tr>
</tbody>
</table>

Please place a check in the appropriate box:

1. How well did the visuals shown by the instructor identify each part of the Boley gauge?
   very well ________ ________ very poorly

2. How well did the visuals shown by the instructor show how to use a Boley gauge properly?
   very well ________ ________ very poorly

3. How helpful was the introductory lecture in orienting you to the Boley gauge and its use?
   very helpful ________ ________ not helpful

4. How helpful was the booklet in helping you read the Boley gauge's scales?
   very helpful ________ ________ not helpful

5. Did you have sufficient time following each visual to examine your own gauge? Yes____ No____

6. Would you prefer an introductory booklet over the lecture to orient learners to the Boley gauge? Yes____ No____

7. Did you have enough practice opportunities to master measuring with a Boley gauge? Yes____ No____

8. Would you prefer a lecture over the booklet format for the scale reading section? Yes____ No____

9. Are there any objects you would recommend be included for measuring practice? Yes____ No____

10. Other comments or suggestions?
The following suggestions may help you prepare questionnaires and interview schedules. Both of these data collecting techniques involve a set of questions; they differ only in how they are administered and in the interviewer's option to pursue an answer to a question (see "Other Resources for Task 7" for a discussion of special problems associated with interviewing).

**Item Formats.** For most information needs, selected response items will supply sufficient answers. This type of item is relatively easy to write and is the easiest to score. If the reasons for a learner's response in a selected response item will be helpful, a combination item should be used. This type of item allows for constructed response but still imposes a structure on learner responses and therefore allows for easy scoring. From a scorer's point of view, constructed response items are the least preferred. However, for some types of questions seeking to obtain information from ill-defined areas, this type of item can be useful. Some guidelines for writing selected response items appear below.

<table>
<thead>
<tr>
<th>Guidelines for Writing Selected Response Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Items should contain a single idea and should be stated positively.</td>
</tr>
<tr>
<td>2. The alternatives provided should represent a continuum (e.g., agree-disagree, very important-unimportant).</td>
</tr>
<tr>
<td>3. When learners are to make a clear choice, an even number of intervals should be used on the continuum (thus eliminating a neutral position).</td>
</tr>
<tr>
<td>4. When learners are to have the option of avoiding a choice, an odd number of intervals should be used on the continuum so as to provide a neutral position.</td>
</tr>
<tr>
<td>5. Items should be worded so that students do not always mark the same end of the continuum. Care should be taken to avoid double negative statements. For example: a learner who enjoys playing a game will agree with the statement &quot;the game was fun&quot; and disagree with &quot;the game was a real bore.&quot; He should not be asked to agree or disagree with a statement such as &quot;the game was not fun.&quot;</td>
</tr>
<tr>
<td>6. Within a questionnaire, try to limit the number of continua used.</td>
</tr>
</tbody>
</table>
The Order of Questionnaire Items. Items should be ordered systematically. There are at least two possible ways to order questionnaire items:

- Ordering items by item format. Sometimes developers do not want answers to constructed response questions to be influenced by other items in the questionnaire. They therefore distribute constructed response questions first and collect the answers before other items are presented. Constructed response questions can also be placed at the beginning of the questionnaire; however, this method provides less control over what influences the learner's response.

- Ordering items by topic or objective. This allows the learner to concentrate on one topic at a time without being distracted by others.

Questionnaire Directions. A complete set of directions should be prepared for every questionnaire.

- Directions to learners should orient them to: the questionnaire's purpose, how answers should be recorded, and how best to use the time allotted.

- Directions to the administrator should describe: the setting required, what materials should be distributed to the learners and in what order, the time required, and the instructions to be given.

- Directions to scorers should include: sample categories against which constructed response answers may be analyzed, examples of properly analyzed constructed response items, and descriptions of how test results should be summarized to facilitate analysis and interpretation.

Tryout of a Questionnaire. The questionnaire should be submitted to a trial run. A small group of two or three people can provide valuable suggestions on how to improve a questionnaire.
Preparing Observation Forms

An observation form is usually a checklist of observable events and a tally sheet for repeated behaviors. It is used to help determine the extent to which instruction occurs as intended. A simple example of such an observation form is shown below:

OBSERVATION FORM
for "How to Use a Boley Gauge"

1. At least one Boley gauge is provided for every two learners. Yes____ No____

2. At least a ten-second pause occurs following each visual.
   1) Yes____ No____  4) Yes____ No____
   2) Yes____ No____  5) Yes____ No____
   3) Yes____ No____  6) Yes____ No____

3. Component 2 is started only after Component 1 is completed. Yes____ No____

4. Questions Raised by Learners

Instructor Response

____________________
____________________
____________________

The following guidelines may help you prepare observation forms:

- State each behavior to be observed positively and in the present tense. Describe the behavior as precisely as possible; avoid terms that imply the inferences you want to draw from the observation.

- Limit the number of behaviors any one observer is to record at any one time. The more behaviors an observer has to keep track of, the more apt he is to miss occurrences of those behaviors.

- List the behaviors in a manner that will facilitate checking or tallying. Behaviors which may be expected to occur together should be placed on the form together. Behaviors that may be expected to occur in a particular sequence should be placed in that order on the form.

- Try out the observation form. This will let you find out if the behavior you have chosen is difficult to read. You may also want to show your form to trained observers who can give you suggestions on how to insure reliable information is collected.
III. CONDUCT A PROTOTYPE TEST

Once you have the plan for the tryout, the various measures, the prototype, and the sample of learners, conducting a prototype tryout can be a straightforward process, usually involving five activities sequenced in the order suggested below:

A. Orient the Learners
   → B. Present Instruction
   → C. Observe Instruction
   → D. Collect Samples of Learner Work
   → E. Administer Post Test and/or Final Questionnaire

In conducting these activities, you should try to do them in a way that can be replicated in future tryouts, since each activity can affect the results of the tryout. Thinking through each of these activities also minimizes the occurrence of unanticipated events that may make interpretation of the results difficult. For example,

- the content and tone of the orientation can affect the way learners work through the prototype. Consider writing out the orientation to insure that all critical points are covered.*

- the way instruction is to be presented is usually well-described in the prototype; however, double check that the description is as complete as it can be and that there are procedures for handling learner questions.

- determine where the observers will be located to insure that the information can be gathered and the learners are not disturbed; consider introducing the observers so that their presence does not bother the learners.

- determine how and exactly which material will be collected so that there will be no confusion on the part of the administrator or the learners.

- review the completeness of the directions to any test and questionnaires that are to be administered.

*Some of the points that can be included in an orientation are: the purpose of the tryout (i.e., not to test learners, but to test the prototype, the time required, the nature of instruction in which they will engage, and the materials that will be collected at the end of instruction).
IV. ANALYZE THE RESULTS

You will analyze the results of a prototype tryout for each component of the prototype by

- organizing the performance information into appropriate arrays, tables, and graphs, and deciding if the component was effective or ineffective

- summarizing judgments collected from learners

- summarizing information about how a component was used and the difficulties learners and instructors encountered; and deciding if it was used as intended.

- recommending revisions

To help you recommend revisions, the following materials may be helpful.

Types of Revisions

There are four general types of revisions. In the order of their relative cost to a developer, they are:

- editorial/layout/format revisions or simple changes made to improve the style and appearance of a prototype.

- administrative revisions or modification of the directions given for using the prototype. For example, improving the clarity of directions, changing the usage requirements listed for the prototype, and completely overhauling the directions given.

- instructional revisions; for example: changing the orientation given learners, adding practice opportunities, or changing the type feedback presented (See Resources for Task 5).

- radical revisions of the character or sequence of instructional activities. For example, changing the form of presentation and setting of an activity, adding or dropping specific instructional activities, and rearranging the sequence of activities.

Guidelines for Selecting Types of Revisions

Determining the type of revision most appropriate for a prototype requires careful examination of the information obtained in the tryout. The following table provides some guidelines for the types of revisions you should consider, given specific information patterns. However, recognize that these are not hard and fast rules; they are only a starting point for ways that tryout results can be examined. Remember also that your interpretation will be based on only a small sample of learners. Major changes should be undertaken only if there is strong evidence that the product is not effective and/or not valued.
### Guidelines for Revision

<table>
<thead>
<tr>
<th>Is the prototype effective?</th>
<th>Is the instruction valued?</th>
<th>Was the prototype used as intended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>This data pattern suggests no major problems with the prototype. Developers may examine process information to identify minor editorial, layout, or format changes that will help &quot;polish&quot; the prototype.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests that although the prototype was not used as intended, it was effective. Consider modifying the directions for the prototype to allow it to be used as it was in the tryout.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests the need for more information to determine what revisions should be made. Consider interviewing learners and the instructor, if appropriate, to determine why they did not value the instruction and why they did not use the product as intended. Reconsider the validity of the criteria for effectiveness. If revisions are identified and made, the revised prototype should be tried out.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests that the component deals inadequately with learner affect. Consider interviewing learners to identify specific problems. If possible, use low-cost revisions to address the problems raised in the tryout. Conduct another tryout following revision of the prototype.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>No</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests that more data are needed to identify why the product failed. Consider interviewing learners, observers, and the instructor to identify possible revisions. Consider improving administrative directions so the prototype is used as intended. Conduct another prototype tryout.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests an instructor effect. Consider revision of administrative directions first. Conduct tryout of the revised prototype.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests that some instruction functions were inadequately performed by the prototype. Consider interviewing learners to confirm this hypothesis. Consider revisions in practice, feedback, and guidance provided. Conduct a tryout of the revised prototype.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>This data pattern suggests that there are serious problems with the prototype. Interview learners to determine specific breakdowns and possible revisions. Consider changes in how instructional functions were performed. If necessary, consider radical changes in the character of the instructional activities (e.g., change of learner activity, form of presentation, social setting, sequence of activities). Conduct tryout of the revised prototype.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example

ANALYSIS OF RESULTS OF A TRYOUT OF
THE "BOLEY GAUGE" PROTOTYPE

COMPONENT 1

PERFORMANCE INFORMATION

<table>
<thead>
<tr>
<th>Learner</th>
<th># of Correct Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gail</td>
<td>6</td>
</tr>
<tr>
<td>Charles</td>
<td>6</td>
</tr>
<tr>
<td>Marcie</td>
<td>6</td>
</tr>
<tr>
<td>George</td>
<td>6</td>
</tr>
<tr>
<td>Wendy</td>
<td>6</td>
</tr>
<tr>
<td>Mark</td>
<td>6</td>
</tr>
<tr>
<td>Chris</td>
<td>6</td>
</tr>
<tr>
<td>Janet</td>
<td>6</td>
</tr>
</tbody>
</table>

Interpretation: Component 1 appears to be effective since all of the practice exercises were correctly completed.

VALUE INFORMATION

Average rating of helpfulness of component in reading a Boley gauge scale was 3.0 on a 4 point scale.

7 out of 8 learners would prefer a booklet presentation over the lecture presented.

Interpretation: Although learners found the lecture helpful, they seemed to prefer a self-paced presentation.

PROCESS INFORMATION

At least 1 Boley gauge was available for every 2 learners; visuals were shown for at least 10 seconds.

Average rating of the clarity of visuals in showing the parts of a Boley gauge was 3.75.

Average rating of the clarity of the visuals in showing how to use a Boley gauge was 3.63.

Percentage of learners having sufficient time to examine their own gauges after the presentation of a visual was 87.5% (7 of 8 learners).

Interpretation: The component was used as intended. Learners seem to feel that the visuals were clear and the pacing of visuals was about right.

RECOMMENDED REVISIONS

Learners did not seem to like the group pacing necessary in a lecture presentation. Consider using a booklet that presents the same visuals, content, and exercises as the lecture presentation.
PERFORMANCE INFORMATION

<table>
<thead>
<tr>
<th>Learner</th>
<th># of Correct Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl</td>
<td>6</td>
</tr>
<tr>
<td>Charles</td>
<td>6</td>
</tr>
<tr>
<td>Marcie</td>
<td>5</td>
</tr>
<tr>
<td>George</td>
<td>5</td>
</tr>
<tr>
<td>Wendy</td>
<td>5</td>
</tr>
<tr>
<td>Mark</td>
<td>4</td>
</tr>
<tr>
<td>Chris</td>
<td>4</td>
</tr>
<tr>
<td>Janet</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learner</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Charles</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Marcie</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>George</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Wendy</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Mark</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Chris</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Janet</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Table of Proportions

<table>
<thead>
<tr>
<th>Interval</th>
<th>1-2</th>
<th>3-4</th>
<th>5-8</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Students</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

# of Students

<table>
<thead>
<tr>
<th>Interval</th>
<th>1-2</th>
<th>3-4</th>
<th>5-8</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Students</td>
<td>0</td>
<td>63.5</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Interpretation: Component 2 was not effective for all learners. On the posttest, only 3 learners achieved or exceeded the criterion level set for the product. Low scores appear to be related primarily to objects in Group C.

VALUE INFORMATION

Average rating of helpfulness of component in reading a Boley gauge's scale was 3.0 on a 4 point scale.

One learner would prefer a lecture presentation over the booklet.

Interpretation: Learners appear to value both the content and the form of the component.

PROCESS INFORMATION

Component 2 was passed out after Component 1 was completed.

No questions were asked.

6 learners reported that they had sufficient practice opportunities.

2 learners suggested that "objects relevant to dentistry" be used in the practice exercises.

Interpretation: The prototype was used as intended. Learners felt that they had sufficient practice.

RECOMMENDED REVISIONS

In light of performance in this component and on the prototype's posttest, additional practice on general scale reading and in scale reading for objects in Group C is needed.

Consider using "dentistry relevant" objects in practice exercises.
Once the data have been analyzed and major problems identified, you may explore your interpretations and conclusions with all participants in the prototype tryout. You may interview instructors, observers, and learners individually or as a group. In the interview(s), you usually review the analysis and logic of the inferences and then seek from the participants:

- confirmation of the results
- explanations for the results, including, if possible, the specific location of deficiencies and problems
- suggestions for improving the instructional product

In conducting such interviews, make sure that the tone of the interview is open, positive, and factual so that all learners will offer comments. If learners express strong criticisms of the product, try not to censure these comments.

If the results of these interviews require modification of the revision recommendations, these should be made and reported.
OTHER RESOURCES FOR TASK 7

1. Introductory Articles

These articles provide three useful perspectives to the task of evaluating instruction.

- Cronbach, L. Evaluation for Course Improvement. *Teachers College Record*, 1963, 64(8), 672-83.

  This article describes three general purposes of evaluation and the range of methods used. It considers some of the particular characteristics of evaluations conducted to guide the improvement of instructional programs.


  This chapter presents the philosophy of empirical testing from the perspective of a developer of programmed instruction. Three phases of testing are recommended: debugging, validation, and utilization. Whereas Markle describes these as separate phases, the Practicus suggests that they are of concern in all phases of testing.


  This article presents a comprehensive conceptual framework for structuring an evaluation. It suggests an evaluator needs to examine not only outcomes, but instructional transactions and antecedents. It sees the evaluator comparing intentions with observations as well as rendering judgments.


2. Instructional Program on Evaluation

These self-instructional materials provide instruction and practice in distinguishing data sources for prototype and field tests, analyzing prototype test data, and applying rules for making decisions about how to revise instructional materials. Since these materials are valuable aids to planning and analysis, they are recommended to students who feel unsure of these tasks.


3. Measures

These three resources provide more complete introductions to strategies of preparing and using questionnaires, interviews, and observation forms.


  This book provides an introduction to attitude measurement. It discusses problems associated with questionnaires, and provides guidelines for item writing. It is recommended to those who are unfamiliar with questionnaires.


  Although this chapter is not written in an instructional development context, it is an excellent introduction to interviewing. Major sections include "The Psychological Basis of the Interview," "Design of the Questionnaire," and "Principles of Interviewing."


  This chapter surveys standard methods of child study, diary description, specimen description, time sampling, event sampling, field unit analysis, and trait rating. Observation problems, observer influence, reliability, and instrumental aids are also discussed.
4. Reviews of Formative Evaluation

These three references provide in-depth appraisals of the state of the field of evaluation as well as suggest some future directions that evaluation methodology may take. Material in these resources are also relevant to issues related to Tasks 3, 4, and 9.


5. Studies of Prototype Testing Procedures

These reports describe specific procedures used in prototype tests. They offer evidence supporting the usefulness of the procedures.


This report presents a model for testing self-instructional products developed for university students. It reports a study that suggests that products tested and revised according to the model are more effective than those untested and unrevised.


This report describes a logical inference procedure for systematically generating hypotheses that might explain particular patterns of student response errors.
THE TASKS OF PHASE III:
DEVELOP PRODUCT
PHASE III: DEVELOP THE INSTRUCTIONAL PRODUCT

Phase III involves developing the instructionally effective prototype into a complete, usable product that meets the specifications set forth in Phase I.

You will undertake two major tasks in this phase of the development process:

- develop the instructional product from the prototype
- try out the finished instructional product and determine its instructional effectiveness and usability

These tasks are repeated until the evidence from the product tryout suggests that the instructional product is effective and ready for general use.

SEQUENCE OF THE TASKS OF PHASE III

When you have completed the product, you may prepare a user's "product report," summarizing the development history of the product and the evidence regarding its effectiveness and usability.
The tasks of Phase III are very similar to tasks 6 and 7 of Phase II. Both involve a development task and a tryout task, and they are repeated until evidence is available that the product works. There are, however, some important differences between Phase II and III. These differences are summarized below:

**Comparison of Phase II and III Tasks**

<table>
<thead>
<tr>
<th>Phase II Tasks</th>
<th>Phase III Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructional product takes the form of prototype materials and procedures.</td>
<td>The instructional product is in final usable form.</td>
</tr>
<tr>
<td>To use the prototype, the developer's assistance is generally required.</td>
<td>The product can be used without any assistance from the developer.</td>
</tr>
<tr>
<td>The purpose of trying out the prototype is to gather information that will enable the developer to improve the instructional effectiveness of the prototype.</td>
<td>The purpose of trying out the prototype is to gather information that demonstrates the product's effectiveness and enables the developer to revise the product so that it can be used as intended.</td>
</tr>
<tr>
<td>The prototype is tried out with a small sample of learners—3 to 8 persons.</td>
<td>The product is tried out with a large sample—20 to 30 persons or 3 to 6 classrooms if an instructor is required by the product.</td>
</tr>
<tr>
<td>The prototype is tried out in an available and convenient setting.</td>
<td>The product is tried out in the settings similar to those where it will be used.</td>
</tr>
<tr>
<td>During the prototype tryout, as much useful data as possible is gathered from learners (test data, samples of student work, observations of student work, post-instruction questionnaires, and interviews).</td>
<td>During the product tryout, data is more selectively gathered from the larger numbers of learners (test and questionnaire data primarily) and, if appropriate, from instructors (questionnaires, interviews, and possibly observations).</td>
</tr>
</tbody>
</table>
In this task, you will develop a final instructional product that includes the elements of your prototype which made it instructionally effective. The product will also incorporate any additional elements which will enable users to use the product without any assistance from you. In this task, the materials that make up the product are put in final form—a form that is both finished in appearance and that can be reproduced easily in the number of sets required by the user group.

Note: When a product is developed for widespread use, it is useful to identify early in Phase III by whom and by what means it will be reproduced and distributed. In this way, the requirements of production and distribution can be taken into account as you develop the final product.
DESCRIPTION OF TASK 8

This task involves two steps:

1. **Develop the necessary components to make the product usable.**
   In order to develop a product which can be used without your assistance, you may need to develop additional components, for example:
   
   - more complete directions for the learner to take the place of those you may have given in person.
   
   - directions for the instructors describing which learners should receive the product, under what conditions they should work through the product, how problems encountered by learners should be handled, and how learner work should be assessed.
   
   - a training program for instructors enabling them to use the product in such a way as to insure its instructional effectiveness.
   
   - orientation materials for supervisors or administrators helping them to decide whether to use the product and to determine what resources are necessary to purchase, use, and maintain the product.

   The components that you will develop depend upon the nature and complexity of your product, the potential users, and the conditions under which it will be used.

   These additional components should be prepared in accordance with the development process—be clear about the objectives for each component, design and develop a prototype, and try it out (See Tasks 5, 6, and 7). If the results of the tryout merit it, incorporate the component into the final product.

2. **Develop the final product.** Depending on the character of your prototype, transform paste-ups into printed texts and exercises; scripts into audio tapes or records; storyboards into filmstrips, film, or videotapes. As you prepare these materials, remember that they are to enhance the instructionally effective elements of the prototype. They need only to be attractive and easy to work with. Avoid developing slick, glossy materials whose appearance or sound will only distract the learner's attention from what is instructionally important.
1. Media Specialists

In producing the final version of your product, consider obtaining assistance from visual design and media specialists. Your decision will, of course, depend on the availability of time and money, the nature of your product, and your artistic and production talent.

2. General Reference


This resource presents procedures for transforming audiovisual mock-ups into actual audio tapes, filmstrips, and films. It provides an extensive annotated bibliography as well as a listing of manufacturers who offer information pamphlets about audiovisual equipment, supplies, and production techniques.
TASK 9

TRY OUT THE FINISHED INSTRUCTIONAL PRODUCT AND DETERMINE ITS INSTRUCTIONAL EFFECTIVENESS AND USABILITY

In this task you will try out the finished instructional product with a representative sample of the learner population under conditions of ordinary use. In the course of the product tryout, you gather information that will:

- confirm that the product continues to achieve its intended objectives
- assess the extent to which the product can be used as intended, without any assistance from the developer
- indicate how the product should be revised to improve its effectiveness and usability

The results of the product (or field) tryout may require revisions of the product. Any revisions made should be further tested to insure that they increase the product's effectiveness or usability.
DESCRIPTION OF TASK 9

This task may involve five steps.

1. **Prepare a plan for the product tryout.** Briefly describe each of the components of the finished product and the criteria to be used to assess their effectiveness and usability. Describe the data that will be collected during the tryout and used to determine if the product is instructionally effective and if each component of the product is usable. Describe the conditions necessary to conduct the tryout and how the sample of learners will be obtained.

2. **Develop measures.** Revise the measures that were used in the prototype tryout to assess the instructional effectiveness of the product. Keep as many of your original test items as possible. Prepare questionnaires to gather student and instructor reactions to the product—particularly about how easy it was to use the product. Consider using observation forms to gather data to determine whether the product is being used as intended. Have any developed measures reviewed.

3. **Administer the product tryout.** Provide copies of the instructional product to learners and, if appropriate, to instructors. Make arrangements for data collection. Sometimes the instructor can gather the data required; sometimes an observer or tryout administrator should be employed to gather the data.
4. Analyze the results of the product tryout. Organize the data collected by individual or classroom and by instructional objective and component. Summarize the data for each objective and component, arraying it on appropriate tables and graphs.

Determine whether the objectives are being achieved. If an objective is not being achieved, examine relevant instructional units; be sure all instructional elements of the prototype are present in these units; if necessary, recommend revisions guided by instructional principles and by data collected.

Determine which units learners or instructors had difficulty using. Recommend revisions based on results of questionnaires, interviews, and possibly observations.

5. Report the results of product tryout. To facilitate review of your analysis of the field tryout, prepare a summary report. The report should include:

- an introduction to the report and the product being tried out
- a summary of the plan for the product tryout
- a description of the administration of the tryout and of any problems encountered
- analysis of data to determine the product's effectiveness
- analysis of data to determine product's usability
- a summary of recommended revisions
1. General References

The references listed in Task 7 are relevant to this task.

2. Simulation


This game introduces some of the activities and problems an evaluator encounters while conducting a field test of an instructional program. In the game, a team of two evaluators try to carry out the hypothetical plan for a field test within a fixed budget. The game is organized into three groups of steps: administrative steps that involve gaining the cooperation of a school system of a particular school and of the parents of that school; instructional steps which involve training teachers and administering the instructional programs; and testing steps which involve training test administrators and administering the test.

3. Guidebooks

There are few resources describing how to plan, conduct, and analyze the results of a field test of an instructional product. Two resources that offer some useful suggestions are:


This handbook provides very detailed checklists for the major tasks involved in planning a field test. Most useful is the overview of field testing presented in the introductory chapter.


This book presents 20 general guidelines for the educational evaluator. These are organized under the topics of objectives, measurement, and data collection and analysis.

4. Reports of Product Tests

One type of resource that can provoke much thought about the state of instructional evaluation is reports of actual product tests.


In the third and fourth sections of these reports, the formative and summative evaluations of some 20 projects are summarized. A bibliography cites the specific reports available.


This is an example of the reports available from educational laboratories describing evaluations of products they have under development. This particular report describes the development and evaluation of a minicourse that helps teachers develop tutoring skills in mathematics. (See ERIC index for other technical reports from educational laboratories.)
PRODUCT REPORT

When the product has been completed, you may prepare a product report for potential users. The purpose of the report is to provide sufficient information about the product, the way it was developed, and how effective it is so that a user can decide whether or not to use it. A list of possible contents for the report appears below:

Possible Contents for "Product Report"

1. The product's objectives and a discussion of the need for the product.
2. A description of the instructional materials and of the procedures followed while using the product.
3. A brief history of how the product was developed.
4. A summary of the tryout made of the product—what materials were used, who used them, how effective the product was.
5. A description of what is required from the user to insure the product's effectiveness.
APPENDIX A:
PLANNING AND MANAGING A DEVELOPMENT PROJECT

This appendix provides some resource material to help you organize your project work. It is organized into three sections:

The first section discusses the advantages and disadvantages of individual and team development projects. It encourages you to consider the question and make the decision that best fits your interests and needs.

The second section outlines the steps involved in planning a development project. It summarizes the experience that other students have had and suggests ways to allocate time to the various tasks. It provides a simple flow chart to help with the planning of a project.

The third section describes the process of managing a development project. It recommends a simple record-keeping system that will help developers determine the amount of time each development task requires.
I. DECIDING ON AN INDIVIDUAL OR TEAM PROJECT

As you begin to plan the project, you should decide if you want to develop an instructional product by yourself or to work with one or more members of the class. To help you make this decision, consider the respective advantages of working on your own and of working on a team.

Some advantages of working on your own are:

- You can pursue a goal that is yours alone; you need not compromise your interest for those of others
- You are responsible for all the project work; you therefore have the opportunity to acquire knowledge and skills related to each of the development tasks
- You can work efficiently at your own pace; you are neither delayed nor pressured by a group

When students work alone on their projects, they find it helpful to obtain the perspective of someone not so deeply involved in the project. Choose someone in the class who will critique your work in return for your critique of his work.

Some advantages of working on a team are:

- A team, with its additional human resources, can choose a more complex goal to work on
- A team can share responsibilities for each task, taking turns creating, reviewing, and revising, and thereby learning from each other
- A team can work together on the more repetitive tasks (e.g., writing test items, preparing practice exercises, scoring and analyzing tests, typing, collating), thereby lightening the burden of some of the project work.

When students work in teams, they can spend much time in making decisions and obtaining group consensus. To minimize group problems, keep your team small. The most efficient teams usually have 1 to 3, or at most, 4 members.

In summary, experience with student development projects suggests that:

- Individual projects seem to work best for students who are self-starters, like to work alone, and have a specific project goal in mind.
- Team projects seem to be best for students who have common subject matter and/or age-level interest, like to work in groups, and have complementary skills.
II. PLANNING A DEVELOPMENT PROJECT

A plan serves two general purposes:

- it provides an overview of the work that needs to be done and the order it should be done in
- it enables developers to allocate their scarce resources (talent, time, and money) over all aspects of a job so that each unit of work receives an appropriate share

Preparing a plan usually involves three steps:

1. The first step is to break a job down into units of work to which people, time, and resources can be assigned. This Guidebook presents one way to break down the job of developing an instructional project—namely, the job is organized into three phases, each phase is further organized into a number of tasks, and each task into a number of steps.

For small development projects, the task is probably the best unit of work against which to plan and allocate resources. For some projects, however, the developer may find it useful to further break down some of the more complex tasks. For example, Task 6, Develop the Prototype, could be broken down into each instructional component that needs to be developed; Task 7, Try Out the Prototype, could be broken down into planning, conducting, and analyzing steps.

2. The second step is to order the units of work into the sequence in which they will be done. The Guidebook, at the beginning of each phase, describes the general sequence of tasks. Using these descriptions and the experiences of students who have taken the Practicum, the flow of tasks has been summarized in such a way that it can be used for most student projects. This flow is depicted in Figure 1. Note that this chart assumes that the tryout of measures (Task 3) will require revision of objectives and measures (Task 2) and that the tryout of the first prototype will require revision of the prototype.

3. The third step in planning a development project is to allocate the available resources to the different units of work. The resource that all student projects must allocate is time—that is, the limited number of hours and days the developer can spend on a project. For team projects, student must allocate talent—that is, decide who is best suited to which task. Finally, some projects may have financial or other material resources. These are usually allocated to the development of the prototype and the duplication of materials for tryouts.
Figure 1 is structured so that you can use it to schedule and allocate time to each task. There is also sufficient space for recording the names of people assigned to each task.

Allocation of time is a decision faced by all development projects. The following summary of suggestions regarding the use of time is drawn from previous student projects:

- In a 10 to 15-week program, most students can successfully complete Phase I and two cycles of Phase II. Usually Phase III can only be undertaken in a 20 to 30-week program.

- In blocking out time in a 10 to 15-week program for project work, 3 to 4 weeks should generally be committed to Phase I tasks, 2 to 4 weeks on the first round of Phase II tasks, and 2 to 3 weeks on the second round of Phase II tasks. Some students have been able to pace their work so that they can recycle Phase II tasks a third time if tryout results require it.

- Within phases, students usually need the most help in connection with Task 2 (objectives) and Task 5 (design). If you do not have any background on these topics, allow a week or more for getting ready to perform these tasks.

- In allocating time for tryouts of measures and prototypes, allow enough time to cover the usual logistical problems (e.g., arranging for learners and for duplication of materials).
PHASE I

Time Period: __________________________ to __________________________

1. Prepare Proposal
2. Develop Objectives and Measures
3. Tryout of Measures
4. Identify Learner Experiences, Preferences, Requirements
5. Revise Objectives and Measures
6. Write Specifications Document

Due Date:

Hours Required:

Assignments:

---

FIGURE 1: PLANNING CHART
FOR A DEVELOPMENT PROJECT

PHASE II
Time Period: ________ to ________

REPEAT PHASE II
_______ to ________

5. Prepare Design

6. Develop Prototype

7. Try Out Prototype

5' & 6' Revise Design and Prototype

7' Try Out Prototype

Prepare Product Report
NOTE

For some developers, the scheme suggested in Figure 1 is too restrictive for their planning purposes. A very flexible, home-made planning system is to use 5" x 8" cards for each unit of work (as in Figure 2) and to display these cards on a bulletin board. Whenever a change must be made, it requires only the movement or replacement of a card.

FIGURE 2

AN EXAMPLE OF A DESCRIPTION OF A UNIT OF WORK WHICH CAN BE PLACED ON A PLANNING CARD

<table>
<thead>
<tr>
<th>Task 1: Prepare a Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dates for Task:</strong> Sept. 7 to Sept. 11</td>
</tr>
<tr>
<td><strong>Dates</strong></td>
</tr>
<tr>
<td>9/7</td>
</tr>
<tr>
<td>9/8</td>
</tr>
<tr>
<td>9/8</td>
</tr>
<tr>
<td>9/9</td>
</tr>
<tr>
<td>9/10</td>
</tr>
<tr>
<td>9/11</td>
</tr>
<tr>
<td><strong>TOTAL ESTIMATE</strong></td>
</tr>
</tbody>
</table>
III. MANAGING A DEVELOPMENT PROJECT

The management of a development project requires (1) keeping records of work accomplished and resources expended, (2) periodically comparing progress with the plan for the project, and (3) when there is a discrepancy between progress and plan, deciding whether to change the plan, the way the work is being conducted, or both.

In conducting individual projects, developers usually manage their work informally. They review their progress daily and decide what changes they will make in their plans and the ways they are working. They rarely keep records of their progress and decisions. For students interested in taking on future development projects, we would recommend that they keep a record of time spent on each task (See Figure 3 for an easy to use record-keeping form). Such a record can provide information on the amount of time it takes to do each task. This information will help developers make better time estimates when they are planning future projects.

In conducting team projects, if the project is managed more formally, individual team members will keep the other members of the project informed. Specifically, they should make clear assignments in their plans and then keep records of their accomplishments (See Figure 3). The team should meet every week to examine its progress and decide whether it needs to modify the project plan or the way it has been doing the work. To help plan and conduct future projects, the team can summarize its records at the end of the project so that it knows what was required to complete each task and the project as a whole.
<table>
<thead>
<tr>
<th>1. Name</th>
<th>2. Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Work Unit</td>
<td>4. Date</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Hours Worked

Total Days Worked
APPENDIX B:

REVIEW SHEETS

The following review sheets are provided in this appendix:

Task 1: Proposal for an Instructional Product
Task 2: Objectives and Procedures for Measuring Their Achievement
Task 3, Step 1 and 2: Preparations for the Tryout of Measures
   Step 4: Analysis of the Results of Tryout of Measures
Task 4: Identified Relevant Learner Experiences and Requirements
Task 5: Design for the Instructional Prototype
Task 6: Prototype of the Instructional Product
Task 7, Step 1: Plan for the Prototype Tryout
   Step 4: Analysis of the Results of the Prototype Tryout
Task 8: Instructional Product
Task 9, Step 1: Plan for the Product Tryout
   Step 4: Analysis of the Results of the Product Tryout

Use these review sheets to check your work on each task. Have the instructor or a fellow student use them to give you an independent assessment of your performance of a task and your readiness to proceed to the next task.
**PROPOSAL FOR AN INSTRUCTIONAL PRODUCT**

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does the goal describe what the learners will be able to do as a result of using the proposed product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2. Is the goal sufficiently worthwhile to warrant the development of an instructional product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3. Can the goal be achieved by a small instructional product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>4. Is the developer knowledgeable of the goal's subject matter?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>5. Has the developer identified a group of learners interested in and willing to use the proposed product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

**Recommendation:**
- □ Satisfactory performance; proceed to next task.
- □ Revise as suggested; then proceed to next task.
- □ Redo task and resubmit for review.

**Reviewer ___________________________**

**Date ___________________________**
OBJECTIVES AND PROCEDURES FOR MEASURING THEIR ACHIEVEMENT

DIRECTIONS: Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>Question</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do the terminal objectives reflect the full intent of the product's goal?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>2. Have any necessary sub-objectives been omitted?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>3. Do all statements of objectives describe precisely:</td>
<td>Comments:</td>
</tr>
<tr>
<td>- the desired learner behavior?</td>
<td>Yes</td>
</tr>
<tr>
<td>- the content?</td>
<td>No</td>
</tr>
<tr>
<td>- an appropriate measurement procedure?</td>
<td>Yes</td>
</tr>
<tr>
<td>- performance standards for determining learning achievement of the objective?</td>
<td>No</td>
</tr>
<tr>
<td>4. Have a sufficient number of test items been generated for each objective?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>5. Do the test items for each objective sample the full range of desired learner behaviors?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>6. Do the test items for each objective sample the full range of content described?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>7. Do the test items conform to the guidelines for the particular format used?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

Recommemtation: Satisfactory performance; proceed to next task. 

Reviewed by: ____________________________ Date: ____________________________ 

Revise as suggested; then proceed to next task. 

Redo task and resubmit for review.
PREPARATIONS FOR THE TRYOUT OF MEASURES

DIRECTIONS: Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Has the developer described how he/she will obtain a sample of the learner population which will include the range of skills which can be expected?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>2. Has the developer described the conditions under which the measures will be administered?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>3. Do the measure's directions to the learners describe the purpose of the test, how to record answers, and how best to use the time available?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>4. Is the measure's organization and layout of the items clear and easy to follow?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>5. Do the directions to administrators describe test conditions, materials, and time required; the information to be given learners; and procedures for handing learner questions?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>6. Do the directions to scorers describe how each item is to be scored and, if necessary, provide examples of scored items?</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>7. Has the developer set criteria to determine test item quality and to decide which objectives to include in the product?</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Recommendation:

☐ Satisfactory performance; proceed to next task.
☐ Revise as suggested; then proceed to next task.
☐ Redo task and resubmit for review.

Reviewer ____________________________ Date ____________________________

177
### REVIEW SHEET FOR TASK 3, STEP 4

#### ANALYSIS OF THE RESULTS OF TRYOUT OF MEASURES

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Are the data correctly arrayed and summarized in subject-by-item and objective tables?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>2.</strong> Are all inadequately performing test items identified?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>3.</strong> Are all objectives on which learners need instruction identified?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>4.</strong> Are all subgroups of the learner population identified that may have implications for the design of the instructional product?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>5.</strong> Do the data suggest interpretations in addition to those made by the developer?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

---

**Recommendation:**

- [ ] Satisfactory performance; proceed to next task.
- [ ] Revise as suggested; then proceed to next task.
- [ ] Redo task and resubmit for review.

**Reviewer** __________________________

**Date** __________________________

178
**REVIEW SHEET FOR TASK 4**

**IDENTIFIED RELEVANT LEARNER EXPERIENCES AND REQUIREMENTS FOR THE DESIGN OF THE PRODUCT**

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did the developer gather information from a sample of learners about their experiences and interests that may be relevant for the design of the product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2. Did the developer gather information from a sample of potential users (learners, instructors, or administrators) about their requirements on the design of the product?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3. Did the developer gather information from a sample of potential users about their instructional preferences?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>4. Is there other important information the developer should have gathered from potential product users?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

**Recommendation:**

- Satisfactory performance; proceed to next task.
- Revise as suggested; then proceed to next task.
- Redo task and resubmit for review.

**Reviewer**

Date
**REVIEW SHEET FOR TASK 5**

**DESIGN FOR THE INSTRUCTIONAL Prototype**

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>1. Are the descriptions of each of the instructional components complete?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Is the organization of the instructional components complete?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Are the ways the various instructional functions (orient, arouse interest, provide guidance, practice, feedback, and maintain motivation) incorporated into the components and organization of the design described?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Does the design meet the specifications for the instructional product?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

**Recommendation:**

- Satisfactory performance; proceed to next task.
- Revise as suggested; then proceed to next task.
- Redo task and resubmit for review.

**Reviewer __________________________**

**Date __________________________**
### Review Sheet for Task 6

**Prototype of the Instructional Product**

**Directions:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

**1. Will the prototype perform the instructional functions described in the design?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Comments:**

**2. Is the prototype sufficiently complete that learners will have no difficulty using it as intended?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Comments:**

**3. Does the prototype contain extraneous or overwritten material that should be deleted or revised?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Comments:**

**4. Does the prototype follow the guidelines for the format it uses (pasting, script, or storyboard)?**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Comments:**

---

**Recommendation:**

- Satisfactory performance; proceed to next task.
- Revise as suggested; then proceed to next task.
- Redo task and resubmit for review.

**Reviewer ____________________________**

**Date ____________________________**

181
REVIEW SHEET FOR TASK 7, STEP 1

PLAN FOR THE PROTOTYPE TRYOUT

DIRECTIONS: Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>1. Does the plan organize the prototype tryout by instructional objectives and/or components?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Are any important types of data—performance, value, or process—omitted from the plan?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Does the plan provide criteria for deciding whether a component is instructionally effective or needs to be revised?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Is the sample of learners to be used in the tryout representative of the learner population described in the &quot;Specifications?&quot;</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Does the plan describe the conditions and procedures to be followed in administering the prototype tryout?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Recommendation:  
☐ Satisfactory performance: proceed to next task.  
☐ Revise as suggested; then proceed to next task.  
☐ Redo task and resubmit for review.

Reviewer ___________________________  
Date ______________________________
ANALYSIS OF THE RESULTS OF A PROTOTYPE TRYOUT

DIRECTIONS: Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>Question</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the analysis presented in terms of the instructional components of</td>
<td></td>
</tr>
<tr>
<td>the design and the prototype?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>2. Are data for each component summarized accurately in tables or graphs?</td>
<td>Comments</td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>3. Are conclusions regarding the effectiveness of each instructional</td>
<td>Comments</td>
</tr>
<tr>
<td>component supported by the data obtained?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>4. Are conclusions regarding the value of each component supported by</td>
<td>Comments</td>
</tr>
<tr>
<td>the judgment data collected?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>5. Are conclusions regarding the use of each component supported by the</td>
<td>Comments</td>
</tr>
<tr>
<td>data obtained?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>6. Do the recommended revisions for the prototype draw on the data</td>
<td>Comments</td>
</tr>
<tr>
<td>gathered during the prototype tryout and on the design ideas generated</td>
<td></td>
</tr>
<tr>
<td>during Task 5?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
<tr>
<td>7. Do the data suggest other interpretations and revision recommendations</td>
<td>Comments</td>
</tr>
<tr>
<td>than those made by the developer?</td>
<td></td>
</tr>
<tr>
<td>Yes No</td>
<td></td>
</tr>
</tbody>
</table>

Recommendation:
- [ ] Satisfactory performance; proceed to next task.
- [ ] Revise as suggested; then proceed to next task.
- [ ] Redo task and resubmit for review.

Reviewers ____________________________                    Date ____________________________
REVIEW SHEET FOR TASK 9

INSTRUCTIONAL PRODUCT

DIRECTIONS: Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>1. Does the instructional product meet the specifications for the product?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Does the product contain all of the instructionally effective elements of the prototype?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Is the product sufficiently complete that it can be used by the intended users without assistance from the developer?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Are there any features of the product that might distract learners from the instruction presented?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Recommendation:

- [ ] Satisfactory performance; proceed to next task.
- [ ] Revise as suggested; then proceed to next task.
- [ ] Redo task and resubmit for review.

Reviewer ___________________
Date ___________________
### PLAN OF A PRODUCT TRYOUT

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

1. Is the plan organized by the instructional objectives and/or components of the product?  
   - Yes  
   - No  
   **Comments:**

2. Are any important types of data omitted from the plan?  
   - Yes  
   - No  
   **Comments:**

3. Does the plan provide criteria for deciding if a component is instructionally effective and usable?  
   - Yes  
   - No  
   **Comments:**

4. Is the sample of learners to be used in the product tryout representative of the learner population described in the "Specifications?"  
   - Yes  
   - No  
   **Comments:**

5. Does the plan describe the conditions and procedures to be followed in administering the product tryout?  
   - Yes  
   - No  
   **Comments:**

6. Is the sample of instructors or product administrators used in the product test described?  
   - Yes  
   - No  
   **Comments:**

---

**Recommendation:**
- Satisfactory performance; proceed to next task.
- Revise as suggested; then proceed to next task.
- Redo task and resubmit for review.

**Reviewer** __________________________  
**Date** __________________________
**REVIEW SHEET FOR TASK 9, STEP 4**

**ANALYSIS OF THE RESULTS OF A PRODUCT TRYOUT**

**DIRECTIONS:** Review project work in terms of the questions below. Circle "Yes" or "No" depending on how well the work meets the requirements of the question. Use the space next to the question to explain or qualify your assessment and to make suggestions. Make a summary recommendation at the bottom of the sheet.

<table>
<thead>
<tr>
<th>1. Is the analysis presented in terms of the instructional objectives and/or components of the product?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Are data for each component summarized accurately in tables or graphs?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>3. Are conclusions about the instructional effectiveness of each component supported by the data obtained?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
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</table>

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<tr>
<th>4. Are conclusions about the usability of each component supported by the data obtained?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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</table>

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<tr>
<th>5. Are the recommendations on how to revise instructional components of the product guided by the design, the prototype, and the data gathered during the tryout?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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<tr>
<th>6. Do the data suggest other interpretations and revision recommendations than those made by the developer?</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

**Recommendation:**

- [ ] Satisfactory performance; proceed to next task.
- [ ] Revise as suggested; then proceed to next task.
- [ ] Redo task and resubmit for review.

**Reviewer** ____________________________

**Date** ________________