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THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

Center for Educational Technology
Florida State University
Tallahassee, Florida 32306

Contract Number N61339-73-C-0150

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ROBERT K. BRANSON

THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

A Description of the Processes, Procedures, and Products

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(Revised March 11, 1974)

Prepared for
The President
Combat Arms Training Board
Fort Benning, Georgia

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PREFACE

This document, The Instructional Systems Development Model, is a description of the proposed set of techniques and procedures to be followed in the development and conduct of Interservice training. It was prepared under Contract No. N61339-73-C-0150 between the Center for Educational Technology at Florida State University and the Combat Arms Training Board, Fort Benning, Georgia.

After the inception of the project, the Interservices Committee on Instructional Systems Development became the approving authority by agreement with the Army. This change in approving authority broadened the scope of the model to include requirements from the Air Force, Marines, and Navy, as well as the Army.

The rough draft of The Instructional Systems Development Model was reviewed and critiqued by members of the Interservice Committee, selected members of the Armed Forces, and by other authorities in the field of educational technology. This revised version of the document includes appropriate, clarifying points from those reviews to the greatest possible degree, and is submitted for approval by the Interservices Committee.

Detailed critiques were supplied by the following: Dr. Leslie Briggs, Dr. William Deterline, Dr. Walter Dick, Dr. Duncan Hansen, Dr. Harold Hunter, Dr. Roger Kaufman, Dr. Franklin Sands, Dr. John Taylor, and by the following interservice sources: Chief of Naval Technical Training; Marine Corps Development and Education Command; Command and General Staff College; Army Service Schools; U.S. Air Force Air Training Command/XPTI.

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INTRODUCTION

This document, The Instructional Systems Development Model, is intended to communicate to senior training managers, instructional systems designers, and experienced personnel exactly what this proposed interservice model is and does, and to stimulate interchange, critique, suggested revisions, and ultimately, agreement. This version is the second draft of the model, the first having been read and critiqued by representatives of each of the Armed Forces, many industrial consultants, and training and management specialists from the civilian and military communities.

Ultimately, an instructional version of this document will become the introductory volume of the multivolume set of training materials, the Instructional Systems Development Package. This package will be described in this chapter, and its introduction to military personnel is described in Appendix A.

The Model

During the past fifteen years, a number of "systems" based models for the design, development, and delivery of instruction have been used throughout the Armed Forces. It is the purpose of the Instructional Systems Development (ISD) Model to bring together the most generally useful components of these past efforts and to add features based on research conducted in the military and civilian education and training communities. A specific effort has been made to make this model compatible with past models in order to minimize change, while at the same time incorporating recent developments.

The ISD Model is based on nine assumptions:

1. That the mission of a military instructional system is to determine instructional needs and priorities, to develop effective and efficient solutions to achieving these needs, to implement these solutions in a competent manner, and to assess the degrees to which the output of the system meets the specified needs.

2. That there are alternative approaches to the solution of instructional problems which are differentially responsive to specific environmental constraints found in the Armed Forces.

3. That the existing large body of research and development in learning, instruction, and management techniques may provide the basis for significantly improved training.

4. That a systems approach to the processes and procedures of instruction is the currently most effective means of evaluating, developing, and implementing these alternatives.

5. That regardless of the complexity of the job tasks to be performed, the instructional system should be in continuous search for approaches to instruction which will optimize the proportion of entering trainees who meet acceptable job task performance standards.

6. That planned responsive change in the operation of the instructional system will be a continuing requirement.

7. That intensive and recurring training of managers and instructional developers in the application of the Instructional Systems Development Model represents a direct first step toward the achievement of this mission.

8. That individuals differ in their abilities, achievement, motivation, and rate of learning, and an instructional system must accommodate these differences to realize the opportunity for increasing the effectiveness and efficiency of training.

9. That two or more equally successful alternative solutions can be found for any instructional problem, and these solutions will differ in cost.

Based on these assumptions, this document describes the functions necessary to analyze instructional needs, design, develop, and implement instruction, and maintain quality control of instruction. A sequential relationship of these functional steps is recommended.

The Instructional Systems Development Package

The purpose of the Instructional Systems Development Package is to provide the necessary knowledges, skills, and procedures to enable responsible personnel in the Armed Forces to implement the ISD Model, which is designed to lead to the optimization of military training. This goal will be achieved through the development of the doctrine, instructional materials, and management procedures necessary to institutionalize a systems approach to instruction through the Armed Forces.

The Instructional Systems Development Package includes three critically necessary components:

1. Management orientation packages and workshops for senior managers of training installations.

2. Techniques for managing and supervising the day-to-day activities of those who actually produce instruction and instructional materials, and those who conduct instruction.

3. A complete set of procedures, documents, and a mediated instructional workshop to be used by those who will actually perform the design, development, and implementation of instruction.

These components are essential because the development and implementation of optimized instructional systems requires a carefully coordinated effort between senior management, middle management, and individuals charged with producing the various elements necessary to conduct adequate instruction. Senior managers will be able to direct the collection of read data for management information upon which they can base long-range planning decisions affecting the instructional program. Middle managers will be provided, through the systematic approach, with techniques and procedures for supervising and managing the production of these more sophisticated instructional programs as well as criteria and considerations for selecting among alternative instructional strategies to meet differing training needs. Individual developers of instruction will be supplied with tools for instructional development, plus the rationale, supplementary information, and training exercises for each of the tools. Basically, the developers will systematically produce the instructional programs which middle managers will be better equipped to evaluate, and on which senior managers will be able to collect crucial data.

The complete training package to effect this coordinated effort will contain (a) The Instructional Systems Design Model, (b) a multi-volume manual which covers the steps in the ISD Model, (c) an adjunct instructional workbook, (d) mediated workshop materials, (e) a workshop manager's handbook. The methods to be used in introducing personnel to the use of these training packages are described in Appendix A.

ISD Model Overview

The body of this document is an overview of the Instructional Systems Development Model, which includes five major phases or steps: Analysis, Design, Development, Implementation, and Quality Control (see Figure 1). As the introduction to each phase, a phase flowchart and written summary will precede detailed description of all flowcharted steps. The description of each step will contain explanatory materials, and a brief summary of the input, process, and output for that step. The model description concludes with a chapter on the parameters of the ISD Model. A glossary of terms used in the document, explanatory materials on the Instructional Systems Development Package (Appendix A), and a list of selected references (Appendix B) conclude the volume.

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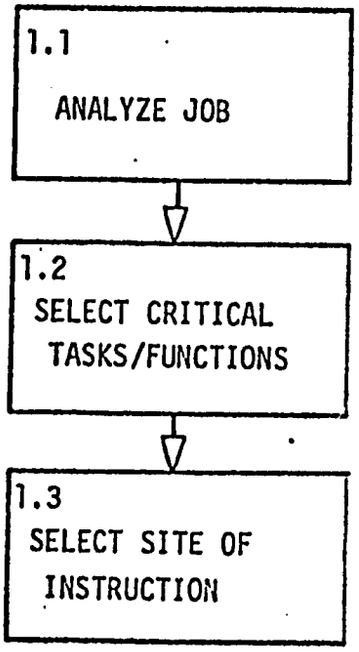
THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

PHASE 1.0: ANALYSIS



The initial phase in the ISD Model is analysis. Three analytic functions are described: Analyze Job, Select Critical Tasks, Select Site of Instruction. Each of these functions has specific inputs and outputs which will be described in more detail later. While the Analyze Job function has been fairly well understood for a long period of time, the function of selecting tasks for training has only recently been systematized. This function also includes the preparation of job performance measures. Instructional site selection serves the purpose of identifying any or all of the alternative sites of training which can be used to achieve the desired job performance.

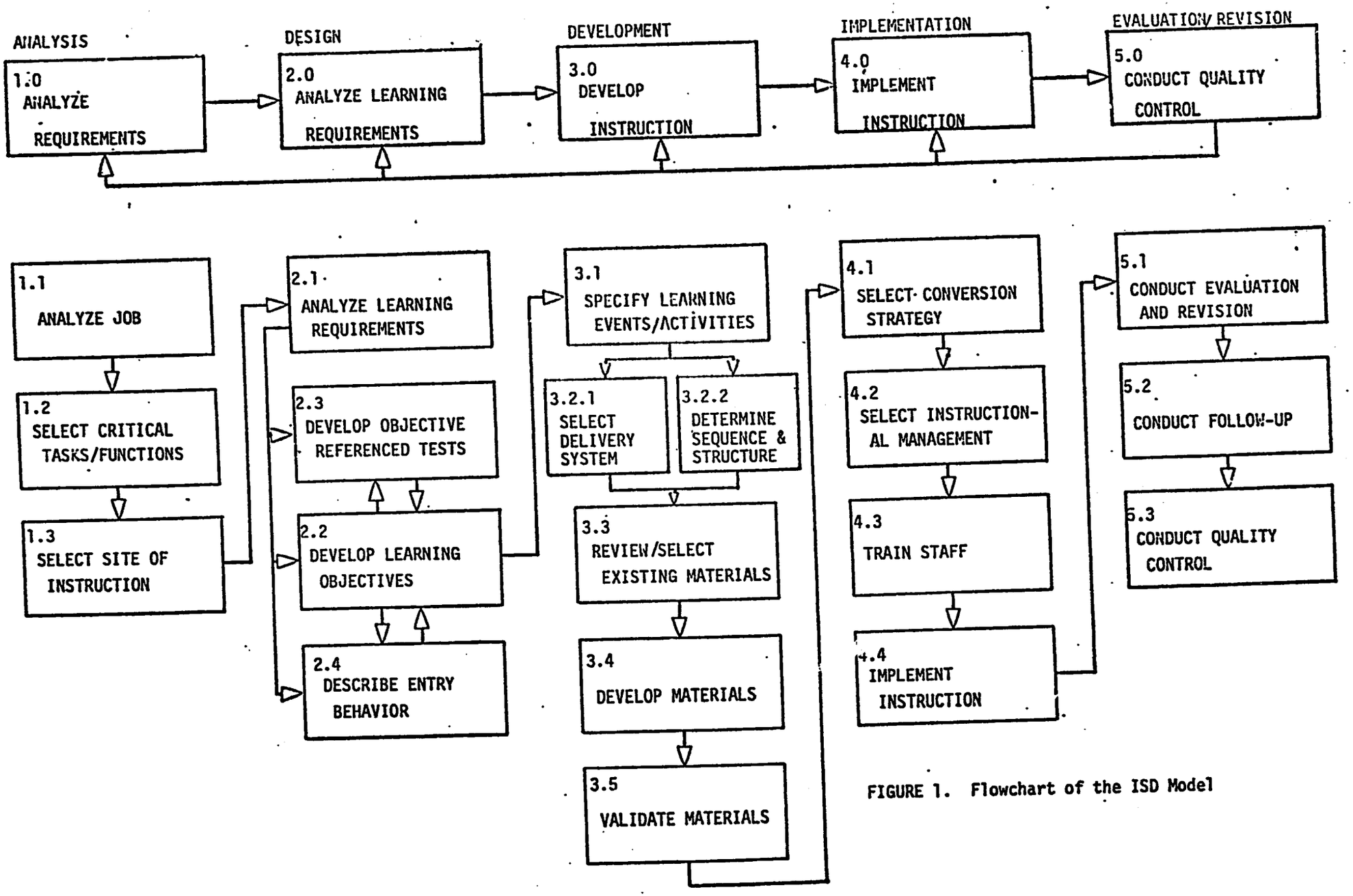


FIGURE 1. Flowchart of the ISD Model

ANALYSIS PHASE

Block 1.1: Analyze Job

Jobs are analyzed in the Armed Forces for a number of purposes, one of which is to clearly specify instructional needs. It is with this aspect of job analysis, the instructional aspect, that the ISD Model is concerned. Numerous researchers and educational specialists have worked on the techniques and procedures of job analysis for the past fifty years with considerable success. Through time, the movement has been toward greater specificity, greater quantification, and toward the use of a common vocabulary to describe human performance.

As job analysis techniques have become more sophisticated and detailed, it has become necessary to adopt methods for coding and systematizing these descriptions. More recently, improved techniques have been devised for quantifying task inventories. Coding and quantifying the task inventories have made the handling of the data more manageable and this has resulted in a much clearer picture of instructional requirements. Ultimately, it is anticipated that researchers will develop wide scale methods for comparing all of the elements of various jobs with each other and projecting these elements in a variety of recombinations allowing for considerably more efficient instructional systems.

The job analysis function of the ISD Model is to extract from job holders, supervisors, or other qualified personnel, information which might be needed in specifying human performance of tasks for a particular job. Every aspect of a job should be detailed to such a degree that an instructional system development team will be able to

design the system to produce the specific job skills. The procedure used must be sufficiently general to allow for a common terminology and individual command adaptability, and still be sufficiently specific to accommodate all of the needs in any of the services. Each service now has its own procedure for job analysis. It is expected that the recommended model for this step will draw the strongest points from each of the various procedures now being used.

ANALYZE JOB INPUT

Needs of the system for trained personnel are the input to the Analyze Job function. These needs may come from a variety of sources, but are usually generated by management. Needs assessment techniques can be used by management as a continuing monitor to determine whether or not jobs have sufficient validity and utility to require instruction of prospective job holders. Requirements for change are frequently the result of installation or anticipation of new equipment and systems (e.g. TRITON submarine, B1 bomber, etc.); elimination of equipment from use; initiation of new operating procedures; impact of policy changes; or other assessed needs. These needs inputs, typically generated through management assessments, constitute the starting point in any single application of the ISD Model.

ANALYZE JOB PROCESS

The process of analyzing a job is one of studying the job holders and/or the job requirement specifications in an actual or future work environment. A large scale job analysis which would best serve in the ISD Model should be based on the administration of task-level job

inventories. This analysis should utilize fulltime inventory writers, large samples, an occupational research group for development of applications of occupational data, and scaling techniques for the estimation of time, difficulty, and criticality of job tasks, as well as sophisticated data processing systems such as the Air Force's Comprehensive Occupational Data Analysis Programs (CODAP). The analysis would use specific task statements, clearly described in behavioral terms using action verbs to indicate what is done, in what sequence, by whom. Environmental considerations, the physical and operational requirements that exist when the task is performed, are described and other information necessary to the development of instruction is clearly spelled out.

ANALYZE JOB OUTPUT

The result of job analysis is an inventory of job tasks with listings of the specific performances or actions required of the person, and the situations or conditions surrounding the performance.

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ANALYSIS PHASE

Block 1.2: Select Critical Tasks

As a result of the job analysis many job tasks have been identified for each job. This listing often includes many more job tasks than instruction could be provided for without too much time and expense. Thus, it is necessary to have an initial screening of the job tasks to identify these tasks for which instruction must be provided. The purpose of this step in the model is to arrange the job tasks in terms of importance for instruction. The job tasks will be ranked in terms of the need for instruction ranging from job tasks for which instruction must be provided to job tasks for which instruction does not have to be offered.

The criteria that will be used in this screening process will likely differ for each service or for different installations within each service. The criteria for ranking job tasks in terms of the necessity for providing training include at least the following:

1. Chances that the task will be seen by the trainee
2. Frequency of poor performance by untrained soldiers
3. Trainability of task (some skills are better obtained through selection than training)
4. Number of job holders who perform task
5. Difficulty of learning and performing the task
6. Degree to which task is critical to the accomplishment of the mission, survival, or protection of life and equipment, etc.

The purpose of this step is to make sure that some form of instruction will be provided for all the important tasks and that no instructional resources will be spent on unimportant tasks.

SELECT CRITICAL TASKS INPUT

The input to this step in the ISD Model is the detailed listing of job tasks.

SELECT CRITICAL TASKS PROCESSES

The major requirement for the screening of job tasks and placing them in order of the importance of providing instruction for them is that a set of criteria be applied to each job task that arranges the task along a continuum from low importance for instruction to high importance for instruction. This process may include criteria of frequency of task performance, criticality of performance for mission accomplishment, and the percentage of individuals performing the task. Coding or weighting schemes should be used to assist in the process of arranging the job tasks in terms of the importance for providing instruction. Once the tasks have been selected, performance measures are prepared for all critical tasks. These performance measures become the absolute standards by which job performance is judged.

SELECT CRITICAL TASKS OUTPUT

The output of this step is the identification of job tasks for which instruction must be provided and accompanying performance measures. This step can result in cost savings by eliminating any job tasks for which instruction does not have to be provided. Once the necessity of providing instruction for a job task has been established, then this instruction

must be provided somewhere in the instructional systems (school, OJT, NRI, etc.). This determination of site of instruction is made in Block 1.3 of the ISD Model.

ANALYSIS PHASE

BLOCK 1.3: SELECT INSTRUCTIONAL SITE

There are a number of formal and informal considerations that must be taken into account before an appropriate selection of instructional site* can be made. These considerations would involve number of trained personnel needed, the availability of facilities, the entire listing of instructional site selection criteria that have been put together for the CODAP System and other analyses. General policies currently in effect regarding the relative emphasis on school or duty assignment training are reflected in CODAP-like systems.

Each of the variables which would have an impact on selecting the site of instruction can be individually weighted and compared in order to get the best estimate of the desired instruction sites. For example, it is quite possible to establish an operating rule which would say to the effect, that unless school instruction is absolutely necessary, it is undesirable. This would tend to require justification of a much larger magnitude for assigning any task to schools for instruction. It would, in some cases, make the assignment of instruction to units a burden on the commander of the unit. In such instances it may be necessary for the proponent of the instruction to prepare the instructional materials when the instruction would be delivered at a unit instead of a school.

---

*School, on-the-job, correspondence study, independent study, and collective instruction are all sites of instruction considered in the Learning Specification Plan (LSP).

Since the number of variables to be considered is large, it is necessary to use a highly systematic weighting procedure to determine the most appropriate site for instruction and then to use a great deal of judgment in the collection of like tasks to be assigned to like instructional sites. While the site of instruction probably can be most efficiently determined after the complete learning analysis has been made, as a practical matter it is often necessary to select the site of instruction at the conclusion of the analysis step.

SELECT INSTRUCTIONAL SITE INPUT

The input to the select instructional site function is the complete listing of prioritized tasks for which instruction will be required. These tasks have already been screened according to the criteria selected by the screeners, and will have to be taught at some site.

SELECT INSTRUCTIONAL SITE PROCESS

The process of determining instructional site is a technical one involving the making of a number of trade-offs according to the needs of the instructional system and the resource requirements imposed by the instruction. Cost considerations, availability of space, the fidelity of the instruction, and other important factors must all be weighted in order to get the best mix of instruction for all of the critical tasks. Each branch of the Armed Forces will have its own set of important criteria that will be applied during this step in the model in order to make site selection consistent with current operating policy. There is probably no single set of criteria that could be universally applied with equal success in all of the Armed Forces. It will also be necessary to identify

the point in the career of the student when he needs to be trained in the listed skills. Hopefully, instructing individuals on tasks that they will not perform until much later in their career can be avoided.

SELECT INSTRUCTIONAL SITE OUTPUT

The output of the select instructional site function is a listing of tasks with the recommendations of their instructional site, grouped into appropriate size packages so that training can be designed for that listing of tasks regardless of where it is to be performed.

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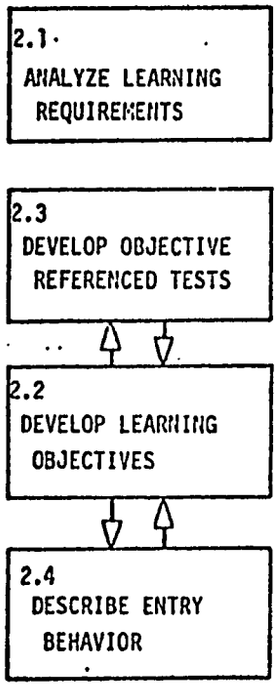
THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

PHASE 2.0: DESIGN



In the Design Phase, instructional goals and students' characteristics are analyzed, subgoals are identified, the training objectives and test items are prepared. In this process, constant trade-offs* are made among objectives, tests, and characteristics of the students. This phase is concerned primarily with the translation of operational needs to learning requirements. Where possible, the actual job performance measures prepared in the Analysis Phase are used in the instructional environment. Where this direct use of performance measures

*Trade-off: In any systematic approach to instruction, it is necessary to make compromises between what is desirable and what is possible. Ordinarily, these decisions involve increases or decreases in time, money, facilities, equipment, or personnel.

is not possible, instructional tests are made to simulate the actual performance test to the highest degree possible. The output of the Design Phase, the Learning Specification Plan, describes the objectives, the tests, and learner characteristics necessary for the development of instruction which occurs in the next phase.

DESIGN PHASE

BLOCK 2.1: ANALYZE LEARNING REQUIREMENTS

Since instruction must be provided for each job task that was identified as important for learning, it is necessary to identify the objectives that must be mastered as a result of instruction. This step is the major link that relates the instruction to the actual job. In this step the performance required to accomplish each job task is analyzed to determine the specific instructional goals. In this manner all instruction is oriented to teaching instructional goals that lead to the job task.

In analyzing the learning requirements an instructional goal* is developed for each performance objective. These instructional goals are then broken down into learning elements* in four classes: mental skills, information, physical skills, and attitudes. Many instructional goals include all four of these classes of outcomes. Some goals may consist of only one or two of these classes. Each instructional goal must be examined to identify those classes that make up the specific goal. Then for each of these four classes of elements, the proper procedure for learning analysis must be conducted to identify the subelements.* This relationship is shown in Figure 2.

---

*An instructional goal is the statement of the desired outcome of instruction based on a specific job task performance objective; i.e., a job task performance stated in instructional terms. An element results from breaking down an instructional goal into its component parts. Elements are classified into mental skills, physical skills, attitudes, and information. Subelements result from the analysis of elements of instructional goals into their component parts. The learning analysis process used is the one most suitable to the class of element; e.g., mental skills elements are analyzed for learning requirements by a hierarchical analysis.

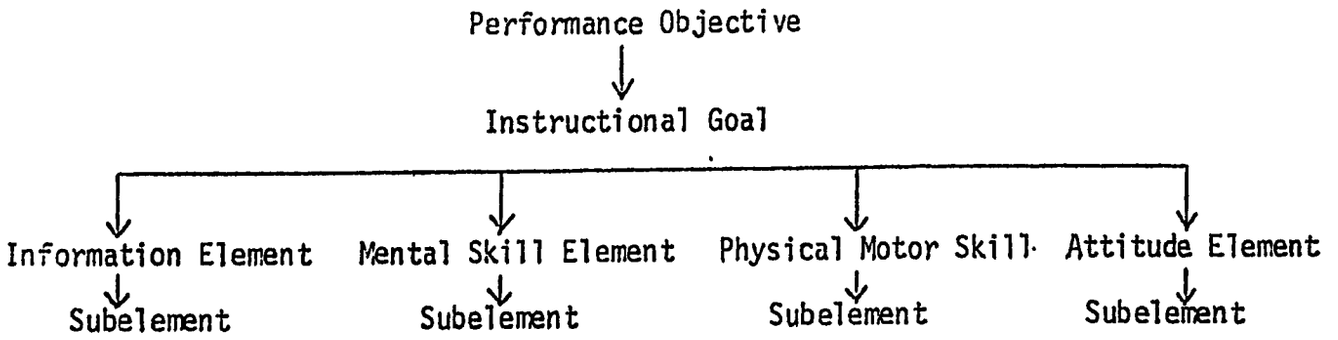


Figure 2.--Learning Task Analysis

ANALYZE LEARNING REQUIREMENTS INPUT

The input to this step is the listing of all important job tasks and performance objectives for which instruction must be provided.

ANALYZE LEARNING REQUIREMENTS PROCESS*

There are three related processes in the analysis of learning requirements:

1. Developing an instructional goal for each performance objective.
2. Breaking each goal down into four classes of learning elements.
3. Analyzing each learning element to determine the subelements that must be learned.

ANALYZE LEARNING REQUIREMENTS OUTPUT

The output of this step includes:

-- a listing of an instructional goal for each performance objective.

*This process will be completely described and proceduralized in the manual. It is too lengthy to include in this description.

-- the listing of four classes of learning elements for each instructional goal.

-- the listing of the subelements for each learning element.

DESIGN PHASE

BLOCK 2.2: DEVELOP LEARNING OBJECTIVES

As a result of the analysis of the learning requirements, the specific learning elements have been identified. In addition, for each one of these terminal learning tasks the subelements would have also been identified through the learning analysis. In the fourth block of the ISD Model, Develop Learning Objectives, these elements and subelements are converted into the form of a learning objective by adding the learning conditions and criteria to the statement of the behavior. In order to develop learning objectives, inputs from two other blocks in the ISD Model are necessary. The main input comes from the analysis of the learning requirement in which each of the learning elements is more clearly defined. The other input to the learning objectives comes from the analysis of the entering behavior of students. When the designer has the task identified and has information regarding the entering capability of the students, it is possible to determine at what level of subordinate or prerequisite learning requirements instruction must begin so that students can master the performances. The terminal learning objectives clearly identify the skills, information, and attitudes that the student will have at the end of the instruction. The enabling objectives bridge the gap between where the student is at the beginning of instruction, or his entering behavior, and where he should be upon completion. These enabling objectives consist of the basic information and skills which serve as background for the terminal objectives.

These enabling and terminal learning objectives are developed from the elements and subelements specified in the analysis of the learning requirements. They serve to communicate clearly the intent of the instruction to the learner, the instructional manager, the materials developer, and to others who are involved in the development and management of the instruction. The concern is to state the objectives so clearly that only the intended interpretation is possible. In order to do this, each objective must contain a statement of the behavior or action required on the part of the learner, the conditions under which the behavior takes place, and the required standard and measure of that behavior in the instructional setting. These enabling and terminal learning objectives are distinguished from job performance objectives in that the learning objectives are used only in instruction and refer to the enabling and terminal behavior in the instructional setting, not in the job situation. The terminal learning objectives represent a very critical feature of the ISD Model in that every succeeding step in the Model is based on these objectives. Therefore it is essential that each terminal objective clearly relate to those tasks that were identified in the analysis of learning requirements as being necessary for training.

DEVELOP LEARNING OBJECTIVES INPUT

The specific results from the analysis of learning requirements are the input to the writing of learning objectives. These inputs include: the listing of the learning goals and elements that reflect job performance tasks, and the component, or prerequisite, subelements related to the learning task as determined by the learning analysis. The other major input to the writing of the learning objectives is the analysis of the entering capability of the target population.

DEVELOP LEARNING OBJECTIVES PROCESS

The process involved in the development of learning objectives is the analysis of each element to be learned in order to identify the observable learner behavior, determine the important conditions that surround the occurrence of this behavior, and determine the standards and criteria for the behavior in the learning setting.

DEVELOP LEARNING OBJECTIVES OUTPUT

The output of this step in the Model is a detailed listing of the learning objectives stated in behavioral terms. Each learning objective, whether terminal or enabling objective, contains a statement of the behavior required of the learner under the given conditions and a statement describing minimal standards of performance. The list of terminal learning objectives reflects the job performance task elements and the list of enabling objectives reflects the learning subelements required for the learner to master the required performance.

DESIGN PHASE

BLOCK 2.3: DEVELOP OBJECTIVE-REFERENCED TESTS

The development of objective-referenced test exercises* also relates directly to the learning task analysis. These test exercises, when developed, are used for diagnostic and prescriptive purposes, as well as for assessment of mastery of learning. These exercises are designed to provide an accurate assessment of the learner's capability and must correspond with as much fidelity as possible to the job performance.

This type of testing in which the test exercises directly measure the learning objectives is somewhat different than the traditional type of testing. Many of the concepts that have guided the development of traditional, or norm-referenced tests do not apply for this purpose since norm-referenced tests are designed primarily to rank order people. Tests are used in the ISD Model to determine whether an individual person has or has not met a learning objective other than how he compares with some norm. In objective-referenced testing, each test exercise is developed from the learning objective and should correspond as closely as possible to the behavior and the conditions described in the objective. The tests are designed to determine whether or not the student has mastered the objective. In addition, objective-referenced tests will be developed for the instructional goals and subgoals to determine whether or not the student has successfully completed a unit on course.

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*Objective-referenced test exercises: the items on an objective-referenced test; may be paper and pencil items, or observation of actual performance. Objective-referenced measurement is designed to determine whether an individual has mastered a specific objective.

DEVELOP OBJECTIVE-REFERENCED TESTS INPUT

The results from the analysis of the learning requirements and from the development of the learning objectives are the inputs to this step. This input includes a listing of the learning elements and sub-elements and the listing of the terminal objectives and enabling objectives, and the instructional goals.

DEVELOP OBJECTIVE-REFERENCED TESTS PROCESS

The process involved in the development of objective-referenced tests is the development of test exercises that measure student performance of a specific element identified in the analysis of the learning requirements and in the statement of the learning objectives. While it is not absolutely necessary to develop test exercises at the same time the learning objectives are developed, the test exercises and learning objectives must be in agreement and must reflect the specific learning elements that were identified in the learning analysis step. The test exercise can be one of a variety of forms, a performance measure, a paper and pencil test, online computer diagnostic tests, observational checklist, or simulation. Coordination between the test writers and the objective writers must occur at this point unless tests and objectives are both developed by the same person. It is essential that they correspond.

DEVELOP OBJECTIVE-REFERENCED TESTS OUTPUT

The output of this step in the model is a listing of objective-referenced test exercises for all the enabling and terminal learning objectives.

DESIGN PHASE

BLOCK 2.4: DESCRIBE ENTRY BEHAVIOR

Entry behavior refers to those behaviors or capabilities that a student has acquired prior to beginning a specific instructional unit. The term entry behavior is used in two manners in the Model. The first usage of entry behavior is to refer to those behaviors that the students, or trainees, actually possess prior to instruction. The second use of entry behavior is to refer to the capabilities that students must have before beginning a unit of instruction. In the development of instruction, it is necessary to use entry behavior in both of these manners. In order to write learning objectives that are attainable by students, it is necessary to have some information on the capability of these trainees or to have a knowledge of the students' entry behavior. After the objectives have been written, it is possible to specify the entry behavior a student must have to begin to learn those objectives. That is to say that the instructional developer has to clearly identify what capabilities a student should have in order to begin to use, or to enter, one segment of instruction.

In order to determine the entering behavior of the students, it is necessary to examine data from the target population. This data can include information from the AFQT or other standardized tests given to large groups of recruits, or could be data from the last group of students in the instructional cycle. The data does not have to be from the actual individuals that will enter the instructional cycle. The purpose of assessing or measuring the entering behavior of the students is to get

some idea of their level of capability so that when writing learning objectives the instructional developer will be able to make certain decisions regarding basic information and mental skills that students from the target population would have before entering instruction, information, and skills which do not need to be included in the instruction. Once the instructional developer has made decisions about what specific learning objectives (terminal and enabling) are to be included in the instructional program, then it is possible for the developer to specify the entering behavior necessary for an individual student to enter the instruction of these objectives. This information on the required entering behavior will be used during the actual instruction for the placement of students into the instructional sequence so that no student will be placed in a situation for which he does not have the entering capabilities or the threshhold knowledge.

DESCRIBE ENTRY BEHAVIOR INPUT

The input for the specification of entering behavior includes the description of the learning element, subelements, and the learning objectives. The additional input to this step in the model is data concerning the information and skills that students actually possess prior to any instruction.

DESCRIBE ENTRY BEHAVIOR PROCESS

The processes involved in the specifying of entering behavior are: (a) analysis of the capability of recruits to determine their actual entering behaviors; and (b) statements from the instructional developers regarding the entering behaviors that are required to begin the unit for specific objectives.

DESCRIBE ENTRY BEHAVIOR OUTPUT

The output from the specification of entry behavior is a detailed listing of the required entering behavior or capabilities of a student for each set of learning objectives. This entering behavior is a statement that describes the specific skills and information that the student must have mastered before he will be able to learn, or to begin the instruction on the terminal objectives.

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Revised

THE LEARNING SPECIFICATION PLAN

DESIGN PHASE PRODUCT

The output of the entire instructional design phase, including its inputs from the analysis phase, is a Learning Specification Plan (LSP) which contains all of the relevant analytic information, learning analyses, objective-referenced tests and performance measures, and an indication of where and how the instruction will be conducted (site of training). As a management control document, the LSP should be approved by appropriate authority prior to beginning Phase 3, Development. The approved LSP then becomes the input to the third phase of the model, and is of importance to both management and instruction control.

Management control. The most important elements of the LSP for management control are the specifications for site of training, and the task mastery plan. The site of training selection requires the developer to indicate whether the instruction should be conducted in a school environment, by formal on-the-job training, self-study, or various other means. These specifications are based on a set of decision rules which take into account relative costs, time requirements, availability of training, attempts to optimize costs, time, and effectiveness.

The task mastery plan indicates not only the site of training, but also the sequence of instruction. Principally, it defines the increments the sites of training contribute to total mastery of a performance, and makes explicit the starting and ending points of these increments. For example, electronics technicians can learn fundamentals in a school setting, and through self-study and formal OJT can then

master the other performances required of them. It is unlikely that mastery of all job performance skill levels can be achieved at reasonable cost in a school setting, even if such a choice were desirable.

While the LSP does not require that all of the knowledges and skills necessary for mastery of job performance be acquired in any one site of instruction, it does establish the sites in which progression to mastery will be achieved. It is expected that the LSP will present a realistic analysis of requirements helpful in planning the total training sequence. It defines explicitly the site in which each training objective is to be achieved and indicates the method of training recommended to achieve it. It avoids the problem often encountered in attempting to define what a "graduate" is by specifying the extent of and limits that school instruction is expected to contribute to mastery of job performance.

Instructional control. The LSP also provides guidance for instructional developers who must plan how to achieve the requirements set forth in the plan. If a formal course is required, the development phase of the ISD Model provides guidance on how to prepare the course. If formal OJT is required, the model indicates the areas in which training support materials are required, such as job aids for trainers who conduct formal OJT, or correspondence courses, or other types of nonresident instruction.

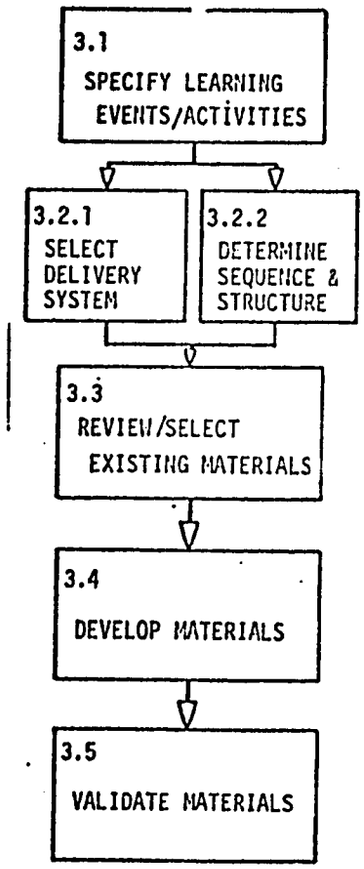
The LSP provides the opportunity to trace the training of a task from entry level to mastery and indicates the need for each kind of instructional materials to be produced. The developer can then produce the necessary plans and materials to support school instructors, OJT trainers, and others whose responsibility it becomes to contribute to the

total instructional effort. The emphasis is always on what is required to learn the task under specified instructional conditions.

By scanning the LSP, the senior instructional officer can tell immediately what is to be learned in school and what is to be learned elsewhere. He can then track the development process to insure that all requirements for instructional materials and support have been met.

THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

PHASE 3.0: DEVELOPMENT



The third phase in the Instructional Systems Development Model involves working with the learning Specification Plan, product of Phase 2.0, in order to provide developed materials which can be validated prior to the beginning of the implementation phase. The first step in this development phase is to specify learning events and activities, which require consideration of the outputs from learning requirements analysis, objectives, and tests. Given the task and population data provided in the LSP, the instructional designer selects an appropriate delivery system and determines the sequence and structure of the instruction. The output of these three steps provides the

basis for reviewing and selecting already existing instructional materials which are appropriate or can be modified to fill instructional needs. After existing materials have been selected, the instructional development team can develop new, needed materials and materials supplementary to the existing materials, and use the validation and revision process to provide instructional materials for the implementation phase.

DEVELOPMENT PHASE

BLOCK 3.1: SPECIFY LEARNING EVENTS/ACTIVITIES

The first step in the development phase is the specification of learning events. The purpose of this step is to identify those events or conditions (not media) that appear most likely to facilitate the desired learning in the instructional setting. This is based on the premise that although there are instructional events which appear to be productive in all types of learning, available evidence suggests that different instructional conditions assist in producing different types of instructional outcomes. This appears to be borne out in both civilian and military instructional development. For this step in the ISD Model, the instructional designer should be provided with inputs from an educational psychologist and representatives of the instructional staff.

General Conditions

A general set of instructional events can be inferred from a review of current literature applying to the development of instruction. Basically, these refer to (a) informing the learner about the goals of the instruction; (b) presenting the instruction using explanations, prompts, directions, hints; and (c) providing feedback to the learner so he can assess his progress.

Whether the learner is acquiring information, physical skill, or mental skill, these conditions for learning appear to have implications for the instructional designer. In addition to these common

conditions, the learner may benefit by conditions more specific to the type of learning he is engaged in.

Specific Conditions

Physical skills. Physical skills range from simple motor chains* to very complex performances. They involve the uses of human senses, and large and small muscles. Physical skills generally are composed of a series of component-part skills and performance depends on the ability to perform the individual component-part skills, and the ability to coordinate these skills to form a more complex physical skill.

The events for learning component physical skills are (a) observation of a correct demonstration; (b) active practice in performing the skills; and (c) feedback to inform the learner of his accuracy. In order to learn more complex skills, the learner must have mastered the relevant subskills. If the subskills have been mastered, then verbal instruction, demonstration of the skills by a model, or a mediated presentation of the skill are events that facilitate the learning of complex physical skills.

Attitudes. An attitude* can be inferred when a person makes a choice in a situation in which he has at least two alternatives and is free to select one. By observing the personal choices an individual makes, it is possible to infer that he has certain attitudes. Available evidence suggests that attitudes are seldom learned or changed by the

*Motor chains are sequences of acts involving motor performances that must occur in a specific order. An attitude is a persisting state of mind of a person that influences that person's choices of action.

use of verbal encouragement or command. More effective instructional events for attitude learning are the use of human models, and reinforcement.

Human models are effective in influencing the attitudes of others when they are people the learner respects. The most effective instructional events for attitude learning include the use of a model to perform or describe desirable behavior, and the reinforcement and encouragement of the learner when he demonstrates the desired behavior.

If reinforcing events follow and are contingent upon certain preceding behavior, the learner is apt to develop a more positive attitude toward that behavior. Thus, success in a learning activity generally leads to a more positive attitude toward that activity.

Information. An effective technique for the learning of information is:

1. Present the larger body of information that the information is related to, supplying a context for its learning;

2. Present the information as clearly as possible using visuals, sound, or both;

3. Relate the new information to its larger context, and to other information familiar to the learner;

4. Allow the learner to practice or overlearn the information;

5. Review the information during several subsequent sessions.

Other events revealed in the literature as being helpful in the learning of information are use of questions embedded in text; use of summarizing statements; and use of techniques for organization and arrangement of information for print and nonprint media.

Mental skills. Mental skills* by nature are hierarchical, so that the learning of more complex higher order skills depends on the previous learning of simpler skills. Therefore, one of the critical conditions for successful learning of mental skills is the mastery of the simpler prerequisites or mental skills by the learner. In addition to this internal condition in the learner, there are external conditions such as contiguity and reinforcement; presentation of objects, illustrations, and examples; definitions or concepts; relationships among classes.

SPECIFY LEARNING EVENT/ACTIVITY INPUT

Information from the Learning Specification Plan, product of the Design Phase, becomes the input to learning event specification. These inputs include, for each task:

-- the class of learning

-- the set of learning (including enabling) objectives

-- the set of test exercises.

SPECIFY LEARNING EVENT/ACTIVITY PROCESS

The process involved in the learning event specification is the analysis of the various inputs to determine what instructional events or conditions have the greatest probability of resulting in the desired learning. The objectives and test items are examined to see what type of performance is necessary for mastery of the task. Using this information and the class of learning, it is possible to specify the instructional events that will allow the students to learn.

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*A mental skill is a capability of a person, inferred by observation, to perform certain types of learning objectives. These performances have a hierarchical relationship in which some enabling performances must be learned before other performances can be learned.

SPECIFY LEARNING EVENT/ACTIVITY OUTPUT

The output is a listing of key instructional events specific to each of the learning objectives. This output does not specify the media; instead, it identifies the required conditions such as provision for immediate feedback, graphic representations, or information organization.

DEVELOPMENT PHASE

BLOCK 3.2.1: SELECT DELIVERY SYSTEM

Many alternatives are available as the interface between the instructional message and the learner. These instructional delivery system alternatives include such media as the instructor, television, multimedia packages, computers, simulators, printed materials, audio, motion pictures, and other modes of communication. The instructional delivery system contains and presents the instruction for attainment of the objectives which the learner will be required to master.

Selection of instructional delivery systems is a process with a possible variety of outcomes, rather than the outcome of a single "best" medium. For example, a list of three potentially effective media might be listed for a specified point of view. This preference, as determined in the selection process, is arrived at through study of the combination of instructional needs (characteristics of the learners), and the instructional events. Deciding which of the alternative media to use then rests on management decisions, considering the need for individualized, autoinstructional activities; current existence or need for purchase of medium; current utilization of existing media; fluctuating enrollment; or size of staff.

SELECT DELIVERY SYSTEM INPUT

Input to the delivery system selection function includes:

-- output of the instructional design phase;

-- output of the learning event/activity specification function.

In sum, all of the output data thus far are required in order to select an optimum delivery system.

SELECT DELIVERY SYSTEM PROCESS

In selecting the instructional delivery system, the designer must analyze the requirements revealed in the earlier stages of the ISD Model. This is accomplished by identifying the class of learning and the events of instruction required for obtaining the given objectives. A statement of conditions of learning necessary to bring about the desired learning objectives is also required. In using these data, media choices can be made on the basis that the medium possesses the capability of providing the conditions of learning necessary for the desired learning outcomes. Once the media which have the capability of delivering the conditions and events of instruction have been identified, instructional management decisions can be made. Cost considerations form a large part of the process of selecting a delivery system.

SELECT DELIVERY SYSTEM OUTPUT

The output of the delivery system selection function is a complete delivery system plan in which each part of the instruction is accounted for, and the availability of the prescribed systems is indicated. The plan is not an idealized version of what ought to be done; it is a real plan which takes site-specific characteristics into account to insure its feasibility. Approximate minumum and maximum enrollments are specified according to the needs of the system for the output of trained personnel.

DEVELOPMENT PHASE

BLOCK 3.2.2: DETERMINE SEQUENCE AND STRUCTURE

The determination of the optimal sequence in which learning objectives are to be mastered is necessary if the learning is to be effective and efficient. This is true for all levels in the instructional system. That is, there is a requirement for proper sequencing of objectives within a small unit such as a period of instruction, or a larger unit such as an entire course or a program of instruction. It is possible that many logical sequences of objectives may exist. However, the instructional designer takes steps to ensure that the sequence decided upon is not only logical, but maximal in terms of facilitating movement from the entry level to the final objective.

DETERMINE SEQUENCE AND STRUCTURE INPUT

Input to the sequence and structure step in the ISD Model is in the form of listings of learning objectives and enabling objectives, and any information on the relationships between objectives obtained from the analysis of learning requirements.

DETERMINE SEQUENCE AND STRUCTURE PROCESS

The process of specifying an instructional sequence actually begins during the learning analysis function. The learning analysis process produces the elements of instruction which must be sequenced for learning. As an example, if the task analysis is performed on competencies within the mental skill domain, a hierarchy of competencies (learning objectives) and subordinate competencies (enabling

objectives) is generated which yields a sequence of instruction of subordinate skills first, and then the skills higher in the hierarchy.

If other procedures of task analysis are used, then the determination of the instructional sequence may be made on some other method. Examples of other possible methods of sequencing are:

-- specific chronological order;

-- known to the unknown;

-- simple to complex;

-- concrete to abstract;

-- whole view to part, etc.

Regardless of the method used to sequence instruction, the sequence requires substantiation during the process of validation. Validation of a sequence of objectives based on contingent relationships can be conducted systematically. If the results of a small group tryout indicate that the learners are not adequately attaining the objectives, and if the sequence of that instruction is not based on contingent relationships between objectives, the sequence is only one of many possible sources of that failure.

DETERMINE SEQUENCE AND STRUCTURE OUTPUT

The output of the sequence and structure process of the ISD Model is logically sequenced objectives or groups of objectives, depending on the interrelationships of the objectives. Additionally, sequences of objectives relating to similar content should be grouped in topical units.

DEVELOPMENT PHASE

BLOCK 3.3: REVIEW/SELECT EXISTING MATERIALS

Because the ISD process is concerned with highly specific statements of objectives and the performance measures for these objectives, all available training materials can be considered for use. Existing materials, although usually not developed according to the ISD process, can be incorporated into courses if they appear to be consistent with the objectives. The process of validation will provide data which can be used to evaluate the materials following their adoption.

Although some instructional development sites do review and select existing materials, experience indicates a tendency to discard the materials because they do not exactly meet specifications for new courses. While this might be an ideal practice, it is too costly to consider on the first tryout of a course. New materials should be developed only when there are no existing materials, or when evidence clearly demonstrates that existing materials cannot be adapted to provide adequate instruction.

To the extent possible, the Armed Forces and civilian community should be fully explored for potentially useful materials. A rich variety of learning materials has been prepared on a wide range of topics, and many can be identified through establishment of contacts with probable sources; e.g., the catalogs of instructional materials available at some service schools. Correct management and articulation of existing materials will save instructional development time and money. Techniques such as adding objectives to the existing materials, or specially prepared student

worksheets which provide guidance for using materials are sometimes sufficient to avoid completely new development costs.

REVIEW/SELECT EXISTING MATERIALS INPUT

The input to the review/select existing materials function will include:

-- learning objectives;

-- criterion-referenced tests;

-- output of learning event/activity specification, Delivery System Selection, and possibly Determination of Sequence and Structure.

REVIEW/SELECT EXISTING MATERIALS PROCESS

The process of reviewing and selecting begins with the identification of the objectives for which the instruction is intended, and comparing the topical content of the existing materials in the selected delivery system with that of the objectives. Because of time constraints and the inability of judges to make precise estimates of the instructional power of instructional materials, the operating rule should be that of selecting the first reasonable film, manual, videotape, or instructional aid which appears to be congruent with the objectives and enables the student to meet the test criterion. Much time can be wasted in continuing to search for "best" materials, when the only known reliable way to determine the instructional effectiveness of materials is through tryout with members of the target population. Therefore, unless data are available on the effectiveness of existing materials, or unless availability of time and resources encourages further identification of materials, the instructional designer should select the first set of materials meeting his requirements.

Should a search identify more than one selection which appears to be consistent with the objectives and test items, they can be used if available. If a choice must be made, alternatives should be listed for further reference in case the selection fails to provide the necessary effectiveness.

REVIEW/SELECT EXISTING MATERIALS OUTPUT

The output of the review/select function is a list of materials in the selected delivery system (or the materials themselves) judged to meet the objectives. Instructional materials and processes may have been chosen to cover all or a portion of the listed objectives. Further, specification of materials that must be developed, either as additions to existing material or as new material, occurs at this point in the ISD process. The listing provides:

-- identification of available existing materials;

-- requirements for additional materials for the existing materials;

-- need for the development of new materials.

DEVELOPMENT PHASE

BLOCK 3.4: DEVELOP NEW MATERIALS

The overriding concern in the development of new instructional materials is to ensure that the materials are sufficient to produce the performances specified in the learning objectives for learners having the stated entry behaviors. The learning objectives represent the outcomes the instructional materials should produce; the learning event specification contains a description of the key instructional events needed, and the delivery system selection identifies the specific medium for which materials are to be developed. Additionally, the review and selection of existing materials has provided instruction judged suitable for the objectives, including specifications for development of adjunct materials for the existing instruction. Using all of these data, the instructional developer begins development of instruction with continual reference to media specialists, instructors, and members of the target population.

DEVELOP NEW MATERIALS INPUT

The input to the materials development step includes:

-- learning objectives;

-- test exercises;

-- description of student characteristics;

-- learning events specification;

-- delivery system selection;

-- existing materials with guidelines for needed adjunct instruction.

DEVELOP NEW MATERIALS PROCESS*

Given the input to the materials development process, the instructional designer uses techniques which vary depending upon the medium for instruction. He consults with the media specialist for specific technical advice; e.g., completing a story board; writing an audio script, etc. In order to provide the greatest likelihood of the instruction producing the specified outcomes, the developer refers to the instructor and to members of the target population, conducting a one-on-one formative process with a student after the first draft of a block of programmed instruction, for example. All efforts are devoted to providing instructional materials which are effective in producing desired performances in the target population.

DEVELOP NEW MATERIALS OUTPUT

Output from new materials development is a set of instructional materials which will be subjected to the process of validation.

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*A complete description of the materials development process will occur in the appropriate manual. It is too lengthy to describe here.

DEVELOPMENT PHASE

BLOCK 3.5: CONDUCT VALIDATION AND REVISION

Three rules are basic to the process of validation* and revision:

1. Measurable goals must be stated in advance.
2. Students must be from the target population.
3. Revisions are made on the basis of student performance data.

Given these basic rules, the process of validation provides the initial moment of truth by testing materials in the development stage in terms of desired learning outcomes. It is at this point that all products are tested against the objectives and other goals or criteria established previously by decision makers, or imposed by outside constraints. The process is essentially one of iteratively testing the instructional materials on samples of the target population, recording all problems, and revising the materials, tests, and/or processes until acceptable goals (criteria, objectives) are met.

Errors or omissions made in the developmental stages of the materials are revealed by the process of validation. In the next iteration, solutions for these found problems are tested. In this context, problems are not to be construed as failure on the part of designers/developers; the purpose of the process is to allow them to make corrections early enough to avoid expensive mistakes. It is essential that student performance data be the source for the revisions. The process of validation and revision is not

*The process of testing the instructional materials in the development stages on the target population and shaping the materials to the learners' needs based on feedback from the evaluative activities.

an arbitrary exercise. No amount of expert or high-ranking judgment about improving instruction is a substitute for it.

CONDUCT PROCESS OF VALIDATION INPUT

The inputs to the process of validation and revision are:

-- selected existing materials and/or developed materials;

-- criterion-referenced tests;

-- other stated goals.

CONDUCT PROCESS OF VALIDATION AND REVISION

The process of validation is the same for developed materials as for selected existing materials. Basically, validation is carried out in three stages: individual student (also often included in the development process); small group, and large group. Performance data, as well as time and attitude, and any other required measurements, are collected at each stage and used to revise the materials, tests, and procedures as revision needs are diagnosed.

The process of validation is iterative, successively repeated until either the stated goals are reached, or until the time and cost required to make increments in effectiveness exceed the value of those increments.

CONDUCT PROCESS OF VALIDATION OUTPUT

Three major products result from the process of validation and revision. They are:

-- validated instructional materials;

-- refined test instruments;

-- documentation on student performance, range of times to completion, and measures of other stated goals.

MANAGEMENT IMPLICATIONS OF THE PROCESS OF VALIDATION

Development Phase

A number of assumptions are basic to the ISD process:

1. Expected job performance can be specified and measured through the process of performance evaluation.

2. Different jobs, tasks, and billets require a range of proficiency from apprentice through journeyman to master.

3. Level of proficiency and breadth of knowledge and skill can be specified for each step in the job performance hierarchy.

4. The student who has satisfied all requirements at any of the skill levels is said to have achieved mastery at that level.

A primary responsibility of the instructional system is to produce the optimum proportion of students who achieve mastery at each level. In a school setting, this concept can also be applied to courses: A course is effective to the extent that the optimum proportion of students achieve mastery within allowable time and cost limits. Generally, the student should demonstrate mastery at the end of the course or at the end of an instructional cycle, since the mastered skills are those which will be required for satisfactory performance on a future assignment.

Having stated the instructional mission in terms of the proportion of students attaining mastery, it is then necessary to produce an instructional system which will yield that result. The only known method of accomplishing this is the process of validation. Generally, this concept applies to the smallest discrete unit of instruction just as directly as

it applies to the complete course or training cycle. Through appropriate tests, measures, and skill demonstrations, the course developer is able to identify those units of instruction which instruct adequately, and, more importantly, to document with specific quantified data any segment of the instruction which is not working as it should. The interpretation of these data provides him with the necessary information to revise and improve the weak areas.

The importance of this process to management cannot be overemphasized since the process yields accurate and specific documentation which can be used in formulating management decisions. For example, suppose that there are 25 major milestones (mastery tests for units of instruction) in a given course. In the first group of students, some will master all of the milestones on the first testing, some will get only half, and others will range between. Analysis of the milestones by proportion passing will enable the instructional system manager to locate weak instruction (in terms of his target population); further information from the students will provide him with ideas on how to improve the units until they meet specifications. Some students in early cycles will need to be retrained only on those areas where they did not achieve mastery, but past results have shown that this number will steadily decrease in ensuing cycles.

In the ISD approach, clearly stated outcomes provide goals against which to compare actual results. Second, detailed information about the degree to which that goal has been achieved provides a direct first step in management planning to alleviate the problems. Further, the process will work as well in the design of lessons for a single hour or period as it will for improving entire courses.

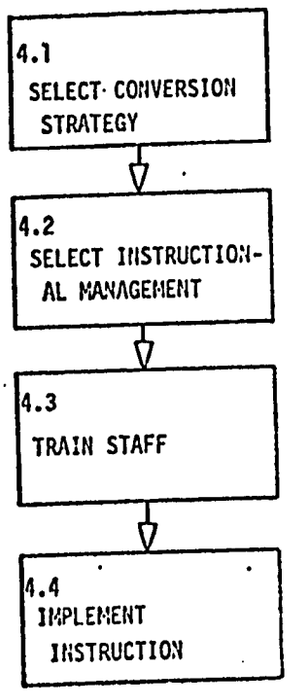
The availability of the data allows the instructional systems manager to approach his problems realistically, eliminating much of the guesswork in trying to improve instruction. Documentation offers quantifiable evidence on questions dealing with the relative amount of time a student should remain in a given department or class. The allocation of time to different instructional departments can then be based on reliable data.

FOR YOUR REVIEW AND COMMENT

Revised

THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

PHASE 4.0: IMPLEMENT INSTRUCTION



The ISD Model phase of implementing instruction includes the selection of appropriate instructional management plans for any course, whether it is new instruction developed by the Model, or an existing course converted by ISD techniques. After selecting instructional management for a course, which might include several management schemes over various course segments, the ISD Model continues with a Train Staff function. In this function instructional managers become oriented to and familiarized with the new techniques they will be required to use with the new course. They may acquire skills in administering new evaluation instruments, using varied equipment, or managing different record systems. When the instructional management staff is prepared to implement the course, and when revisions from the validation process have been completed, course implementation occurs.

IMPLEMENTATION PHASE

BLOCK 4.1: SELECT CONVERSION STRATEGY

The most common application of the ISD Model will likely be to existing courses of instruction. The danger in converting to an ISD course is in accepting existing learning objectives and materials as being both necessary and sufficient. Often there is wastage in existing courses in the form of extraneous learning objectives and instructional materials that are not efficient, or not specifically oriented to the objectives. The intent of the ISD process is to provide instruction that is both effective and efficient. Therefore, it is necessary to carefully examine all aspects of existing courses of instruction during the conversion to ISD courses.

The starting point in conversion is with the performance objectives from the job, since these represent the necessary specific instructional outcomes. In cases in which the learning objectives correspond well to the performance measures used, the alternative of starting with learning objectives is acceptable, although the more desirable approach is to begin with the actual performance measures. These measures are then compared with the priority-ranked list of job tasks to determine if there are performance measures for each job task that has been selected for training, and to determine if there are performance measures that do not correspond to selected job tasks. If a listing of selected job tasks does not exist, it will be necessary to conduct task ranking and selection before comparing performance measures and the selected job task lists. If adequate job task data are unavailable, then it is necessary to begin with the job task analysis.

The results of the comparison of performance measures with selected job tasks will reveal job tasks for which there are no performance measures, and performance measures with no corresponding job tasks. By using such a procedure to add and delete, it is possible to make sure that there are performance measures for all necessary job tasks, and that there are no extraneous performance measures. Once this is done, it is possible to conduct the analysis of the learning requirements and proceed with the steps in the ISD Model. The existing materials used for the instruction can then be reviewed and evaluated according to the procedures in the ISD Model to determine their adequacy.

SELECT CONVERSION STRATEGY INPUT

The inputs for conversion include:

-- job task lists;

-- selected job tasks;

-- existing performance objectives and measures;

-- test exercises;

-- instructional materials.

In short, all available information will be used. In many cases, some of the described information will not be available.

SELECT CONVERSION STRATEGY PROCESS

The process in conversion is to compare existing performance measures with the listing of selected job tasks to ensure an adequate matching. This may involve conducting a job task analysis or the priority-ranking of job tasks if these steps have not been completed.

Following the comparison, extraneous performance measures are deleted, and performance measures are developed for those selected job tasks for which there are no performance measures. The conversion then proceeds to the analysis of learning requirements step in the ISD Model.

SELECT CONVERSION STRATEGY OUTPUT

A systematically-produced course, revised from an existing course, is the product of the Select Conversion Strategy function.

IMPLEMENTATION PHASE

BLOCK 4.2: SELECT INSTRUCTIONAL MANAGEMENT

The ISD Model contemplates two aspects of "management." First, in the generic sense, it is concerned with the utilization of men, materials, and resources toward the accomplishment of stated goals; planning, scheduling, staffing, monitoring, and budgeting functions are all parts of the general management system. Second, in the instructional context, management means the particular scheme selected to organize the learning events and the learners in order to optimize the output of the instructional system.

Resources, environment, equipment, and the availability of trained staff, serve either as constraints or as opportunities in formulation of the instructional management scheme. The recent literature has provided a variety of management plans to serve differing needs, including learner controlled instruction, learner directed study, peer tutoring, individualized instruction, contingency management techniques, and pacing. The important factor is that the management scheme is not an end in itself, only a means to improve the effectiveness and efficiency of instruction.

Historically in the instructional field, innovations have occurred as ends in themselves. For example, one of the more recent of these is "individualized instruction." Many practitioners have taken the view that individualized instruction in and of itself must be good and should be used to the exclusion of all other methodologies. In the ISD Model, the measure of the "goodness" of instruction lies not in the method used,

but in the results obtained. Looking at results rather than process is one of the more difficult transitions to make in any instructional system, because it is a distinct departure from tradition, not only for instructors but for instructional managers as well.

A sound instructional management plan is based on the recognition that each student is an individual with measurable characteristics and that taking these individual characteristics into account will enable the instructional designer to improve the operating results of the system. It is a fundamental law of the behavioral sciences that individuals differ in many ways, such as in their achieved knowledge and skill, the rate at which they learn, and their persistence toward the completion of a task. It is the responsibility of the instructional designer to arrange a series of instructional events that will enable each student to achieve mastery at the specified level.

It is not uncommon to find entering students in some courses who have already learned as much as 25% of the objectives planned in the course. Planning instruction so as to avoid teaching individuals what they already know can yield time savings, provided that the system can accommodate individuals entering the course at an advanced point. An instructional management plan should accommodate fast and slow learners in order to produce the maximum proportion of students achieving mastery at the end of the course. Faster learners often can complete individual objectives in half the time required by slower learners in the same group. Many options for managing instruction permit fast learners to move ahead, and thereby provide for the concentration of resources on those learning slower. Faster learners do not necessarily perform better on the job, even though they do make more desirable students.

Several options are available for the utilization of the time saved by fast learners:

1. They can be sent to their duty stations earlier than their classmates unless a motivational problem is created in doing so.

2. They can be used as peer tutors, according to a formal schedule, assisting slower learners to achieve course expectations.

3. They can be assigned to do other work in the instructional system which needs to be done unless this is seen as punitive action (sending faster learners to undesirable duties will quickly slow down the rate of learning).

4. They can be given additional instruction according to a learner directed study plan which will broaden their skills and make them more flexible in subsequent duty assignments.

Instructional time is there to be used, but it will not be productive unless careful planning takes place to insure that it is. Often, student-management systems other than block scheduling create an increase in the clerical burden in that more frequent entries are required in instructional records. Effective instructional managers can provide for this increased clerical load and still obtain a significant improvement in system operating statistics.

Ideally, the instructional system would provide for, and encourage through appropriate and available incentives, the fastest possible completion of the course. The rate of progress of individual students is itself manageable to a large extent through the use of properly scheduled rewards. The systematic scheduling of rewards to be given for satisfactory completion of units or segments of a course is called contingency management. Many

instructional settings can take advantage of the benefits to be gained from contingency management techniques which have been used successfully in chronic discipline cases, with low ability students, and students with casual attitudes toward advancement. Contingency management usually results in increases in performance and reductions in learning time when properly supervised.

SELECT INSTRUCTIONAL MANAGEMENT INPUT

The input to the select instructional management function includes:

-- course structure;

-- materials selected and/or developed;

-- delivery system specifications;

-- learner characteristics

SELECT INSTRUCTIONAL MANAGEMENT PROCESS

The select instructional management function is one of trying to accommodate the instructional needs to the available resources, taking real constraints into account. The designer attempts to select the most effective management scheme from those available. He will likely have different approaches for different instructional problems, and may design a scheme using multiple approaches for different parts of the same course. Group instruction may be selected as the only feasible alternative for certain kinds of highly expensive demonstrations where simulators are not available; in other situations he will use individually paced schemes.

SELECT INSTRUCTIONAL MANAGEMENT OUTPUT

The output of the select instructional management function is a specification for student and instructional management which will fit the needs of the instructional system. It will contain instructions for applying the management system, including the requirements for record keeping, scheduling, and type of instruction to be used.

IMPLEMENTATION PHASE

BLOCK 4.3: TRAIN STAFF

Two distinct kinds of staff training are inherent in the ISD Model. First, there is the general training in ISD given to all persons who will work in the instructional system (see Appendix A). Provision has been made to offer this training in group or individual modes and in sufficient depth to allow those trained to perform their specified tasks in ISD. Further, sufficient resources will be available for individuals specializing in particular aspects of the ISD process to go into considerable depth in those selected areas. This training should take place prior to the assignment of such personnel to tasks in the ISD process.

The second kind of training will be aimed at the staff charged with the implementation of specific courses developed through the ISD process, many of whom will have been instructional development team members. Regardless of the kind of course, special requirements and procedures will require relatively brief but specific training, particularly if new management, media, or equipment characteristics present an unusual situation.

This TRAIN STAFF process is primarily one of familiarization and orientation and less of knowledge and skill development except in rare cases. Experience has indicated a necessity for providing additional training just prior to the implementation of courses which depart from normal operating procedures (e.g., changing from group to individualized instruction).

If practice is required in the administration of the evaluation instruments, the manipulation of the equipment, the management of student records or time, etc., that practice will be provided at this step. The design characteristics of the course and the expected outcomes are discussed until the implementation staff demonstrates thorough understanding of the expectations.

TRAIN STAFF INPUT

The inputs to the staff training function will be:

-- instructional materials and plans;

-- description and plans for the instructional management scheme adopted for the particular course;

-- characteristics of the trainees;

-- evaluation instruments that will be used to assess trainee progress.

TRAIN STAFF PROCESS

The process of the staff training function is that of organizing the course plan and materials so that instruction can be provided in an efficient and orderly manner. Except in unusual circumstances, lengthy and expensive training sessions will not be required. Staff training is planned, instruction is offered, and feedback is obtained from the staff to insure that they can implement the course. Those staff members who have already demonstrated capability to work in the kinds of courses being developed can reasonably be excused from this orientation.

TRAIN STAFF OUTPUT

The output of the staff training function is the demonstrated competencies of the staff presented in a form acceptable to local

requirements. Little documentation is necessary--perhaps only a checklist to insure that all those affected have the necessary skills to implement the course.

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IMPLEMENTATION PHASE

BLOCK 4.4: IMPLEMENT INSTRUCTION

Implementation occurs when the course is ready for installation as an operational training system component. Ordinarily, implementation occurs at a suitable time interval after validation and revision are completed. The range of problems faced during implementation is large, often due to the sheer numbers of people who must become involved, and a great deal of management and supervisorial attention is required. Even with a specially trained staff, implementation will be difficult since the staff will, in the early years, not be totally skilled in the operation of the course.

Preparation for implementation must be done well in advance, and probably should always be scheduled by a PERT or similar technique. The program manager must integrate the student management system, the course, the evaluation system, and insure that all facilities and equipment are in place as scheduled. He must anticipate the problems he will face if the course is more efficient than he had planned, and also, problems which will result if the system does not work well. Delivery of materials and equipment, arrival of students, and difficulties of the instructional staff should be anticipated.

The plan for implementation should be prepared well in advance and all appropriate authorities notified. Required or desirable internal and/or interservice liaison should be instigated and maintained.

Appropriate channels to handle student grievances, particularly in the early years, should be established. Tallies and analyses of these

grievances should be evaluated regularly, since output from the student, in whatever form, is the principal source of data necessary to operate the course. Experience has shown that there are some predictable student reactions to their first ISD course which tend to drop out as they become accustomed to using the system. Often, more time is required of the student to meet absolute performance standards than is required simply to retain relative position in class. While this problem can be eliminated through successive iterations of the course, it will be a real problem in the early stages. Alternatively, some students who are self-motivated, or for whom the programmed incentives work exceptionally well, may finish in much less time than was anticipated. This can create serious problems for individually paced courses if it is not provided for in advance.

If early finishers are not rewarded in some form--allowed to achieve something they want--word quickly passes through the students and the entire benefit of self-pacing can be lost. While some students would welcome the honor of helping with the course, tutoring other students, or doing other productive work, some others would prefer early assignment to duty stations. Early assignment is another area of potential serious problems. If early completers are given all of the preferred duty assignments, late completers may find the environment of the school to be more desirable than course completion.

Instructors who are not assigned to classroom duty must be managed in useful and productive work when they are not needed in the conduct of the course. In many cases, groups of instructors can spend much valuable time in brainstorming sessions. Further, when traditionally trained

instructors are faced with a change in role, they often tend to react against the system. Good management personnel will continue to work with instructors, provide encouragement, and keep them engaged in activities leading to accomplishment of mission.

During implementation, it would be naive to overlook Murphy's first law: If anything can possibly go wrong, it will. (Even if it can't, there is still a strong likelihood that it will.)

IMPLEMENT INSTRUCTION INPUT

The input to the implementation function consists of:

-- all course materials and procedures;

-- evaluation instruments;

-- management forms and procedures;

-- resource utilization plans (facilities, equipment, personnel).

IMPLEMENT INSTRUCTION PROCESS

The implementation process entails following the plan for implementation of the course, managing and operating the course as required, and producing qualified students. As implementation is completed, specialized ISD personnel will gradually phase out of operations.

IMPLEMENT INSTRUCTION OUTPUT

The output of the implementation function is twofold: reports and descriptions of course operations, and trained personnel.

Management Implications of the Implementation Phase

A fundamental tenet of the model, based on the interpretation of available research, is that the maximum potential for increasing effectiveness and efficiency of instruction occurs in the Design Phase. Principally, this is due to the "cost added" nature of the ISD process. Any task or function deemed of low priority should not occupy instruction or development time. Perhaps the management component of the instructional implementation phase offers the second greatest opportunity for improving effectiveness and efficiency.

Except for new instructional tasks, there exists in virtually all instructional locations a very rich menu of courses, materials, equipment, plans, and other resources. The careful articulation of these resources, according to the plans drawn in the Instructional Development Phase, can provide improvements in the system. The manager should look carefully at existing resources and instructional plans to insure that redundancies are not being created through lack of coordination.

Further, available instructional equipment and materials can often be substituted for repetitive human activities in instruction, with no loss and often a gain in effectiveness. The process of substitution requires careful management planning during the entire ISD process in order to insure that maximum benefit is obtained from each of the instructional resources. To be effective, this process requires a change in the point of view taken by management. The manager should view all human and materials resources as having a separate and distinct function which can only be fully optimized through planning and effective controls.

Specification of these separate functions will create the need to identify new roles for the entire instructional staff. For example, if an instructor is thought of solely as one who plans and delivers instruction, then full benefit cannot be gained by the ISD process. If, on the other hand, he is thought of as a manager of students and learning resources, many opportunities for improvement will be presented. His job will then require him to use alternative and even repetitive instructional resources until the students have met the performance requirements. This shift in emphasis from that of presenting instruction to that of managing students to mastery of the performance requirements will yield an improvement in the proportion passing measure fundamental to the ISD process. However, the instructor will typically not make this shift in his own performance unless he is required to do so by management, and is provided the necessary instruction to perform as he is required.

Learning is an individual matter which is predictable and controllable through the application of research-based procedures. Students learn at different rates, but there is every reason to believe that through correct procedures, virtually all qualified students can meet the informed expectations of the instructional establishment. Management can provide the opportunity for students who learn faster to do so in order to concentrate resources on those who learn slower. Further, research has shown that management can increase the average rate at which all students complete requirements through alteration of the instructional procedures.

Currently, the reduction in the time of instruction is often accomplished through the elimination of content from the curriculum. But, in the ISD process, all unnecessary content has been eliminated in the Analysis

Phase. If time in instruction is to be further reduced without eliminating critical material, then the approach to instruction must be altered to meet the requirements. Changing the approach to instruction is clearly the responsibility of management and is highly unlikely to occur without strong management actions. Further, it will require that management concentrate on the basic data of system performance, rather than on the processes employed in instruction. If there are clear instructional objectives, good criterion measures for those objectives, and instructional resources to apply toward the achievement of the objectives, then the manager's job becomes one of examining the indices of system performance and diagnosing problems when the indices are not revealing satisfactory results.

The effective manager will employ more effective ways of measuring system performance and more useful criteria than in the past. Rather than spending his time in examining instructional materials and visiting classes to judge presentations, he will measure system outputs by independent quality control procedures. He will assign these procedures to staff members responsible only to him. His attitude will be one of problem identification and solution rather than one of blame placing. Since he will have measures of effective system performance, he will work to improve his results rather than concentrate on the processes of instruction. As his measures and management skills improve through directed efforts and practice, his results will also improve.

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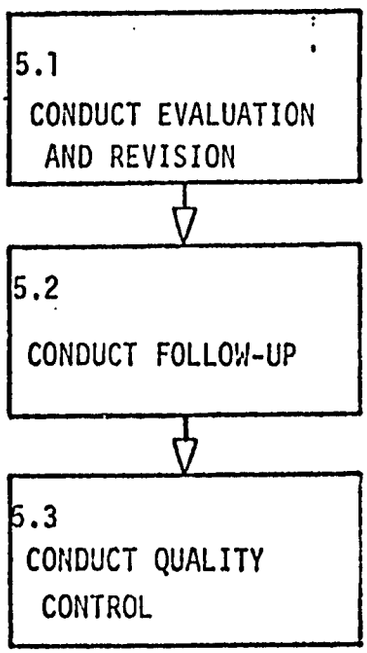
THE INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

PHASE 5.0: QUALITY CONTROL



The final phase of the ISD Model is one of quality control. It includes three steps for maintaining this control. First, an evaluation of the course implementation which began in the preceding step provides data for needed revisions in the course which are brought to light by the actual full-scale administration of the instruction in its selected setting. Graduates of these courses provide further means for collecting data on course effectiveness, as they go to the field with the skills they have acquired in school. Actual field visits, or other types of data collection on performance on the job, are used in follow-up studies which provide further feedback to the ISD system for course improvement. The quality control step, conducted by individuals who report directly to management,

prevents problems which typically arise when individuals are required to evaluate their own work. The quality control function determines when instruction has met the need for which it was intended.

QUALITY CONTROL PHASE

BLOCK 5.1: CONDUCT EVALUATION AND REVISION

The evaluation/revision function is a major subsystem in the ISD Model. Some measurement and evaluation activities occur at very early stages in the ISD process, beginning with the output of the task priority-ranking procedure and extending throughout the development and delivery phases up to quality control function. The systematic process of evaluation is one of the key features of the ISD approach to instruction and represents a point at which there is a fundamental departure from traditional methodology

The logic of a systems approach to instruction or training requires:

1. that clear objectives be stated so that correct resource allocation can occur;

2. that efforts aimed at accomplishing those objectives be judged solely on that basis;

3. that internal evaluation efforts be directed to the collection of information which can be used to judge whether the efforts expended have achieved the objectives stated.

The internal evaluation provides the opportunity to judge an instructional system in terms of its objectives rather than in terms of its relative success as compared to other systems. The majority of evaluative efforts are aimed at the system as a whole, rather than at the determination of the relative success of the students.

In the ISD Model, average scores and class ranks are not generally useful information unless, in a research sense, different instructional methods are being compared. The relative standing of students provides virtually no information on which management decisions can be based,

provides inadequate data for revision purposes, and is not an indicator of the proportion of students who meet minimum training standards.

Large amounts of data are collected on students--not for purpose of ranking or comparing them--but for the purpose of determining system strengths and weaknesses. These data, such as time required to complete, ratings of course materials and procedures, performance measures and evaluations, are probably the most valuable resources for management planning and action.

The revision function here refers to data-based revisions, not editorial or format revisions which occur in the early stages of the model. The most commonly used method for finding the areas of instruction which are not performing satisfactorily is a tally sheet on which all of the objectives are arranged horizontally on a matrix, and student names are listed vertically. Each time a student fails to meet the requirements of an objective, a tally mark is placed at the intersection of the student's name and the name of the objective. Then, the columns are totalled vertically and a proportion failing or passing can be quickly calculated.

For those objectives on which the proportion passing did not meet system expectations, further analysis is required. The technique applied here forces a "management by exception" approach to revision where the exceptions are carefully documented. It is important to note that the process described does not provide information on what needs to be done, it only identifies specific areas of weakness. The instructional designer must then consider all of the data available on those weak areas and recommend specific actions to improve the instruction. Past experience has indicated that the obvious remedy of simply expanding the amount of

instruction in weak areas is not a good general solution. It is more likely that the instructional procedures and/or materials were improperly designed.

EVALUATE AND REVISE INPUT

The input to the evaluation/revision function includes:

-- the learning specification package;

-- all data collected in course implementation;

-- student characteristics data;

-- other planning and analysis documents.

EVALUATE AND REVISE PROCESS

The evaluation process consists of analyzing collected data, performing appropriate statistical procedures, and then organizing these data into a form useful for management. Evaluation is concluded with recommendations for revision.

The revision process is one of analyzing the evaluative data, the original planning and specifications for the course, the procedures followed, identifying and isolating any inadequate system performances, and their causes. Having identified suspected causes, the instructional designer and/or manager then identifies alternative approaches to problems in materials or procedures, selects one of these approaches, and revises the course accordingly.

EVALUATE AND REVISE OUTPUT

Output of the evaluation/revision subsystem consists of:

-- management reports, with data displayed in a form which highlights problem and success areas;

-- recommendations to the revision function;

-- documentation of the relative success of the entire effort.

The output of the revision function is the new approach to training in particular areas which have been designed on the basis of the data collected in the evaluation function. The actual revised course materials and tests are prepared as a part of this function.

QUALITY CONTROL PHASE

BLOCK 5.2: CONDUCT FOLLOW-UP

Recent efforts in ISD have indicated the importance of following up students on their first and even subsequent duty assignments. When representatives of the school actually visit the work stations of students, they are able to perform a quality control function that is not possible in any other known way. Since every student cannot be followed, it is necessary to sample from among all students and follow as many as possible.

The follow-up activity will enable those responsible for the course to determine the relationship between what was taught in the course, what is used on the job, what is not used on the job, and what is needed on the job but was not taught in the school. Since requirements regularly change, the data from follow-up activity can be used directly in keeping the course current. Further, the level of skill required by the job can be compared with the expected outcomes of the course in order to make the best match between the two that time and resources will permit.

Often, it is not possible to schedule actual field visits on all courses offered by a school, and alternative techniques are required to collect data. Questionnaires have been used (and abused) for this purpose with varying degrees of success. It is reasonable to try this approach if there are no alternatives, but in time, graduates from all courses should be actually contacted in the field. Regardless of how the follow-up data are collected, they represent a highly critical source of information to the course designers and managers. Little real improvement through time can occur if systematic follow-up and revision efforts are not made a part of any ISD effort.

FOLLOW-UP INPUT

The inputs to the follow-up function include:

-- all course specifications;

-- performance measures;

-- description of target populations;

-- lists of student duty station assignments.

FOLLOW-UP PROCESS

The process consists of conducting active follow-up activities including field visits, distribution, collection, and analysis of questionnaires, analysis of field visit data, and collection of data from internal publication sources. Available proficiency test data on students should also be collected, particularly when a short time period has elapsed between the completion of instruction and the administration of the proficiency test.

Comparisons are made between expected performance on the job and actual performance on the job. Data are analyzed to identify unneeded student skills for which instruction had been provided, and needed skills for which no instruction was provided.

Any feasible methods or procedures which contribute to the quality control effort are used.

FOLLOW-UP OUTPUT

The output of the follow-up function is an analysis of the relative success of the instruction for actual job performance, recommendations for additions or deletions to existing courses, and identification of relative strengths and weaknesses within the course, including summaries of all relevant statistical data that can be used for management decision making.

QUALITY CONTROL PHASE

BLOCK 5.3: CONDUCT QUALITY CONTROL

The quality control function is composed of two subfunctions: internal evaluation and follow-up activities. In an ideal system, the quality control function would collect and interpret a completely independent set of evaluative data. Because of cost effectiveness considerations in instruction completely independent sets of data are rarely available. A compromise is to make the function independent, and staff the function with individuals who report directly to management and who have no responsibilities for developing or implementing the instructional program. This prevents the problems which typically arise when individuals are required to evaluate their own work.

In the ISD Model, the quality control function is a direct tool of management to insure that accurate and independent assessment is made of the training program according to principles and rules established in advance. Quality control provides the data which allow for careful "value engineering" of instruction. Normal positive human efforts ordinarily lead to an attitude and practice of trying to enlarge the scope of one's own area of responsibility. Since some individuals are more adept at manipulating the bureaucracy than others, disproportionate resources can be allocated at the expense of other functions which are just as critical to the mission.

The quality control function determines when instruction has met the need for which it was intended: when it has adequately served the "market." It further determines when the instructional system has performed optimally in terms of its own objectives. These determinations

and interpretations are made primarily for management and the data reported are not in a form ordinarily useful to instructional designers.

The necessity to maintain an independent quality control function cannot be overemphasized. This concept is another key feature which distinguishes the ISD Model from traditional approaches to instructional development.

QUALITY CONTROL INPUT

The input to the quality control function comes from two sources: the evaluation/revision function and the follow-up activity function. In addition, all of the documented needs, priorities, and plans are available.

QUALITY CONTROL PROCESS

The process is principally that of assessing actual performance as determined by interpreting the collected system data, and comparing the actual performance with expected or planned performance. Quality control must also indicate the degree to which the plan of the instructional system meets the actual needs of the operating systems it serves. It provides feedback, through analysis of all available documents and data, to the management system on the implications of instruction for management in the entire organization. Questions regarding the procedures for generating instructional requirements are analyzed from an instructional point of view in order to recommend improvements. The function generates cost-effectiveness and cost-benefit analyses based on cost and operating data internal and external to the instructional system.

QUALITY CONTROL OUTPUT

The output of the quality control function occurs in the form of reports assessing the following areas:

-- system performance;

-- discrepancies between needs and performance;

-- problem areas requiring management attention;

-- costs and benefits;

-- relative effectiveness of alternative methods of instruction;

-- other general information needed for management decision making.

System Documentation

Implementation Phase

Data collected, organized, and analyzed as a result of the final step in the delivery phase, the follow-up and quality control function, provide the final documentation of any single instructional system development. That is, given new course development in a training area, all data collected for the individual steps in design, development, and delivery provide total documentation for this new course. Each package of documentation provides both management and instructional personnel with evaluative data and information which can be used not only to assess the individual course, but also to evaluate totally the operation of the model, and to reveal proven development procedures and products.

Management uses of ISD systems documentation. Since the quality control function allows the comparision of what the system was intended to accomplish, and what it actually accomplished, management is able to measure intended versus real outcomes. Whether the system meets its goal or not, it is of interest to management to view the design, development, and delivery process through the completed system documentation, in order to evaluate the operation of each step, and the complete model. Adequate documentation will reveal not only the product of each step, but also what revisions were made in each step in evaluation processes, and how these revisions affected remaining steps. Strong and weak points of the model can then be identified, or, more frequently, the preferred or inadequate methods of operation in each process which led to various outcomes. This total overview gives management insight into operation of the ISD Model, and insight into any discrete application of it.

Simultaneously, management can evaluate the adequacy of its own operations, and those of the instructional development and instructional staff, as shown by the totality of documentation. Reinforcements can be applied to build stronger management and instructional team members where documentation shows good practices, and to eliminate problems such as inadequate documentation procedures, misguided revisions, inappropriate planning, etc.

Complete systems documentation can be utilized at the local level in determining how the system should work, how it is working, where it can be changed, and in evaluating its application to any one discrete instructional task.

Instructional development uses of systems documentation. Teams of instructional designers and developers, typically involved in one-at-a-time activities, are hard put to maintain an overall perspective which is important in the development of an instruction course. Completed systems documentation restores this perspective, whether it is at the end of the course development, or whether it is obtained during development activities by reference to already completed documentation of other courses. Developers and instructors who are aware of the uses of systems documentation are better documenters, and tend to be able to plan better since they hold a wide perspective of activities and procedures which provide data adequately.

Systems documentation can provide background information for new instructional development personnel, and for lessening the problems associated with changing personnel during instructional development. A catalogue of previously produced, complete systems documentations, and documentation on any instructional development as it progresses are tools at the local level in efficient instructional systems development.

Parameters of the Instructional Systems Development Model

At what point in the management system does the Instructional Systems Development Model logically terminate? The answer to this question is more complex than the question of the starting point for the system. For certain discrete tasks, for certain personnel, the question can be clearly specified; for the system as a whole, the ISD function of quality control implies that all instruction is open for improvement as collected data warrant revisions. Thus, while an instructional task force which designed, developed, and delivered an instructional package might complete those tasks and move into development of a new course, collection of follow-up data could provide a basis for improving management, content, and/or procedures, revisions which would be produced by a totally different task force of developers.

One of the discrete tasks in the ISD Model, for example, is that of monitoring individual progress and examining data to be sure that a prespecified proportion of students have achieved the objectives spelled out in the instructional program. As this criterion is reached, the discrete task of determining the adequacy of this training is completed.

Specific involvement of personnel is illustrated in the role of an instructor who is concerned with only the operation of a given section of a specific course at a school. His concern would be centered around the question of whether his graduates meet the expectations and what his alternatives are to see that a greater proportion of graduates do reach those objectives. As he reaches this goal of optimal output, he completes a primary task.

At more senior levels, the Instructional Systems Development Model specifies a continuous process which follows up sufficient numbers of graduates to their assigned duty stations to be sure that the instruction given has been adequate and meets the initial specifications of the job task analyst. This kind of systematic follow-up, based on field-use data, provides the only reasonable basis for making modifications in the training system. Internal modifications can always be made in order to increase the effectiveness or efficiency according to the objectives specified at any given point in time. What is continuously in question is whether the level of training provided is adequate to meet the needs of the operating system. The responsibility for determining this lies directly with the instructional system manager.

The performance of the follow-up function and decisions based on the data gathered will provide the instructional system manager with one of the more complicated problems that he must face. How much instruction is enough? If individuals trained in specific courses only approximate field requirements, is it better to improve those courses or to allocate resources to newer problems which may have a considerable higher priority? It is at this point in the Model that the presence of empirical data in the management information system collides with tradition most dramatically. Once a course has been established and individuals have the responsibility for its execution, the elimination of or major changes in all or part of the course training objectives should become a continuing management concern.

The Instructional Systems Development Model approaches this problem directly by establishing quality control procedures throughout the entire design, development, implementation, and follow-up processes, which, when

properly used, can provide the basis for more rational decisions about overall instructional needs. Typically, each individual in the instruction system is justifiably proud of his speciality and his job, and often sees his role as that of promoting the interests of his own speciality. An individual's prode in his speciality, and overall morale, cannot be dismissed lightly. On the other hand, the operational needs of the entire system cannot be subordinated to the enthusiastic promotion of individuals or groups within the instruction system. This fact illustrates a second and highly important reason for establishing a well-managed and monitored job task priority-ranking procedure so that internal arguments can be objectively resolved and held to a minimum.

In sum, while discrete tasks and individual performances can be said to "begin" and "end" in the ISD Model procedures, the Model itself contains functions which continuously trigger change and improvement. The documentation and managerial decisions which signal revisions in the total instructional system are provided by the monitoring capabilities of the ISD Model; in particular, by the culminating quality control function.

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GLOSSARY

ANALYSIS OF LEARNING REQUIREMENTS. The analysis of job tasks to determine how these may be learned best; includes the identification of the class of learning, prerequisite subtasks, and site of instruction.

ASSESSMENT. A judgment of the effectiveness and efficiency of a training system, in terms of measurement and evaluation.

ATTITUDES. A persisting state of mind of a person that influences the person's choices of action.

CLASSES OF LEARNING. The four classes of learning outcomes (information, mental skills, physical skills, attitudes) into which learning can be divided.

COLLECTIVE TRAINING. Coactive or team training; training of two or more persons in the jobs they will perform together; applicable to jobs in which incumbents are interactive.

COMPONENT SKILLS. Those various unique individual motor skills which, when executed in the proper manner and sequence, constitute a complete motor skill.

CONCRETE CONCEPTS. A concept whose key attributes are observable; a concept based on physical properties.

CONTIGUITY. Refers, in learning, to the principle that events that occur closely together become associated by the learner.

CONTINGENCIES OF REINFORCEMENT. Refers, in training management, to the amount and type of student behavior important for achieving the planned and scheduled rewards--or avoiding the punishments of the system.

CONTINGENCY MANAGEMENT. The establishment of a set of procedures by which trainees are required to perform a certain amount of work or to achieve certain objectives before engaging in activities that are preferred by the trainee (e.g., recreation, a break, or a more desirable training event).

CONVERSION STRATEGY. A plan of action that describes how existing traditional courses can be changed to ISD courses.

COST-BENEFIT ANALYSIS. A ratio of the performance on the objective-referenced measure to the cost of training; often used to compare alternative methods, forms.

CRITERION. The standard of indicator of acceptable performance.

CRITICAL TASKS. Tasks defined by managers and job incumbents according to a set of agreed upon criteria (e.g., universality, importance to a mission accomplishment, preservation of life or property, etc.). These tasks rank at the top of the training task priority list.

DEFINED CONCEPTS. Concepts whose key attributes are not observable but can be defined by rules.

DELIVERY SYSTEM. Any method including procedures for the presentation of instruction. Platform instruction, television, OJT, correspondence courses and accompanying devices are all delivery systems.

DISCRIMINATION. The intellectual skill resulting in making different responses to different stimuli.

EFFECTIVE. In instruction, the extent to which planned objectives are achieved. Measurement of effectiveness usually implies the proportion of students meeting minimum passing requirements.

This term is restricted to measures or ratings of student performance, and does not include judgments of instructor performance.

EFFICIENT. (Time) Refers to the extent to which effective instruction achieves the planned objectives in optimum time. Instruction cannot be efficient if it is not first effective. EFFICIENT. (Cost) Effective instruction is efficient to the extent that optimum costs have been reached.

ELEMENT. The result of breaking down an instructional goal into its component parts is elements in four classes: mental skills, physical skills, attitudes, and information.

EMPIRICALLY VALIDATED. Testing of all instructional materials on the target population and revision according to what is needed to accomplish the objectives. A principal tenet of the ISD Model is that instructional development is based on observation of learner experience.

ENTRY BEHAVIOR. The skill, knowledge, and/or attitude required before beginning a new segment of instruction. Also may refer to the capability a person has prior to new learning.

FEEDBACK. The return of information. Information on student performance is "fed" back to the student so that he can improve that performance; to the instructional designer so that he can improve materials and procedures on the basis of student needs; to the management system so it can monitor the internal and external integrity of the instruction and make appropriate revisions. Or, refers to the flow of data or information from one step in the ISD Model to others.

FOLLOW-UP ACTIVITY. The quality control activity in which students are tracked from the instructional system to their duty assignments and their preparation for that assignment is evaluated, in terms of both over- and underpreparation.

FUNCTION. In the ISD Model, the activity and outcome of a given step in the model. Function does not imply who or in what kind of structure the activity occurs. Functions are generally interdependent steps in the model.

GOAL ANALYSIS. The procedure of analyzing instructional goals, especially in the attitude domain, that do not refer to observable behavior and converting them into performance oriented goals.

GROUP INSTRUCTION. Any instruction that is presented to more than one student by one delivery system at the same time.

HIERARCHICAL. Describes the relationship among learning tasks in which some tasks must be learned before other tasks can be learned.

HUMAN MODEL. The use of people to perform the desired task or demonstrate certain attitudes while learners observe.

IMPLEMENTATION. The installation of a completed ISD course at its point of intended use and according to the design requirements. It follows the validation and revision function.

INDICATOR BEHAVIOR. Refers to that behavior that indicates the presence of a specific attitude.

INDIVIDUALIZED INSTRUCTION (IT). Refers, in the ISD Model, to a management scheme which permits individual characteristics of trainees to be a major determinant of the kind and amount

of instruction given. Here, IT nearly always implies some form of self-pacing.

INSTRUCTIONAL EVENTS. The activities that occur during instruction.

INSTRUCTIONAL GOAL. The statement of the desired outcome of instruction based on a specific job task performance objective; i.e., a job task performance stated in instructional terms.

INSTRUCTIONAL MANAGEMENT PLAN. The specifications for the scheduling, instruction, evaluation of trainees toward the goal of course completion.

INSTRUCTIONAL MANAGEMENT SYSTEM. The installed version of the instructional management plan. The operating scheme through which training is accomplished.

INSTRUCTIONAL SYSTEM. The total effort, distinct from the operating system by location, authority, or mission, that is concerned with the preparation of individuals to serve the operating system.

INTERFACE. The point in a system where two or more subsystems interact with other internal system elements or with elements external to the system. An interface normally implies an input, output, or feedback relationship between or among elements.

ITERATIVE TESTING. The process of repeated testing. As part of the validation subsystem, materials are tested on learners, revised on the basis of learner performance, then retested and revised again.

ITERATIVELY. Repeated in successive cycles.

JOB. A grouping of closely related functions and tasks actually performed by a person in a particular duty assignment (specialty).

JOB TASK. A unit of work activity which is a consistent and significant part of a job.

JOB TASK ANALYSIS. The basic method or activity used to obtain a detailed listing of duties, operations, and skills necessary to perform a clearly defined, specific job. It involves observations of workers and conversations with those who know the job, in order to describe in detail the work involved, the conditions for performance and the qualifications necessary for the worker who must perform it.

LARGER CONTEXT. The larger body of information to which specific names and facts are related.

LEARNER CONTROLLED INSTRUCTION. A form of individualized instruction in which the learner manages his progress through the requirements. The student is normally given a list of resources and requirements and allowed to pace himself to course completion.

LEARNER DIRECTED STUDY. Study which is initiated at the request of the student, either in addition to or in place of planned instruction. Usually, learner directed study is reserved only for those who have completed all requirements early or entered the training system having achieved the requirements elsewhere.

LEARNING ANALYSIS. A procedure to identify subelements that must be learned before a person can achieve mastery of the performance.

LEARNING EVENT. The specific activities whose occurrence will facilitate learning.

LEARNING HIERARCHY. The result of a hierarchical learning analysis in the class of mental skills that indicates the subelements that must be learned before a given task can be learned.

MANAGEMENT. The general term for the assignment, monitoring, and assessment of the personnel, materials, and resources dedicated to a specific mission, operation, or function.

MANAGEMENT BY EXCEPTION. The action taken to correct system operations which deviate from planned outcomes. The manager ignores all nominal operations and concentrates on problem areas.

MANAGEMENT OF INSTRUCTION. The activity engaged in by the manager to achieve the planned outcomes of instruction.

MANAGEMENT SYSTEM. The operating rules and procedures including the communications relationships among the elements installed as a result of the management plan.

MARKET. In the ISD Model, the entire group of users of the instructional personnel. Serving this market implies meeting the needs of the group of users.

MASTERY. In terms of learning, refers to meeting all of the specified minimum requirements for a specific performance. Criteria for mastery are defined in the design phase of the ISD Model.

MASTERY LEARNING. Learning in which time, path, and/or materials of instruction are allowed to vary while level of trainee performance is held constant, in contrast to traditional goals of instruction.

MEANINGFUL CONTEXT. Refers to the larger body of information to which specific names and facts are related in information learning. See also LARGER CONTEXT.

MENTAL SKILLS. The capability of a person, inferred by observation, to perform certain types of learning tasks including problem solving, rule learning, concept learning, and discrimination.

MODELING. The act of showing a learner an actual or simulated representation of the desired performance. See also HUMAN MODELING.

MONITORING. The process of regularly gathering management information from necessary sources to permit adequate management. It is a continuing process of data collection for managers.

MOTOR CHAINS. Sequences of acts involving motor performances that must occur in a specific order.

NECESSARY AND SUFFICIENT. Refers to some behavior, information, directions, or actions that must occur or be present and whose occurence or presence is in and of itself all that is needed.

NORM-REFERENCED TESTS. Those tests whose scores have meaning only in reference to a certain group of scores (or norm).

OBJECTIVE-REFERENCED MEASUREMENT. The type of measurement designed to determine if an individual has mastered a specific objective.

OBJECTIVE-REFERENCED TEST EXERCISES. The items on an objective-referenced test; may be paper and pencil items, or observation of actual performance.

OBSERVATIONAL MEASURE. A test item that assesses a learner's behavior by requiring an instructor or observer to observe the learner's performance and indicate whether certain performances occurred or not.

ORIENTATION. Brief instruction of trained personnel on the unique features of a particular instructional system.

OVERLEARNING. Refers to continual practice on a learning task by a person who has correctly performed the task.

OVERT BEHAVIORS. The observable tangible acts of a person.

PACING. Determination of the rate of completion of specific instructional requirements. Pacing is managed to control the amount of time spent in instruction. It can be controlled by the learner, the management system, or by the characteristics of the group.

PEER TUTORING. A form of instruction in which students at the same or more advanced level of knowledge provide instruction to students at the same or lower level of knowledge on the specific objectives under consideration. Peer tutors are not members of the existing instructional establishment.

PERFORMANCE MEASURES. The absolute standard by which a job performance is judged. A performance measure in the inventory of job tasks with each performance objective.

PERFORMANCE OBJECTIVES. A precise statement of what the learner will be able to do in a job task on the job. The verbs used describe an action or task that can be observed or a behavior that indicates that the learner has mastered the objective. The

statement also includes information on what the learner will have to perform and how well he will do it.

PERFORMANCE REQUIREMENT. The actual specification of the behavior of the student when he is demonstrating accomplishment of a given objective.

PERT. Program Evaluation and Review Technique. One of many systematic methods for scheduling and managing the accomplishment of a specific effort.

PREREQUISITE SKILL. Specific mental skills that must be learned before learning a given mental task.

PRIORITY-RANKING. The establishment of a list of job tasks in descending order of importance in order to permit the selection of training tasks critical to the mission. It is usually accomplished by having knowledgeable incumbents, managers, and trainers rate each task according to specified criteria.

PROBLEM SOLVING. The highest intellectual skill in which a learner must combine, in a new and novel way, the concepts and rules he has acquired to solve a problem.

PROFICIENCY TEST. An examination and/or performance demonstration which permits the examiner to infer the level of knowledge and skill that an individual has in a given specialty. These tests are norm-referenced and ordinarily used in promotion decisions.

REINFORCEMENT. The strengthening of a behavior by presenting a reward or reinforcer following performance of the behavior.

RULE LEARNING. The intellectual skill that involves the learning of the relationships among concepts.

SIMULATORS. Machines or processes designed to provide training which will have high positive transfer to the real world equipment or situation. Simulators are ordinarily cheaper, safer, or more available than the ultimate situation or equipment.

SITE OF INSTRUCTION. School, OJT, correspondence study, independent study, collective training, are all forms of training considered in the preparation of the Learning Specification Plan (LPS) in the ISD Model.

SKILL LEVELS. The plateaus on the progression of skills an individual must have achieved to be promoted to or retain a given rank or rating in a specialty. In some branches of the service, these plateaus correspond roughly to the labor progression of apprentice, journeyman, master.

SUBELEMENT. Elements of instructional goals are analyzed into their components (subelements) by the learning analysis suitable for that class of element; e.g., mental skills elements are analyzed for learning requirements by a hierarchical analysis.

SUBORDINATE COMPETENCIES. Those skills a person must possess prior to learning a final skill.

SYSTEMS APPROACH. A generic term referring to the orderly process of analysis, design, development, evaluation, revision, and operation of a collection of interrelated elements.

TARGET POPULATION. The pool of potential entrants to training for which instructional materials are designed and tried out.

TEST EXERCISES. The items that make up a test of a learner's performance; these may be paper and pencil items or observation of actual performance.

TRADE-OFFS. In any systematic approach to instruction, it is necessary to make compromises between what is desirable and what is possible. Ordinarily, these decisions involve increases or decreases in time, money, facilities, equipment, or personnel. Training aids and simulators, represent examples of trade-offs. The additional cost of the simulator can be traded against the improvement in training and can be judged cost effective.

TRAINED PERSONNEL REQUIREMENT (TPR). The number of individuals trained per major unit of time, where the time is ordinarily stated in months or years. The number of individuals completing training in a year would be the requirement specified by management for trained personnel.

UNIT INSTRUCTION. Includes all formal and nonformal instruction conducted in the unit.

VALID. The state of having validity; for tests, valid refers to the condition in which the score obtained by a person on a measure is an accurate representation of his actual capability.

VALIDATION. The process of testing the instructional materials in the development stages on the target population and "forming" the materials to the learner's needs based on feedback from the evaluative activities.

"VALUE ENGINEERING." Refers to the process of designing equipment or instruction to meet but not exceed the required outcomes. Ordinarily, it refers to the elimination of features or instructional objectives that have not been demonstrated to be positively necessary.

VERBAL CHAINS. Sequences of sentences, words, letters, or numbers either written or spoken, in a set order.

VERBAL CUES. Bits of information used to aid a learner by focusing his attention; a hint.

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FOR YOUR REVIEW AND COMMENT
Revised

APPENDIX A

INSTRUCTIONAL SYSTEMS DEVELOPMENT
TRAINING MATERIALS PACKAGE

The Instructional Systems Development Training Materials Package contains components essential to produce the carefully coordinated effort between senior management, middle management, and individuals charged with producing the various elements necessary to conduct adequate instruction for the optimization of military training. The complete training package to effect this coordinated effort will contain the following elements:

1. An Instructional Systems Design Model, with explanatory written and pictorial matters.

2. A multivolume manual (series of books and pamphlets) which covers the steps in instructional systems design, development, evaluation, implementation, updating, and revision. It will also contain alternative approaches to each of the steps in the ISD Model, and support criteria to be applied in selecting among these alternatives to meet local needs.

3. An adjunct instructional workbook which is to be used in conjunction with the multivolume manual. The workbook will contain practice exercises, forms, and procedures to be followed; methodology to be employed; and the necessary self-evaluation items to enable the student to check on his own progress.

4. Mediated workshop materials to be used either individually or in groups which provide a planned instructional program to teach trainees the necessary knowledges and skills described in the model. These mediated workshop materials will consist of tape and slide presentations

combined with exercises from the adjunct workbook and will provide regular feedback to the trainee on his progress in achieving the objectives.

5. A workshop manager's handbook which describes the procedural steps necessary to conduct short or longer term workshops utilizing 1, 2, and 3 above. It will contain suggested exercises, suggested methods for adapting the general procedures described in 1, 2, and 3 to local conditions and situations, and will contain additional evaluation instruments necessary for quality control.

These materials will be packaged in a convenient format to be distributed throughout the Armed Forces where instructional systems development skills are required. A combination of individual study, group study, and review materials, the package is designed to accommodate a variety of learners and institutional requirements. The ideal situation, however, would be for an individual first to attend a directed workshop with a group of other trainees. There he would receive practice exercises, orientation sessions, and informational presentations to enable him to grasp the general concepts of the Instructional Systems Development Model. Further, he would be taught how to access and use the information contained in the multivolume manual, how to use existing Armed Forces publications referenced in the adjunct workbook, and how to continue to improve his skills at the conclusion of the workshop.

Both the multivolume manual and the adjunct workbook are cross-referenced to significant existing publications dealing with the specific topics covered. Each of the Armed Forces has published manuals on effective and efficient procedures for the development of training. These

manuals have neither been revised nor reproduced in the packaged materials. Each step in the design model contains references to specific publications available to the Armed Forces schools.

The multivolume manual serves the function of information storage, and is intended to be a set of reference works rather than instruction. The manual is designed in this fashion to enable individual commands to add specific books and manuals to its basic list of references in order to make the model adaptable to local needs.

The adjunct workbook is loose-leaf in format so that individual commands may add or subtract material to meet local needs. The workbook and multivolume manual, in combination, constitute one application of the Instructional Systems Development Guidance Package. It can be easily transported to remote units where immediate need for the development of new training occurs and where it is not possible to have personnel attend specially scheduled workshops. Of necessity, the combination of the workbook and multivolume manual will be most useful to those individuals who have independent study skills.

The mediated workshop materials will be organized and articulated to provide a carefully guided instructional sequence in a workshop or individual learning center setting. These materials are also to be used in combination with a training enabler to train larger numbers of individuals at the same time, particularly in those situations where groups or departments need simultaneous training. The training workshops will teach the use of the multivolume manual and will rely on the adjunct workbook for the provision of practice exercises and self-evaluation.

These workshops can provide either intensive training in specific

areas contained in the Instructional Systems Development Model, or a complete overview of the model and its elements for those individuals having need for a more general level of skill.

The last element in the package is a workshop manager's handbook which contains lesson administrative instructions for each of the components of the Instructional Systems Development Model. It also contains scripts for the tape recordings, additional practice exercises, pre- and posttests for the entire package, and suggested instructional development problems, for which alternative solutions are available, and which can be desgined as case studies in a workshop setting.

The workshops can be used in a group mode for two or three weeks duration for individuals who need to learn design, development, evaluation, and delivery skills. The supervisor's workshop will be of approximately one week's duration and will contain the major concepts, information sources, and strategies for selecting alternative forms of instruction.

The director's workshop lasts approximately two days and deals with the longer range management, planning, budgeting, and strategy considerations necessary for the continuation of the new training system.

A design consideration permeating the Instructional Systems Development Training Materials Package is that all individuals within a command who are concerned with any of the aspects of instructional development should receive training at or near the same time in order to establish a common basis for communicating about methods, procedures, and evaluative techniques that are to be used. This previously mentioned three-level design involving senior management, middle management, and

individual developers is intended to promote the institutionalization of modern instructional systems techniques in the Armed Forces.

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Appendix B

Suggested Readings

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