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THE ANALYSIS AND DESIGN OF AN INSTRUCTIONAL SYSTEMS COURSE

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THE ANALYSIS AND DESIGN OF AN INSTRUCTIONAL SYSTEMS COURSE

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by RUSSELL W. WATSON

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

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ABSTRACT

Instructional Systems Development is a comprehensive method for the analysis, design, development, implementation, and evaluation of training. It was produced for the United States Army in 1975 by Florida State University. Since that time, it has been the Army's goal to develop all of its training using this format. This has become increasingly difficult in the case of the U.S. Army Intelligence Center and School, because more and more of its instruction is being developed by civilian contractors. Contract completion dates must continually be extended while contractors train their personnel in the policies and procedures of Instructional Systems Development. Additionally, these delays then serve to increase contract costs.

This study was conducted to ameliorate this performance discrepancy by providing a framework for the development of an Instructional Systems Development course for contractors. Both the analysis and design procedures accomplished in this effort were performed using the methods discussed in the actual Instructional Systems Development process. Thus, an instructional course would be developed through the use of the methods it would be teaching.

The analysis portion of the study includes a comprehensive major and subordinate task list. This compilation identifies the twelve major tasks a contractor must perform in order to develop training materials according to the Instructional Systems Development process. These are:

1. Perform behavior analysis.
2. Perform analyses procedures.
3. Select tasks for training.
4. Perform all procedures in developing objectives.
5. Assess existing training materials.
6. Design and develop all tests.
7. Perform all sequencing procedures.
8. Develop job aids.
9. Select delivery methodologies.
10. Develop course procedures and control documents.
11. Write all training materials.
12. Validate all training materials.

Each task has been analyzed to determine the skills and knowledges required for its satisfactory performance. Thus, the results of the analysis portion of the study are a complete task listing and a compilation of all required skills and knowledges.

The design portion of the study concentrates on the pyramiding of all of these identified skills and knowledges. Pyramiding is a process whereby skills and knowledges are displayed in the hierarchical order in which they must be learned. They also provide valuable data for use in the development of instructional maps, detailing the sequences in which students may progress through the course. The final section of the study involves using the information generated in each pyramid to develop complete performance objectives. These objectives provide the framework around which the actual course is to be developed.

The final products of the study are the competency tests constructed for each of the performance objectives. The development of the tests at this point in the process ensures that only the objectives are tested and not any extraneous material that might be included by either a course writer or an instructor.

Thus, the parameters for a course for contractors working with the United States Army Intelligence Center and School have been defined. These parameters represent the instructional framework for the construction of an Instructional Systems Development course.

CHAPTER I

THE PROBLEM

Introduction

For a number of years, the United States Army was confronted with the question of how to develop and conduct training to ensure that all skills necessary to perform a particular job were identified and presented to the probable learners in such a way as to generally ensure their success.

Historically, the U.S. military agencies have had to take products of our educational systems and utilize those people in the defense of the nation. Those products came from different school systems, were exposed to a variety of teaching methods, and all performed at various levels of efficiency. Usually the Army had to draw from a lower academic level because the draft frequently excused higher academic performers through deferments for schooling, teaching, or defense-related employment. This process generally left the Army with students who graduated from high school as well as a significant number of non-high school graduates. To take these people and train them to run more and more sophisticated defense machinery proved an extreme challenge to military and political leaders (Smith, 1965).

By securing the services of leading academic institutions and relying heavily on the education leaders working for the Army, the first efforts in performance training began to surface. This occurence led to the in-depth examination of performance objectives. Although

the initial efforts were somewhat fragmented, the idea of "need-to-know" training related directly to job performance had been raised and addressed. In the early sixties the Army began to examine performance training through objective delineation as stated by Mager (1962) and Ammerman and Melching (1966). This move had a significant effect on military training and resulted in the streamlining of considerable amounts of training material. The Army began to realize that soldiers had to have better training and that training for insignificant job requirements was time that could have been better spent training the soldier to perform duties of a primary nature.

By the early seventies, the Army had moved toward a process known as systems engineering, which was formalized by the U.S. Army Intelligence Center and School (USAICS) in 1975 in Systems Engineering, which will hereafter be referred to as USAICS Reg. 350-300-1. Systems engineering, the forerunner of Instructional Systems Development (ISD), used the concept of the systematic approach to the determination of what was to be taught the soldier. The problem with early performance training was the inconsistency in determining what a soldier should know for his worldwide mission. Most early performance programs were written in objective terms, but the objective was usually what someone considered to be necessary based upon previous experiences and assignments. Consider for a moment the problem of one agency teaching a soldier to perform maintenance on a truck in Alaska whereas another teaches a soldier to work on one in a tropical environment. With limited control over where each soldier is to be assigned, due to changing world requirements, one might find the soldier trained for the

tropics being actually assigned to Alaska. In an attempt to compensate for this problem, the training objectives were virtually changed every time a lesson writer incorporated his personal interpretation in his work. Systems engineering was implemented by the U.S. Army to cure this problem of "fluctuating objectives."

Systems engineering involved the examination of tasks to be taught, and although the subject-matter expert (SME) interview remained a critical part of task gathering, it was not the only method whereby a task list was produced. The move to a systems-analyzed approach to training was directed by the Continental Army Command and was to be implemented by all Army schools. This process, as directed, required the performance of the following seven steps (USAICS Reg. 350-100-1):

1. Job analysis.
2. Selection of tasks for training.
3. Training analysis.
4. Preparation for training
5. Development of testing materials.
6. Conduct of training.
7. Training quality control.

The first step required identification of the job, development of a task list, and the validation of the task list. Steps for determining the task list were left somewhat to the interpretation of the individual training school. This left the Army with the same problem it had initially faced in that subject matter experts were still providing most of the input through means of writing the task list and

then certifying that those tasks were valid. This abuse of the analysis steps of systems engineering affected all other steps because the front-end analysis process dictated tasks to be trained and subsequent lesson plan production. Most early problems with systems engineering were not so much that the system was unusable but that personnel using the system were left to their own resources in using the model. The designers, primarily soldiers writing for other soldiers, were not trained in the utilization of the process, and their interpretation of an "absolute process" resulted in lessons of varying preciseness.

Upon examination of the remaining steps of the process, it is readily obvious that, because of the inconsistencies generated through misapplication of job analysis, the remaining steps would be distorted.

The final problem with the utilization of systems engineering was how to input any results gathered in the quality-control phase. The ultimate conclusion concerning quality of training rested with the abilities of graduates to perform on the job. If graduates were found to be deficient, the analyzers were hard pressed to locate just where to input the change because they could not locate the deficiency in the training process. Some suggested improving front-end analysis, whereas others suggested better media and methods. Due to the problems resulting from systems engineering, the Army contracted Florida State University in the early seventies to design and produce a program known as Instructional Systems Development (ISD). The result, Interservice Procedures for Instructional Systems Development (U.S. Army Training and Doctrine Command, 1975), which will hereafter be referred to as TRADOC PAM 350-30, was disseminated in August 1975 and was accompanied

by a command directive that the system be utilized to develop training materials. The Army faced the same problem in implementing this system, in that it was still faced with a body of potential training developers, none of whom were trained in the Instructional Systems Development process. In order not to repeat the errors of the systems engineering implementation, the Department of the Army purchased a method of training that closely related to the first phases of Instructional Systems Development. This course, Criterion Referenced Instruction by Mager and Pipe (1976), was distributed throughout the Army schools and served as an adequate training package to teach front-end analysis procedures.

In this course, training developers learned the ways and means of developing task lists and sequencing objectives into learning programs. Criterion-referenced Instruction (CRI) is still widely used in Army schools, and only at a few locations has it fully given way to Instructional Systems Development. The reason for the slow conversion from Criterion-feferenced Instruction to Instructional Systems Development is due to the fact that this new process remained somewhat theoretical and failed to explain clearly to the users just how to utilize the system. Criterion-referenced Instruction filled a large part of this gap, but Army schools were still groping with the internal training of their own personnel who would be developing cirriculum. As requirements for new systems of weaponry expanded, service schools and, in particular, the U.S. Army Intelligence Center and School (the focus of this study) began to look to the private sector for contractual development. The contractors were informed that USAICS not only wanted new weapons

systems developed but needed the training materials for them as well. The private agencies (RCA, Motorola, Hughes, etc.) were extremely proficient in developing new weapons hardware but were generally new to the particulars of systems-designed instruction. Most of the contractors were highly skilled products of our educational systems, but their competencies were in fields of engineering and electronics. Thus, a problem began to clearly surface. Military agencies were having to spend considerable time attempting to explain how to use the Instructional Systems Development model to develop military training materials.

Need for the Study

In discussions with Mr. Gary Ketchie, Chief, New Systems Branch, Directorate of Training Developments, U.S. Army Intelligence Center and School, Fort Huachuca, Arizona, the problems of contractor inability to produce training programs for the Intelligence School in a systems-analyzed format and geared to the current learner level were identified and listed.

In general terms, Mr. Ketchie, a recognized expert in contractor negotiations, listed the following problems:

1. Contractor lack of knowledge of front-end training analysis procedures.
2. Contractor inability to gear learning programs to the intelligence level of the user.
3. Contractor inability to write lesson material in the Instructional Systems Development format detailed in TRADOC PAM 350-30.

The described deficiencies do not reflect a lack of ability on the part of the contractors as much as they point to a lack of exposure to the training that would provide them with the skills and knowledges to take new fielded systems of weaponry and produce the necessary training to accompany them. Often, developers of instruction, whether they are contractors working for the government or public educators, fail to evaluate the needs of the user prior to beginning literature production. A program teaching the specifics of task identification and procedures for describing the users of the training programs is therefore required.

People learn at different rates and respond to different instructional media (Howes, 1970). It is therefore an absolute requirement that contractors not view learning from a developer's point of view. The third identified deficiency dealt with the lack of knowledge of contractors in using a system engineered approach for developing training material. Mr. Ketchie never questioned the ability of the contractors to write training using Instructional Systems Development, given adequate instruction, but saw as critical their evident lack of knowledge of this format in the initial important stages of material development.

Upon examining the areas identified by Mr. Ketchie, one begins to see a need developing to actually address the production of training material that will meet the demands of the contractors as well as those of the Intelligence School.

To substantiate the existence of a continuing training deficiency, a review of course offerings in the 1979 catalogs of the three

Arizona universities was conducted. This review revealed that no university in Arizona provides specific training to cover the requirements of the Military. All catalogs referred to courses that included parts of cirriculum development, method and media determination, and target population descriptions; however, no cohesive course structure exists that addresses consistently the needs of the contracting agencies and the Intelligence School.

The systematic approach to teaching and training is nothing new, and many training institutions have been known to utilize this procedure to develop courses (Kaufman, 1972). Due to the limited preparation of students for alternate educational fields, however, colleges do not seem to have pursued the needs of special groups of educators. In relation to the interview with Mr. Ketchie, it is evident that contracting agencies will never be able to respond directly to the needs of Army training until they have participated in and become competent in the procedures of Instructional Systems Development. Within the population of potential contractors with the Army, there are a number of people who could enter the contracting market immediately if they were competent in the required training development procedures.

According to the current philosophy of TRADOC, the Army has been faced with the task of training individuals with lower levels of intelligence. The increasing complexity of weapon systems leaves the Army with a training problem of some dimension. In efforts to solve this problem, service schools have resorted to hiring private contractors to develop training materials with the production of new military systems. As previously stated, however, contractors have to bid

government contracts without knowledge of instructional design and training delivery systems as required by the Army. Thus, contracts are let and contractors must then request considerable time and material from the agency (Intelligence School) in order to train their personnel in the policies and procedures of Instructional Systems Development.

Purpose of Study

The purpose of this study is threefold:

1. To identify and assess the need for training new systems contractors employed by the U.S. Army Intelligence Center and School in methods of Instructional Systems Development.
2. To perform a complete Instructional Systems Development analysis of the identified needs.
3. To produce a design for instruction that could be utilized in the development of a comprehensive training program for said contractors.

The final products of this study will include a needs assessment, multiple task analyses, complete performance objectives, tests, and a sequential course map for describing and controlling student progress.

Basic Assumptions

This study is based on the following assumptions:

1. That a course of study can be developed and presented that will eliminate the performance discrepancies that exist between the requirements of the U.S. Army Intelligence Center and School and the skills of contractors attempting to satisfy those requirements.

2. That bidding contractors will use a course of instruction geared specifically to the requirements of the Army and, in particular, the Intelligence school.

Limitations of the Study

The study will be conducted based on the discrepancies that exist between contracting agencies and the U.S. Army Intelligence Center and School. Therefore, all results may not necessarily have complete application to the civilian academic community. The daily contact with both the contractors and the Intelligence School required to accomplish this project mandates that the majority of dissertation research be conducted on location.

Definitions of Terms

For the purpose of this study, the following terms are defined:

1. Course map--A flow diagram, or flow chart, showing the modules or units of a criterion-referenced course and various relationships between them (Mager and Pipe, 1976).

2. Criterion-referenced Instruction (CRI)--A method of organizing and managing instruction in which prescribed performance criteria are achieved by each qualified learner (Mager and Pipe, 1976).

3. Criterion-referenced testing--A method of testing the criterion elements of the objective in such a way as to

assess the learner's competency to perform the standards of the objectives.

4. Instructional Systems Development (ISD)--An approach to training design and implementation characterized by a systematic analysis of training needs and the preparation of objective-oriented material. This system differs from previous ones in its validation/feedback mechanism.

5. Objective pyramid--A visual display describing the hierarchical relationship between skills required for the performance of a given task.

6. Systems engineering--A systematic approach to the analysis of training needs. This process lacks a workable feedback mechanism.

7. SME--Subject-matter expert.

8. Target population characteristics--Terms that serve to describe the group to which instruction is to be presented. This description includes, but is not limited to, analysis of the learner's educational level, anticipated attitudes, and military education and experiences.

9. TRADOC--U.S. Army Training and Doctrine Command. This agency is responsible for the training of all military personnel working for the Army. It is located in Virginia and is commanded by a four-star general.

10. USAICS--U. S. Army Intelligence Center and School, Ft. Huachuca, Arizona.

CHAPTER 2

REVIEW OF LITERATURE

Due to the specific nature of this project, the review of literature has to revolve around educational theorists and practitioners who are in tune with systems training, mastery learning, and competency-based instruction. It was with this in mind that an ERIC search was conducted at the University of Arizona Library. This search provided a printout of over seven hundred documents dealing with competency-based education. After a comprehensive review of the printout, coupled with a library search, a number of books and articles were identified that dealt with the needs of the Army in relation to an instructional systems development procedure. These were then reviewed specifically for documentation dealing with front-end analysis, objective development, competency test construction, and sequencing instruction.

Front-end Analysis

The examination of literature reflected that considerable numbers of instructional systems analysis procedures exist. Those that both describe and employ applicable front-end analysis methods, however, were few.

Kaufman (1972, p. 6) stated that front-end analysis must begin with planning and that "planning, and the commitment to planning before taking action, can prevent us educators from putting the cart before the horse by deciding how we are going to do something before we know

what should be done. It will also keep us from merely treating symptoms (with marginal success or perhaps even failure)." Kaufman divided front-end analysis into four sections:

1. Needs assessment.
2. Mission analysis.
3. Function analysis.
4. Task analysis.

The needs assessment process is a method of discrepancy analysis that compares the two polar positions of where are we now and where we really want to be (Kaufman, 1972, p. 28). To be effective, the results of the assessment must represent the discrepancy between the two poles and be stated in measurable terms. "Measurable is a key word, for it is not enough to guess or intuit either where we are or where we should be. We require hard empirical data for both polar positions of a need" (Kaufman, 1972, p. 49).

The second section of Kaufman's front-end analysis is mission analysis. This process involves constructing a precise statement detailing the outcome of a mission or job in performance terms. This statement is then analyzed to determine all of the subordinate actions that must be performed to accomplish the mission.

This step leads directly to the third section of front-end analysis. Kaufman called it function analysis. He defined functions as "things that have to be done to achieve a product or part of a total product. Functions are jobs that must be done to accomplish the mission objective" (Kaufman, 1972, p. 75). Function analysis proceeds

from the results of the mission analysis to a precise statement naming the functions that must be performed in order to solve or eliminate the discrepancy. It identifies in detail the specifications and requirements of the subordinate actions and their interrelations.

The last section of the front-end analysis process is task analysis. This involves listing each step and decision that must be undertaken to successfully perform the subordinate actions. When this has been done, "the educational planner has, for the first time, determined all the whats for successful problem solution" (Kaufman, 1972, p. 106).

Kaufman's system of front-end analysis is a detailed method for identifying all of the performance requirements in a given mission or job. The intricacy in which he describes it, however, often tends to confuse the reader, rather than to explain how the system works.

Banghart (1969), in his book, Educational Systems Analysis, explained that every type of educational system must begin with some organized method of front-end analysis. This, he said, is the most critical portion of the entire systems process. The method he advocated involves identifying the area to be analyzed, specifying all of the individual operations in the area, and isolating problems that might be evident. At this point, Banghart directed the rest of his discussion at how to use computers to complete the analysis process. Computers will not be involved in the subject of this dissertation, thereby making the latter portion of Banghart's book irrelevant to this study.

Objectives Development

The second area of literature reviewed focused on the development of objectives. In the context of a systems designed process, objectives become the force that drives the entire system. According to Mager (1962, p. 3), if clearly defined objectives are lacking, "it is impossible to evaluate a course or program efficiently, and there is no sound basis for selecting appropriate materials, content, or instructional methods." After defending the requirement for specific objectives, Mager continued by explaining the three parts each objective must contain. The first part identifies the terminal behavior or action by name. This is the performance that will be accepted as evidence that the learner has achieved the objective. The second part further defines the objective behavior by describing the important conditions under which the behavior will be expected to occur. The third and final part specifies the criteria of acceptable performance by describing how well the learner must perform to be considered acceptable.

In Taxonomy of Educational Objectives, Bloom (1956, p. 26) defined educational objectives as "explicit formulations of the ways in which students are expected to be changed by the educative process. That is, the ways in which they will change in their thinking, their feelings, and their actions." The criterion that objectives involve a change mandates that they be both observable and measurable. In this respect, Kapfer (1971, p. 24) further clarified this concept by explaining how to develop measurable and observable objectives.

> Criteria of performance may include such measures as the percent of correct responses on an examination, the number of books read, number of hours spent in a particular activity, or the grade to be achieved. And, if it is to be considered a factor in the criterion performance, time allotted to the representative task must also be specified.

Kapfer cited many advantages to using measurable objectives. Students know from the very beginning what is expected of them and can plan their studies accordingly. The guessing game about what will be on tests no longer exists. Grading is facilitated because of the specific performance criteria detailed in the objective.

Additional advantages and reasons for using measurable objectives are listed by Briggs (1970) in Handbook of Procedures for the Design of Instruction. He specifically noted that measurable objectives may:

1. Serve as a basis for certification or job placement.
2. Provide a basis for grade placement for transient students.
3. Provide a structured basis for teacher examinations.

Briggs also stated that objectives must satisfy the following six characteristics:

1. Objectives must describe what the learner will be able to do as a result of the learning experience.
2. Objectives must explicitly state the essential characteristics of the desired behavior.
3. Objectives must specify the conditions under which the learner will perform the behavior.
4. The required behavior must be within the ability level and the development level of the learner.

5. The behavior must be observable.

6. The behavior must be able to be evaluated.

Competency Testing

The next area reviewed was the construction of tests. Tests become the tools for measuring student achievement of the objective. Additionally, tests provide the student with reinforcement and feedback as to his ability to perform the desired behavior. This concept of reinforcement is founded in the theories of B. F. Skinner. In The Technology of Teaching, Skinner (1968, p. 64) said that "teaching is the arrangement of contingencies of reinforcement under which students learn."

Instruction based on performance objectives reinforces learning through the use of competency tests. The possible results of competency tests are competent or not-yet-competent. As a student completes a competency test, he is informed immediately if he has performed satisfactorily. If he has not, he is directed to continue working until he masters the objective. This concept is further emphasized by Block (1971) in Mastery Learning. The process of mastery learning is based on the proposition that "all or almost all students can master what they are taught"(Block, 1971, p. 3). Mastery is defined in terms of a specific set of major objectives describing behaviors the student is expected to exhibit at a subject's completion. The subject is then broken into a number of smaller learning units, each with an objective defining mastery at that level. Mastery of the smaller objectives is essential for achieving mastery of the major objective. Testing

of the smaller objectives provides continuous feedback to both instructor and student as to the latter's ability to achieve the objective.

In order for this last statement to hold true, the tests and the objectives must match. Objectives are stated at the beginning of class to describe intended student outcomes. According to Mager (1973), tests are used at the end of class to measure each student's success at achieving the intended outcomes. Tests must match the stated objectives in the required performance, conditions, and criteria for competency. When they do not, the tests should be changed.

Sequencing Instruction

Mager and Pipe (1976) further defined the relationship between objectives and tests in their Criterion-referenced Instruction course. The course begins with instructional modules explaining how to state and analyze learning outcomes in terms that depict performances. The results of these analyses are then sequenced graphically in a hierarchical order based on their learning prerequisites. That is to say, before a student can be taught "X" skill, he must first be taught "Y" skill. The final steps in the Criterion-referenced Instruction method are to develop performance objectives for the stated learning outcomes and construct competency tests for each objective. Objectives must be both observable and measurable, and must contain an action stating what the desired behavior is, the conditions under which it is to be performed, and a set of criteria describing how well it must be accomplished to achieve competency. The major limitations of Criterion-referenced Instruction as a comprehensive systems analysis training

course are that it fails to teach instructional delivery systems and media determination.

The final instructional system reviewed was the five-volume Interservice Procedures for Instructional Systems Development (TRADOC PAM 350-30). The system, developed by Florida State University for the Army in 1975, is a five-phase process for the development of training. The five phases are analysis, design, development, implementation, and evaluation and control. The analysis phase is concerned with the collection and analysis of all tasks involved in the job to be trained. Additionally, a target population description is developed detailing the characteristics of the proposed job trainees. One of the final steps in the first phase is to define the job conditions and standards for each task that is to be trained.

In phase two, the tasks analyzed in phase one are pyramided (Mager and Pipe, 1976) based on their prerequisite skills and knowledges. Complete performance objectives are then developed for each task. Also, test items to measure each objective are constructed. The final step in the design process is to sequence the objectives into a course map.

Phase three begins with the selection of instructional methodologies for each of the developed objectives. The training material is written and validated to ensure that it teaches what it was designed to teach. Revisions are made as they are needed.

The implementation phase, phase four, places the instructional material into the classroom. Additionally, instructors are taught how to conduct training using the Instructional Systems Development process.

Phase five provides the drive for the entire system. Information is collected and documented about student performance in the course as well as on the job. These continuous evaluations not only provide data for revisions but serve as the quality control for the entire system.

The existing requirement for military training to be developed using a systems approach was the paramount factor for consideration during this review of literature. Although many methods of systems analysis and design were reviewed, TRADOC PAM 350-30 most closely met the needs of the problem as stated in this study. Therefore, it served as the primary source document for this proposal. The other resources listed, however, served to bridge the gap between the people generally geared to a civilian view of education and educational practices and the people who have worked in the military educational specialist field for such a time as to become insensitive of the educational basis for much of what they do.

CHAPTER 3

PROCEDURES OF THE STUDY

Introduction

The scope of the procedures in this study involves identifying the specific problem area to be studied and performing a comprehensive analysis on it. Once this has been done, a framework will be designed for the development of a course that will solve the identified problem.

The above will be accomplished through the use of the systems analysis method approved for use in the Army by TRADOC. This method is Instructional Systems Development (TRADOC PAM 350-30). Additionally, this was the method identified in the review of literature that most closely approximated the needs of this study. In this manner, the framework for a systems course will be designed through the use of an established systematic approach to the development of training.

The following pages consist of explanations for each of the procedural steps in the Instructional Systems Development process to be adhered to in this study.

Analysis Phase

Step 1

Step 1 involves analyzing the job or performance discrepancy to be studied. As stated in the introduction, the first procedure to be accomplished is to identify the problem area. This task will be done

using interview techniques described by Mager and Pipe (1970) and TRADOC PAM 350-30.

Once identified, an analysis of the job discrepancy will be conducted. A comprehensive list of all tasks that must be performed in the job area will be compiled through use of the following technique:

1. Review all literature related to the job area and assess its comprehensiveness and currentness.
2. Conduct a task observation of the actual job being performed.
3. Survey personnel working in the field to identify possible solutions as well as additional aspects of the discrepancy.
4. Conduct a subject-matter expert (SME) interview to determine the tasks involved in performing the job correctly.

The completed task list will provide valuable information in four specific areas (Davis, Alexander, and Yelon, 1974). The first two ensure that all essential material will be taught and at the same time that no unnecessary information will be included in the course. The other two areas deal with the methods to be used, or how to go about teaching the tasks. In this respect, the task list will help to identify the types of learning involved and the order in which to teach sub-tasks and concepts. One of the most important factors in deciding how to teach something is the type of learning involved. According to Garry and Kingsley (1946) different types of learning require different approaches to teaching. Furthermore, within any given task, there may be several different types of learning. The task list will help to identify these types so that they may be taught in the most effective manner.

The last procedure to be accomplished in step 1 will be to analyze the flow of actions and decisions involved in learning and performing the identified tasks. These analyses may take either the form of a flow diagram or a task detailing. Those areas that cannot be task analyzed will be evaluated using the process of goal analysis of Mager and Pipe (1976).

Step 2

Step 2 involves deciding which of the tasks identified must actually be taught. The first consideration in this step is to develop a comprehensive description of the proposed target population (Mager and Pipe, 1976). This description must include all pertinent characteristics and abilities. These, in turn, will constitute the starting point of the course.

Each task will then be evaluated on the basis of

1. the competencies of the target population,
2. the consequences of poor or nonperformance,
3. the learning difficulty of the task in terms of the time required to learn to perform the task competently,
4. the percentage of contractors who are required to perform the task,
5. how often the task must be performed on the job, and
6. the criticality of the task in terms of the final product.

The results of this evaluation will then be used to determine which of the tasks should be selected for training. There are reasons why every task should not be included in the course. The consolidated task list

prepared in the analysis phase of the development details the full dimensions of the job, including all of its variations caused by the mission and by geographical, procedural, and environmental conditions. It would be wasteful in terms of time, personnel, money, and other resources to provide the instruction required to train each student to perform every task of a particular job. On the other hand, some tasks are highly critical to successful job performance, and the complex nature of the tasks makes training imperative. The purpose of this selection process is to ensure that some form of instruction will be provided for all of the critical tasks and that instructional resources will not be wasted on the unimportant ones (Training Development Institute, 1979).

Step 3

Step 3 involves the development of the performance standards for each of the tasks selected for training. Before this can be done, reviews should be conducted of the subject matter expert interview and the analysis of each task. These should provide specific input as to how well each task must be performed in order for a student to be certified as competent in that area (Dillman and Rahmlow, 1972). The standards should provide objective criteria for judging the adequacy of the student's performance. They should leave no room for subjective opinions. The particular standards chosen will depend upon the nature of the task behavior. Some of the most widely used types of standards are:

1. If a number of errors are important, state the number.

2. If mere occurrence of the behavior is sufficient, describe the behavior.
3. If accuracy is important, provide acceptable ranges or deviations.
4. If time or speed is critical, state the minimal levels.
5. If a known reference provides the standards, list the reference (Davis et al., 1974).

Step 4

Step 4 consists of reviewing the course offerings of the three Arizona state universities to assess if and how they are providing the instruction in the area of the identified discrepancy. All pertinent materials and courses will be analyzed for their relevancy and adaptability.

This step will be accomplished by reviewing university catalogs, conducting staff interviews, and analyzing all course areas identified as relevant.

Design Phase

Step 1

In the design phase of the procedure, the first step that must be accomplished is to determine and list the skills and knowledges required to perform each task. This can best be done by analyzing every step in each task in terms of what the student must know and be capable of doing in order to competently perform that step (Espich and Williams, 1967). The required skills and knowledges will then be used

to construct objective pyramids. This is a technique developed by Mager and Pipe (1976) in their Criterion-referenced Instruction course that graphically displays the relationships that exist among the identified skills and knowledges. Pyramids provide the means for visually describing and clarifying relationships that otherwise might be somewhat obscure and possibly overlooked. Additionally, they provide input as to the sequence of instruction. The order in which tasks and subtasks are taught will depend on their hierarchical relationships.

Step 2

This is one of the most important parts of the study, as it concerns developing the objectives on which the training course will be based. To effectively accomplish this step, a thorough knowledge and understanding of behavioral, or performance, objectives is required. According to Mager (1962), each objective must contain the following three parts:

1. Action. States what the student will be able to do when the instruction has been completed.
2. Standards. State how well the action must be performed in order for the student to be certified as competent.
3. Conditions. State the conditions under which the student must perform the action, for example, from memory, at night, and with no peer assistance.

Additionally, each objective must be:

1. Measurable. Each objective must be written in terms that include standards that can be evaluated to determine the competency of the student.
2. Observable. This criterion requires that each objective be discernible to at least one of the senses of the evaluator.
3. Realistic. Every objective must be relevant to the overall job being taught.
4. Attainable. Objectives must be written so that they can be achieved by the students. This characteristic concerns the abilities of the target population.

Each objective will be written describing an intended outcome of instruction, not the process of instruction. The objectives developed will provide a sound foundation for selecting and designing instructional content and procedures, for evaluating or assessing the success of the instruction, and for organizing the students' efforts and activities for the accomplishment of the important instructional intents. "In short, if you know where you are going, you have a better chance of getting there" (Mager, 1962).

Once the objectives have been developed for each of the levels identified in the objectives pyramids, they should be consolidated into terminal objectives. According to Kapfer (1971), terminal objectives provide additional flexibility for designing the instructional system as well as for identifying and describing the terminal behaviors for each task in objective terminology.

Step 3

Although step 3 is critical to the overall course design, it is a relatively simple action. All of the methods of testing used in Instructional Systems Development are criterion referenced and competency based. Therefore, test construction in this step will simply involve changing each objective into a directive. In other words, the test will direct the student to perform the action of the objective within the standards specified and under the conditions stated (Glaser, 1967).

The follow-up procedure to this process involves comparing objectives with tests to ensure that they match. If there are inconsistencies, revisions should be made to the tests, not to the objectives (Popham, 1973).

Step 4

Once the criterion tests have been developed, any special tests that are to be used must be constructed. These will include pretests, posttests, entry-level tests, and prerequisite tests. Before beginning this phase of development, however, it is essential that a thorough review of both the abilities of the target population and the tasks discussed with the subject matter expert be conducted.

The method for designing prerequisites and entry-level tests discussed by Mager and Pipe (1976) defines prerequisites as those skills students must already possess before they can begin a course. Entry level is defined as the level in a given course at which a student can begin to work based on his background and current abilities.

Entry-level tests provide valuable information to an instructor concerning the previous training experiences of students (Silvern, 1972).

Testing before and after training are essential tools to evaluate the gain in performance abilities of students completing a course. They can and, in fact, should be the same test. Based on criterion-referenced theory, they test the action portions of the terminal objectives for the course. Any references or materials the student will be allowed to use in the posttest should also be provided in the pretest environment. The conditions and standards for testing should be the same for both tests (Butler, 1972).

Necessary revisions because of inconsistencies between tests and objectives should be made to the tests, not the objectives.

Step 5

The last step in the design phase of the course development procedure concerns sequencing instruction. To accomplish this, there are four critical factors that must be considered (TRADOC PAM 350-30). The following is a brief explanation of each of these factors:

1. Select training site. The decision as to where all or parts of the instruction will be conducted will dictate certain constraints to the sequencing of the course.
2. Select media. The availability and unique requirements of the media selected for use in the course must be considered in this step.

3. List facility constraints. This consideration includes the availability, capabilities, and characteristics of the facilities to be used for the course.
4. List equipment constraints. The equipment referred to in this factor pertains to any actual materiel that the student will have to use in his performance of the objectives.

These factors will all serve as guides and limitations in the actual sequencing of the objectives for the course. Once sequencing has been accomplished, the remaining step in the procedure is to design and construct the course map. This will visually display the manner in which a student will progress through the course as well as identify the prerequisite units for each block of instruction (Mager and Pipe, 1976).

CHAPTER 4

RESULTS

As stated earlier, the product of this study is a framework for the development of an Instructional Systems Development course for contractors who work with the Army. In accordance with Mager and Pipe's (1976) Criterion Referenced Instruction and TRADOC PAM 350-30, Interservice Procedures for Instructional Systems Development, this framework must include a complete listing of tasks that have been analyzed, skills pyramids, performance objectives, and competency tests for each objective.

The framework presented in this chapter meets all of the aforementioned requirements. The needs assessment was based primarily on the subject matter expert (SME) interview conducted with Mr. Gary Ketchie. As Chief of the New Systems Branch, Directorate of Training Developments for the Army Intelligence Center and School, Mr. Ketchie had daily contact with the civilian contractors discussed in this study. His assessment of the existing discrepancy between contractor requirements and contractor performance is considered to be extremely current. The results of this needs assessment were compiled into a complete master task list identifying twelve tasks a contractor would be required to perform in order to use the Instructional Systems Development model (TRADOC PAM 350-30). The tasks were then analyzed using the flow-charting method of Mager and Pipe (1976). This method

of analyzing tasks breaks each task down sequentially. Every action and decision that must be accomplished in the performance of the task were identified. Each action and decision was then analyzed to determine the skills and knowledges that would be required for its successful performance. Skills are defined as "hands-on" types of activities, and knowledges as the mental back-ups that allow the skills to be done correctly (Mager and Pipe, 1976). The final step in the analysis procedure was to write each knowledge in action terms. This was done in order to both observe and measure the knowledge. The skills and rewritten knowledges, labeled "sub-tasks" by Mager and Pipe (1976), are all of the actions that must be performed to accomplish the major task.

The sub-tasks were next placed in subordinate skills pyramids. This technique, developed by Mager and Pipe (1976) in their Criterion-referenced Instruction course, uses diagrams to visually display hierarchical relationships. Read from bottom to top, pyramids identify which sub-tasks must be mastered in order to learn the next higher one. This subordination diagram additionally provides information for sequencing the instruction.

The next step in the study was to develop complete performance objectives for the higher level sub-tasks of each pyramid and terminal objectives for each of the twelve major tasks. This was done in accordance with the criteria reviewed in Mager's (1962) book Preparing Instructional Objectives. Once the objectives were written, competency tests were constructed to match each objective in action, conditions, and standards (Mager, 1973).

The final procedure was to sequence all major tasks in the order in which they should be taught. This was done through development of a course map.

Analysis of Tasks

This section begins with the master course map (Figure 1) for the twelve major tasks. Read from bottom to top, the map depicts how a student would progress through the course. Arrows are used to designate any prerequisite units of instruction the student should have (Mager and Pipe, 1976). Also given is a comprehensive itemization of the sub-tasks in each major task area (Table 1).

The results of the analysis of each major task are then presented in the following format:

1. Statement of the task.
2. Task initiating cue.
3. Skills and knowledges sub-tasks list and pyramid as a figure.
4. Objectives.
5. Competency tests.

The numbering of the tasks and sub-tasks was done for identification purposes only. There is no significance to the order in which they are numbered.

Task 1. Perform Behavior Analysis

Initiating Cue. Given a requirement to develop training.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 2.

Figure 1. Master Course Map and Major Tasks List for Instructional Systems Development

Major Tasks List

1. Perform behavior analysis
2. Perform analyses procedures
3. Select tasks for training
4. Perform all procedures in developing objectives
5. Assess existing training materials
6. Design and develop all tests
7. Perform all sequencing procedures
8. Develop job aids
9. Select delivery methodologies
10. Develop course procedures and control documents
11. Write all training materials
12. Validate all training materials

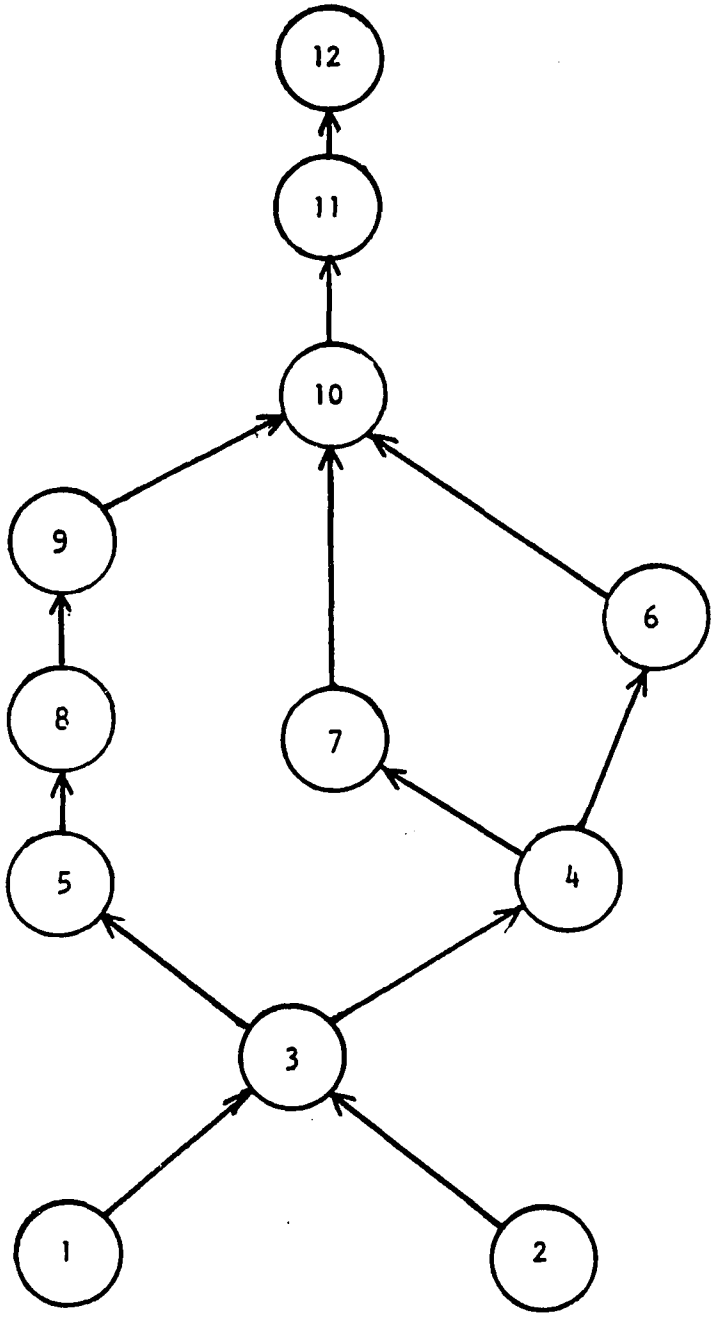

Figure 1. Master Course Map and Major Tasks List for Instructional Systems Development

Table 1. Task List

Major Tasks	Subordinate Tasks
1. Perform behavior analysis	a. Perform task observation b. Conduct document study c. Conduct subject matter expert interview d. Perform field survey
2. Perform analyses procedures	a. Select analysis procedures b. Perform goal analysis c. Perform task analysis
3. Select tasks for training	a. Develop target population description b. Use the Eight Factor ISD Task Selection Model
4. Perform all procedures in developing objectives	a. Determine knowledges b. Determine skills c. Construct skill pyramids d. Develop performance objectives
5. Assess existing training materials	a. Evaluate materials relative to objectives b. Determine validity of skill assumptions c. Compute reading levels d. Analyze illustrations
6. Design and develop all tests	a. Develop tests b. Evaluate testing methods relative to objectives.
7. Perform all sequencing procedures	a. Select training sites b. Apply ISD Media Selection Model c. Prioritize constraints d. Develop instructional maps
8. Develop job aids	a. Evaluate tasks with job aid types b. Evaluate tasks with job aid criteria c. Construct job aids d. Validate job aids

Table 1. -- Continued

Major Tasks	Subordinate Tasks
9. Select Delivery methodologies	a. Explain the following: task analysis, target population descriptions, programmed instruction, criterion referenced instruction, and information mapping b. Explain criteria for selecting methodologies
10. Develop course procedures and control documents	a. Develop administrative procedures b. Develop subject matter procedures c. Develop student procedures d. Develop instructor control documents e. Develop student control documents
11. Write training materials	a. Outline instruction b. Write instruction c. Integrate media into instruction
12. Validate all training materials	a. Conduct individual tryouts b. Conduct group tryouts c. Conduct field tryouts d. Compile tryout results e. Analyze tryout results f. Revise training materials

Figure 2. Skills and Knowledges Sub-tasks List and Pyramid for Task 1, Perform Behavior Analysis

Skills and Knowledges Sub-tasks List

1. Recall task observation procedures
2. Recall what a task observation is
3. Recall how to validate a task observation
4. Validate a task observation
5. Conduct a task observation
6. Perform a complete task observation
7. Recall how to extract tasks
8. Recall types of training materials
9. Extract tasks
10. Conduct a document study
11. Recall the basic
12. Utilize questioning techniques
13. Recall interview procedures
14. Utilize interview techniques
15. Recall assessing techniques
16. Assess SME interview input
17. Conduct a SME interview
18. Recall questionnaire development procedures
19. Develop questionnaire
20. Recall rules for administering questionnaire
21. Administer a questionnaire
22. Recall questionnaire evaluation procedures
23. Evaluate questionnaire data
24. Perform a complete field survey
25. Conduct a complete behavior analysis

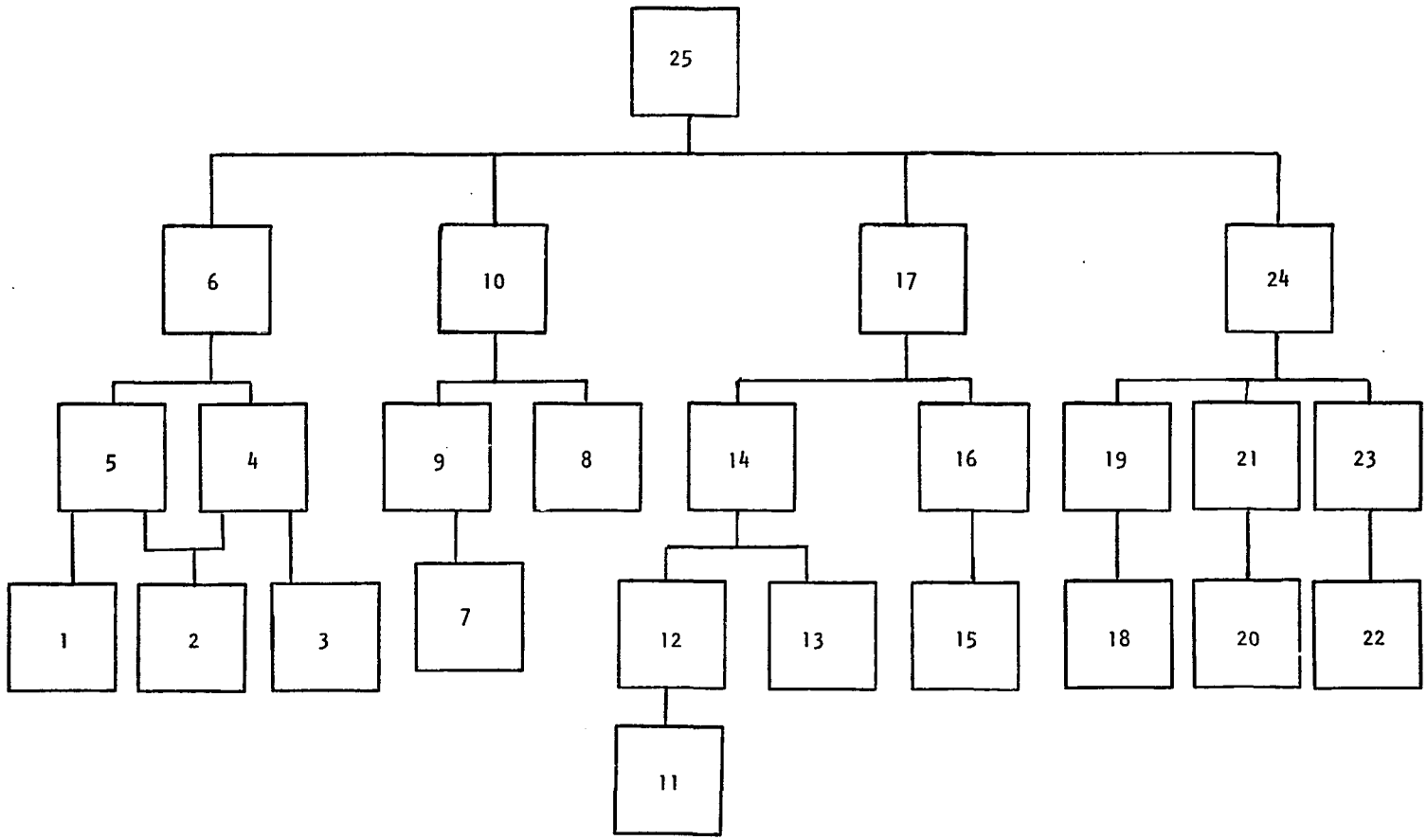

Figure 2. Skills and Knowledges Sub-tasks List and Pyramid for Task 1, Perform Behavior Analysis

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given all necessary materials, the student will be able to conduct a complete behavior analysis.
2. Subordinate Objectives. Upon completing this unit of instruction, given all necessary materials, the student will be able to:
   a. Conduct a task observation.
   b. Conduct a complete document study.
   c. Conduct a complete subject matter expert interview.
   d. Perform a complete questionnaire field survey.

Competency Tests.

1. Using the videotape provided, conduct a task observation. Prepare a task list of all steps with explanations of how they are performed when the task is accomplished.
2. Using the objectives and research documents provided, conduct a document study of all tasks necessary to accomplish the objectives.
3. Conduct a subject matter expert interview by contacting a course manager and arranging an interview on an area of his expertise. When you have completed the task, take your work back to the course manager for validation.
4. Construct a field survey questionnaire of not more than ten questions to gather data on the subject area provided. Include both open-ended and closed questions in your work.

Task 2. Perform Analyses Procedures

Initiating Cue. Behavior analysis is complete.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 3.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a statement that may require either a goal or task analysis, the student will be able to select the correct analysis procedure and complete the analysis so that it reflects all steps necessary to perform the action.
2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given a task, the student will be able to analyze the task by completely flow charting all steps.
   b. Given a goal, the student will be able to analyze the goal by listing all performances included in the goal accomplishment.
   c. Given a list of goals and tasks, the student will be able to separate the list into the two specific distinctions without error.

Competency Tests.

1. Analyze the task provided using the flow-chart format. Include all actions and decisions.
2. Analyze the goal provided using the goal analysis process. Your analysis must list all steps in performance terms.

Figure 3. Skills and Knowledges Sub-tasks List and Pyramid for Task 2, Perform Analyses Procedures

Skills and Knowledges Sub-tasks List

1. Recall what goal analysis is
2. Recall what task analysis is
3. Recall goal validation procedures
4. Recall goal analysis procedures
5. Utilize goal validation procedures
6. Recall performance terminology
7. Develop performance requirements
8. Utilize goal analysis procedures
9. Recall differences between goals and tests
10. Select appropriate analysis procedures
11. Recall task analysis procedures
12. Utilize task analysis procedures
13. Perform analysis procedures

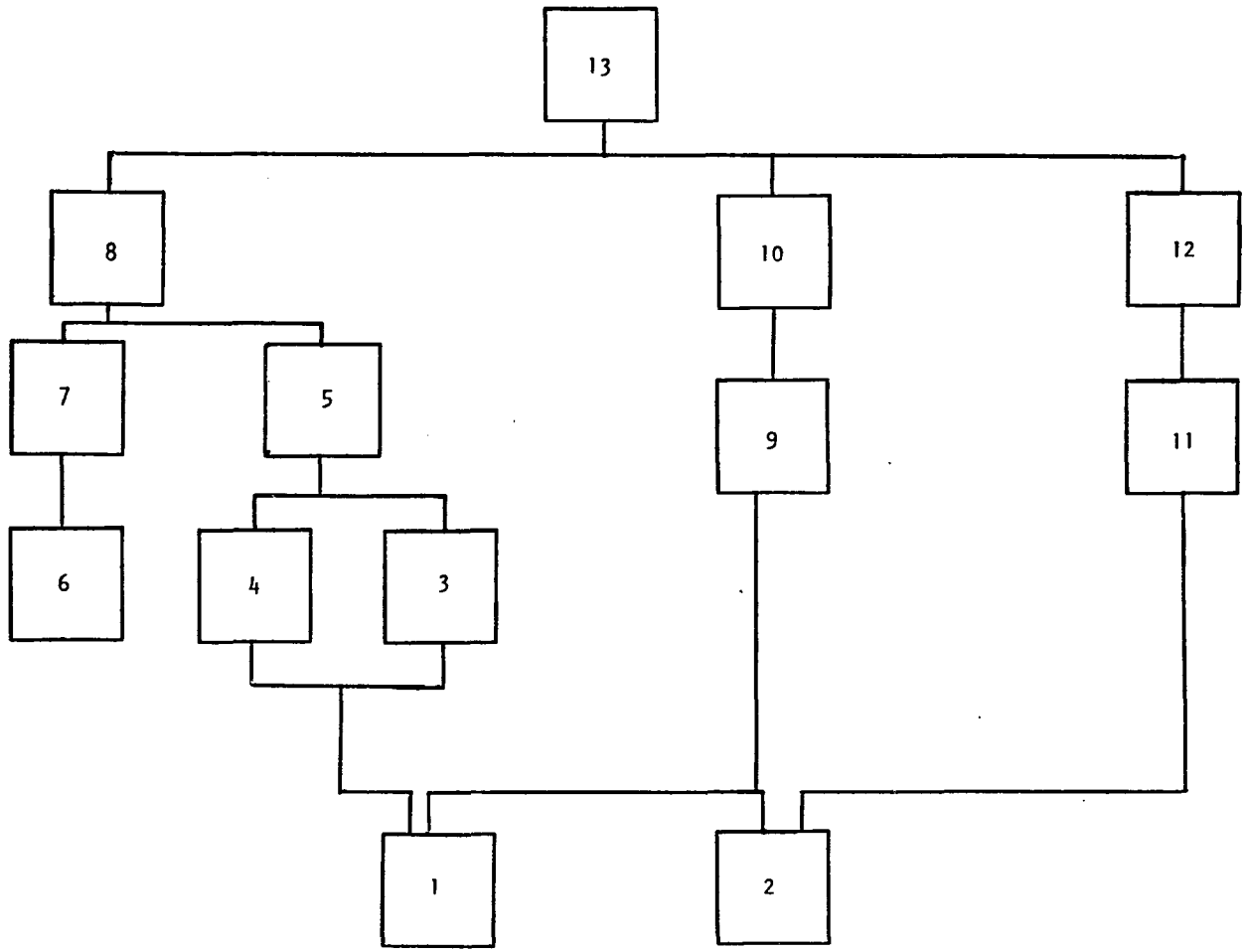

Figure 3. Skills and Knowledges Sub-tasks List and Pyramid for Task 2, Perform Analyses Procedures

3. Separate all items into the appropriate category, task or goal, using the list of tasks and goals provided.

Task 3. Select Tasks for Training

Initiating Cue. Analyzed task list has been completed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 4.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given all necessary materials and an analyzed task list, the student will be able to select the appropriate tasks for training using the Instructional Systems Development 8-factor task selection model.
2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given an analyzed task list and information about a proposed target population, the student will be able to develop a complete target population description for the task list.
   b. Given an analyzed task list, the student will be able to apply the 8-factor ISD task selection model for each task.

Competency Tests.

1. Using the target population information and task analysis provided, develop a complete target population description for the given task.

Figure 4. Skills and Knowledges Sub-tasks List and Pyramid for Task 3, Select Tasks for Training

Skills and Knowledges Sub-tasks List

1. Recall parts of the target population description
2. Recall target population development procedures
3. Develop target population descriptions
4. Recall use of ISD 8 factor task selection model
5. Utilize the ISD 8 factor task selection model
6. Select tasks for training

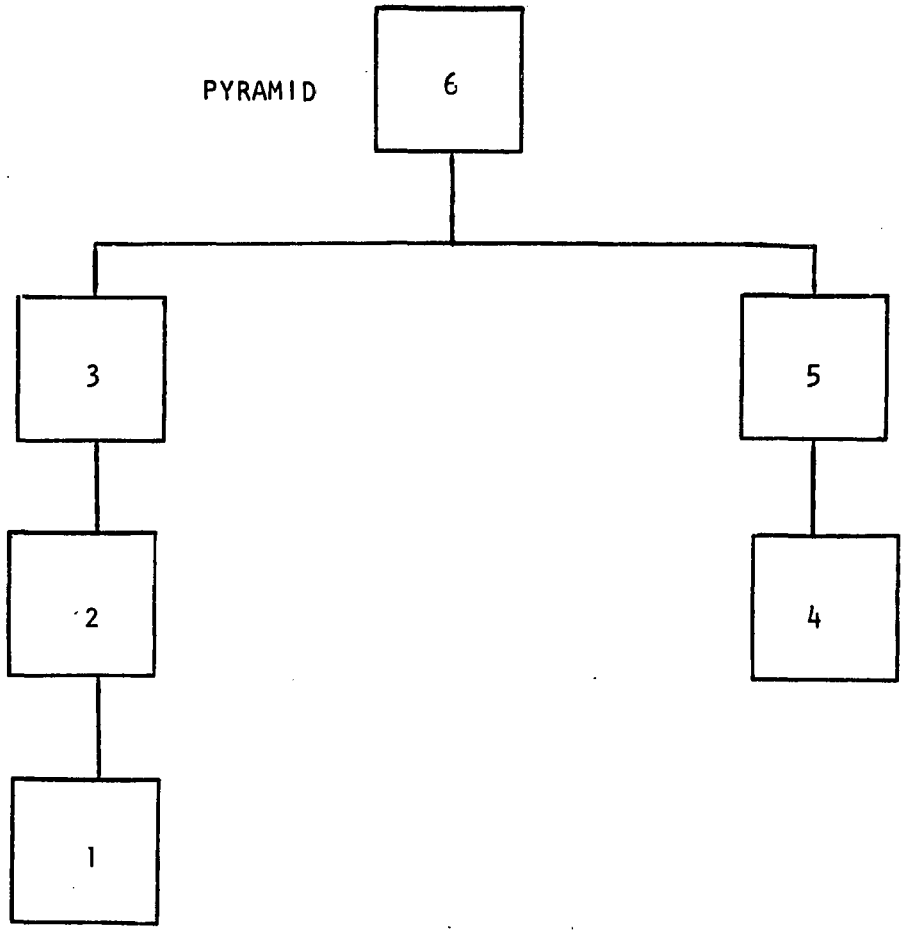

Figure 4. Skills and Knowledges Sub-tasks List and Pyramid for Task 3, Select Tasks for Training

2. Using the task analysis provided, apply the 8-factor ISD task selection model to each task and list whether or not you would select each task for training.

Task 4. Complete All Procedures to Develop Objectives

Initiating Cue. A list of tasks selected for training has been completed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 5.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a list of tasks selected for training and appropriate analyses, the student will be able to complete all required objective development procedures for each analysis. The student's final product must include for each task:
   a. A list of skills and knowledges.
   b. A skills pyramid.
   c. Terminal objective.
   d. Subordinate objectives.

2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given a task analysis, determine and list all knowledges required to perform the task.
   b. Given a task analysis, determine and list all skills required to perform the task.

Figure 5. Skills and Knowledges Sub-tasks List and Pyramid for Task 4, Perform All Procedures in Developing Objectives

Skills and Knowledges Sub-tasks List

1. Recall analyses procedures
2. Recall knowledges
3. Determine appropriate knowledges
4. Recall skills
5. Determine appropriate skills
6. Recall skill sequencing procedures
7. Apply skill sequencing procedures
8. Recall action terms
9. Recall information dealing with pyramids
10. Recall how to construct pyramids
11. Construct skill pyramids
12. Recall the characteristics of objectives
14. Recall how to develop terminal objectives
15. Develop performance objectives
16. Perform all procedures to develop objectives

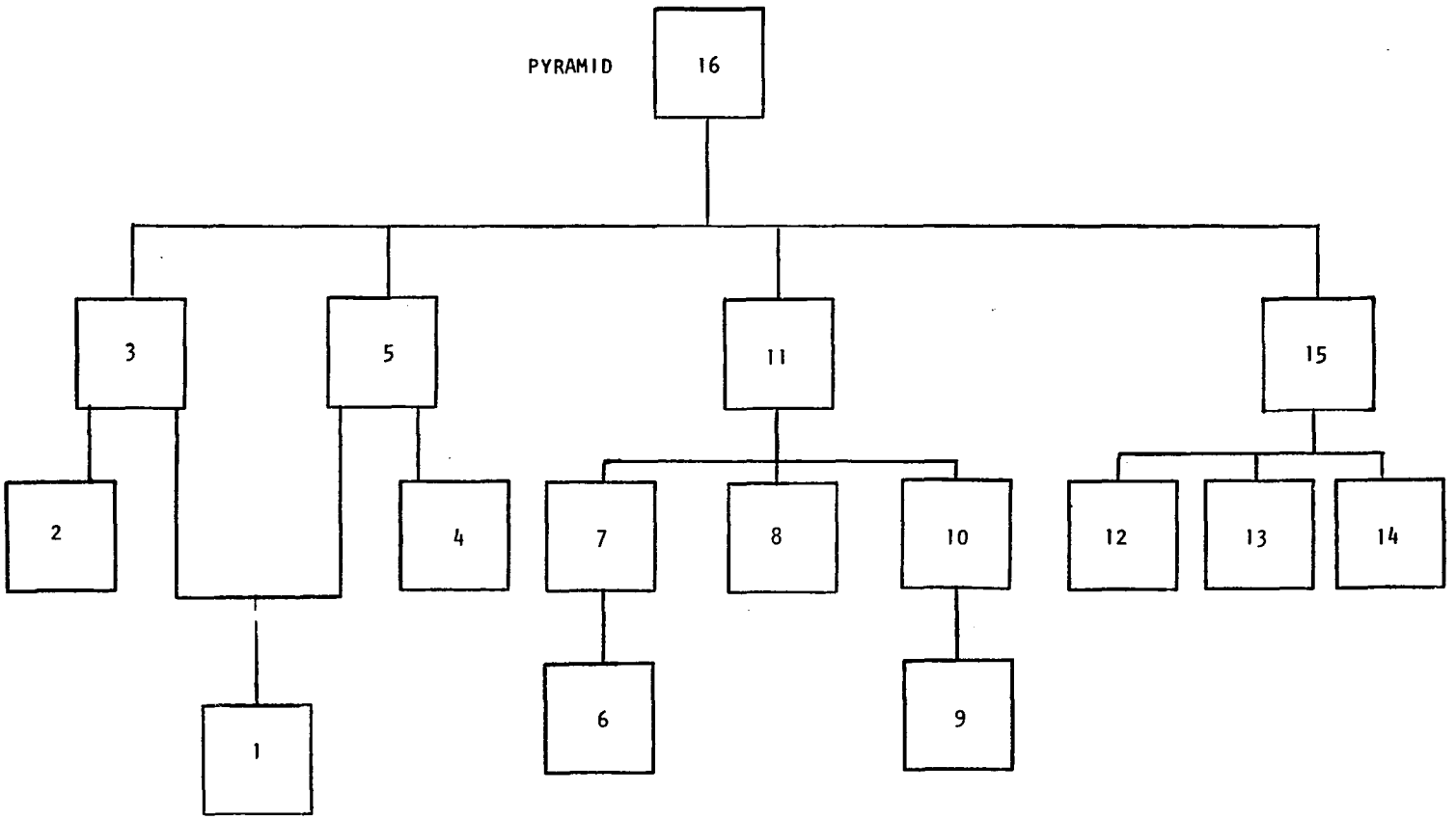

Figure 5. Skills and Knowledges Sub-tasks List and Pyramid for Task 4, Perform All Procedures in Developing Objectives

c. Given a list of skills and knowledges for a task, the student will be able to construct a skills pyramid.

d. Given a skills pyramid, construct complete performance objectives for each block in the pyramid.

Competency Tests.

1. From the task analysis provided, list all knowledges required to perform each of the steps in the task.
2. From the task analysis provided, list all skills required to perform each of the steps in the task.
3. Construct a skills pyramid for the provided list of skills and knowledges.
4. Construct complete three-part performance objectives for each block in the skills pyramid provided.

Task 5. Assess Existing Training Materials

Initiating Cue. Course objectives have been developed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 6.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given developed course objectives and all related existing training materials, the student will be able to assess the materials and select those that can be used to teach the objectives (a) as is or (b) with revisions. The student must be able to explain his choices.

Figure 6. Skills and Knowledges Sub-tasks List and Pyramid for Task 5, Assess Existing Training Materials

Skills and Knowledges Sub-tasks List

1. Recall evaluation procedures
2. Evaluate materials relative to objectives
3. Recall skill assumption procedures
4. Determine skill assumptions
5. Recall how to validate skill assumptions
6. Determine validity of skill assumptions
7. Recall how to determine reading levels
8. Determine reading levels
9. Recall revision procedures
10. Recall how to determine adequacy of illustrations
11. Determine adequacy of illustrations
12. Assess existing training materials

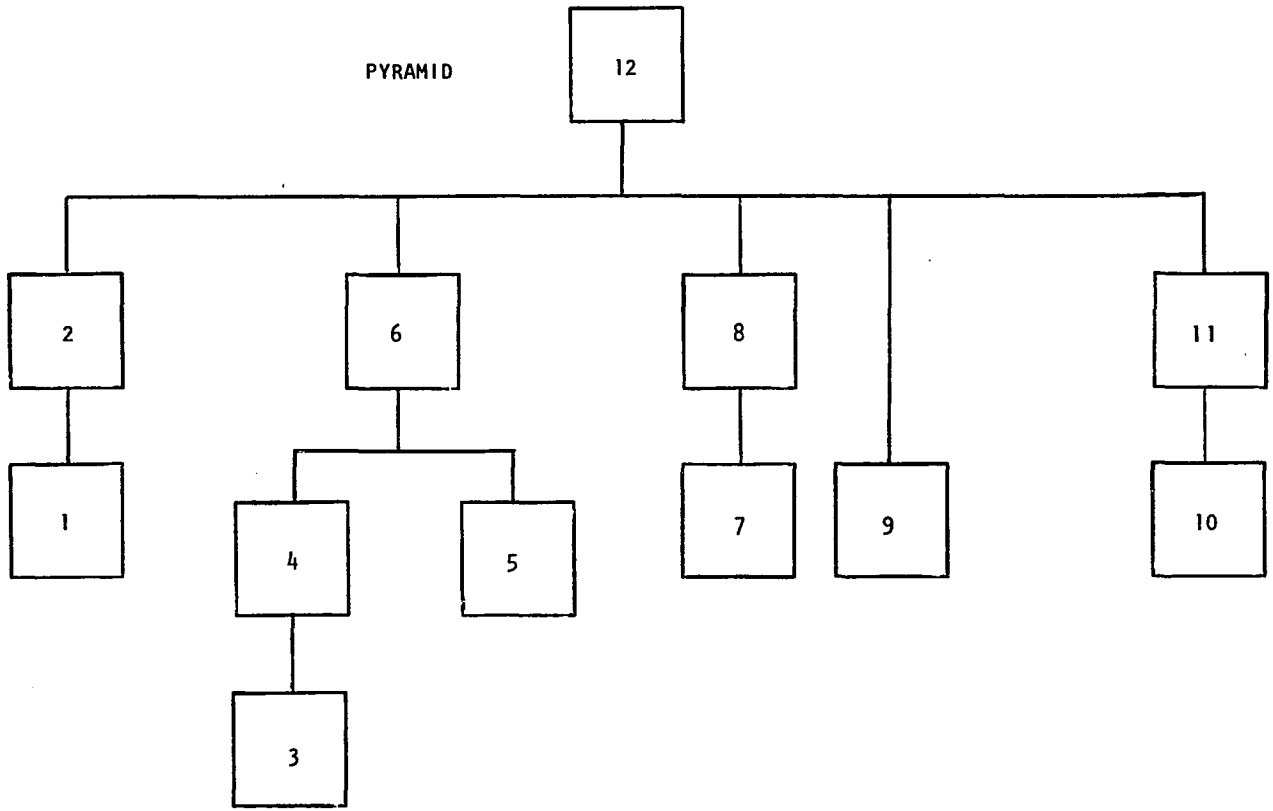

Figure 6. Skills and Knowledges Sub-tasks List and Pyramid for Task 5, Assess Existing Training Materials

2. Subordinate Objectives. Upon completing this unit of instruction,

   a. Given a performance objective and a training reference, the student will be able to evaluate the reference and categorize it as to whether it (i) teaches, (ii) partially teaches, or (iii) does not teach the subject.

   b. Given a target population description and a training reference, the student will be able to list all valid and invalid skill assumptions made by the reference in relation to the population.

   c. Given a reading-level formula and a selected reading passage, the student will be able to correctly compute the reading level of the passage.

   d. Given a performance objective, training reference, and a target population description, the student will be able to determine the adequacy of the illustrations in the reference in relation to the objective and specified population.

Competency Tests.

1. Using the performance objective and training reference provided, evaluate the reference and categorize it as to whether it (a) teaches, (b) partially teaches, or (c) does not teach the objective.

2. Using the target population description and training reference provided, list all valid and invalid skill assumptions made by

the reference in relation to the skill level of the target population.

3. Using the reading passage and any of the three reading-level formulas provided, correctly compute the reading level of the passage.
4. Using the performance objective, training reference, and target population description provided, list which illustrations in the reference are adequate and which are inadequate in relation to the objective and target population.

Test 6. Design and Develop All Tests

Initiating Cue. Performance objectives have been developed.

Skills and Knowledge Sub-tasks List and Pyramid. See Figure 7.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a list of performance objectives and approved testing methods, the student will be able to design and develop tests for each objective.
2. Subordinate Objectives. Upon completing this unit of instruction:
   a. Given a performance objective and a selected testing method, the student will be able to develop a test for the objective using the specified method.

Figure 7. Skills and Knowledges Sub-tasks List and Pyramid for Task 6, Design and Develop All Tests

Skills and Knowledges Sub-tasks List

1. Recall testing methods
2. Recall performance objectives
3. Develop tests
4. Evaluate tests relative to objectives
5. Design and develop all tests

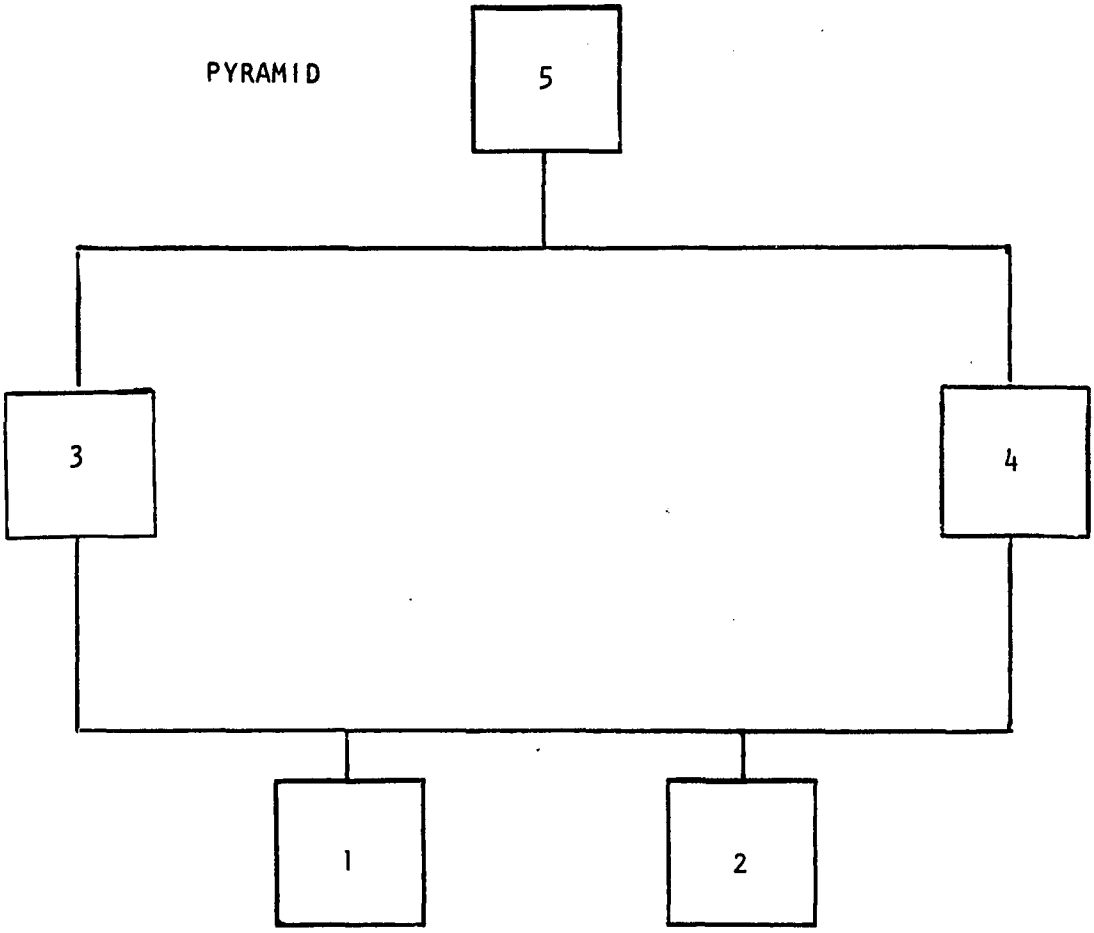

Figure 7. Skills and Knowledges Sub-tasks List and Pyramid for Task 6, Design and Develop All Tests

b. Given a list of objectives and their tests, the student will be able to evaluate the tests to determine whether they actually and completely test the objectives.

Competency Tests.

1. Using the assigned testing method, develop a test for the performance objective provided.
2. Evaluate the list of performance objectives and their corresponding tests provided to determine if the tests completely measure competencey to meet the objectives.

Task 7. Perform All Sequencing Procedures

Initiating Cue. Objectives, tests, and skill pyramids have been developed.

Skills and Knowledge Sub-tasks List and Pyramid. See Figure 8.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a set of objectives, tests, and skills pyramids, the student will be able to perform all sequencing procedures necessary to result in instructional maps and a master course map.
2. Subordinate objectives. Upon completing this unit of instruction,

Figure 8. Skills and Knowledges Sub-tasks List and Pyramid for Task 7, Perform All Sequencing Procedures

Skills and Knowledges Sub-tasks List

1. Recall site selection criteria
2. Evaluate site selection criteria
3. Recall site selection options
4. Select training sites
5. Recall use of ISD media selection model
6. Use the ISD media selection model
7. Recall types of constraints for facilities
8. Recall types of equipment constraints
9. Identify facility constraints
10. Identify equipment constraints
11. Prioritize constraints
12. Recall skills pyramids
13. Recall sequencing procedures
14. Sequence instruction
15. Recall map development procedures
16. Develop instructional maps
17. Perform all sequencing procedures

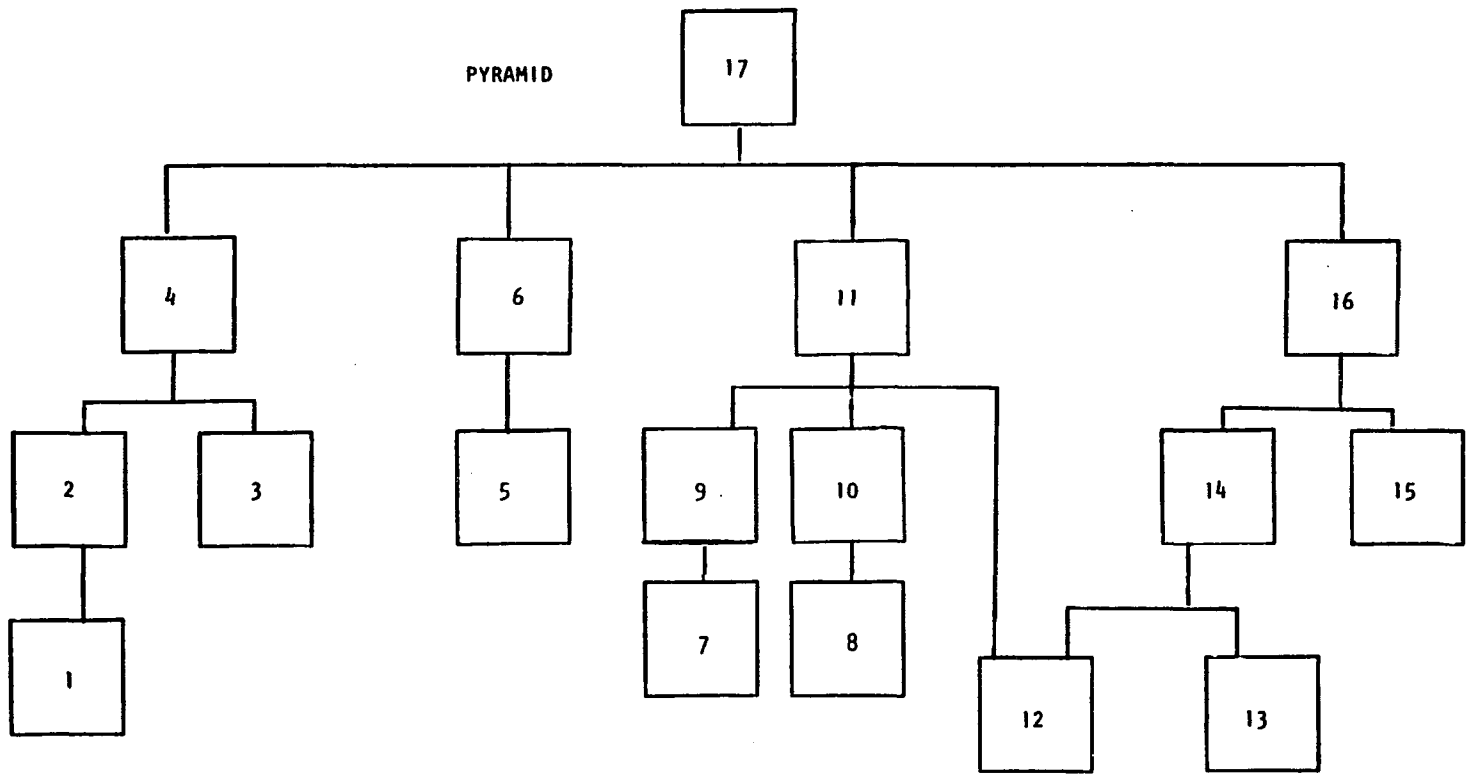

Figure 8. Skills and Knowledges Sub-tasks List and Pyramid for Task 7, Perform All Sequencing Procedures

a. Given all necessary materials, the student will be able to evaluate applicable criteria and select appropriate training sites for each objective provided.

b. Given an objective and all necessary data, the student will be able to apply the ISD media selection model and select the correct media for use in training to meet the objective.

c. Given a list of objectives with selected training sites and selected media, the student will be able to identify and prioritize all instructional constraints.

d. Given a set of objectives, skills pyramids, and instructional constraints, the student will be able to develop an instructional map for all of the objectives.

Competency Tests.

1. For the objectives provided, evaluate all required criteria and select the appropriate training sites.
2. Apply the ISD media selection model to the objectives and information provided and list the media selected for use in training the objectives.
3. Identify and prioritize all instructional constraints that must be considered before sequencing the objectives and information provided.
4. Develop an instructional map for the objectives and information provided.

Task 8. Develop Job Aids

Initiating Cue. Analysis and design phases have been completed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 9.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a task analysis, target population description, objective, and test, the student will be able to develop an appropriate job aid for the task. The student must then be able to validate the aid and explain his results to a course manager.
2. Subordinate Objectives. Upon completing this unit of instruction:
   a. Given a job aid and all required materials, the students will be able to validate the aid.
   b. Given three tasks, the student will be able to construct the following job aids:

      First task . . . . . cookbook

      Second task . . . . . algorithm

      Third task . . . . . decision table

   c. Given a set of tasks with all required data, the student will be able to evaluate each task and list which of the three types of job aids would be the most appropriate for it.
   d. Given a set of tasks with all required data, the student will be able to evaluate each against the criteria for job

Figure 9. Skills and Knowledges Sub-tasks List and Pyramid for Task 8, Develop Job Aids

Skills and Knowledges Sub-tasks List

1. Recall job aid construction procedures
2. Construct job aids
3. Recall types of job aids
4. Evaluate tasks with types of job aids
5. Recall task analysis procedures
6. Evaluate tasks with job aid criteria
7. Recall job aid criteria
8. Recall job aids validation procedures
9. Validate job aids
10. Develop job aids

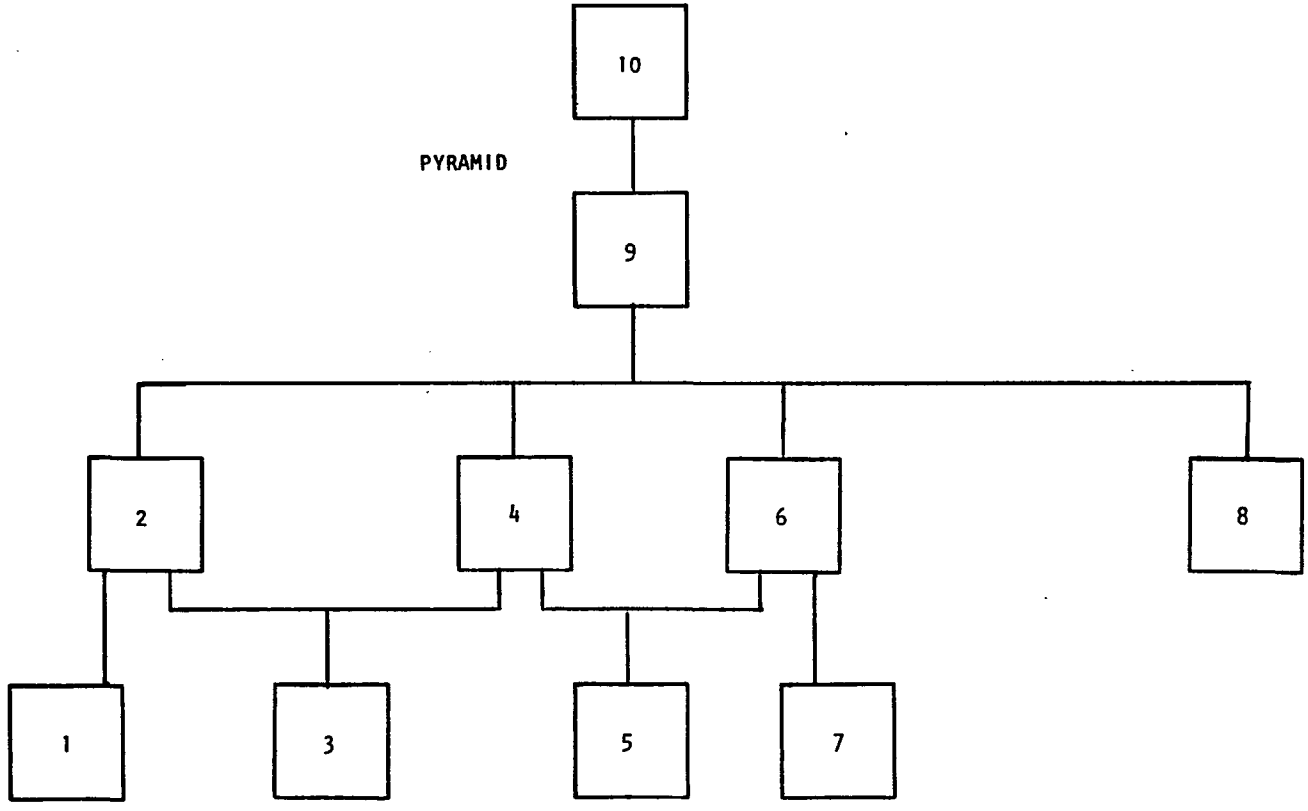

Figure 9. Skills and Knowledges Sub-tasks List and Pyramid for Task 8, Develop Job Aids

aiding and list which of the tasks should be job aided and which should not.

Competency Tests.

1. Using the job aid provided, validate the job aid.
2. For the three tasks listed, construct the following job aids:

   First task . . . . . cookbook

   Second task . . . . . algorithm

   Third task . . . . . decision table
3. Using the set of tasks and data provided, evaluate each task in terms of which of the three types of job aids would be the most appropriate for each.
4. Using the set of tasks and data provided, evaluate each task in terms of which of the three types of job aids would be the most appropriate for each.
5. Use the set of tasks and data to evaluate each task against the criteria for job aiding and then list which of the tasks should be job aided and which should not.

Task 9. Select Delivery Methodologies

Initiating Cue. Analysis and design have been completed and instruction has been sequenced.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 10.

Figure 10. Skills and Knowledges Sub-tasks List and Pyramid for Task 9, Select Delivery Methodologies

Skills and Knowledges Sub-tasks List

1. Recall task analysis procedures
2. Recall target population description procedures
3. Recall four programmed instruction methodologies
4. Recall Criterion-referenced Instruction method
5. Recall Information Mapping method
6. Recall methodology selection criteria
7. Select appropriate delivery methodology

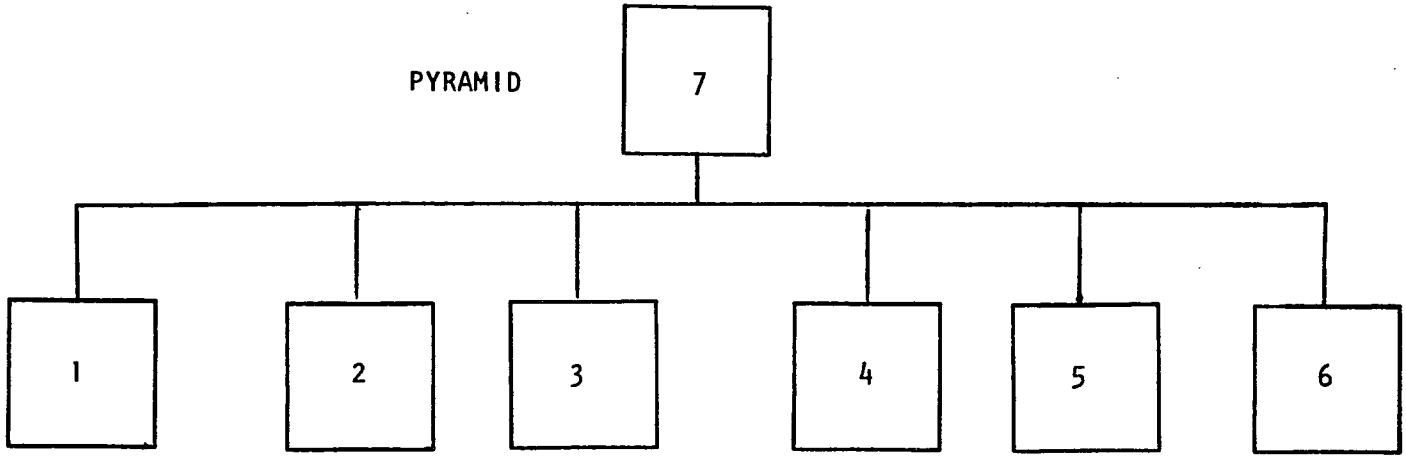

Figure 10. Skills and Knowledges Sub-tasks List and Pyramid for Task 9, Select Delivery Methodologies

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a task and all required data, the student will be able to select the appropriate delivery methodology for the task.
2. Subordinate Objectives. Upon completing this unit of instruction, the student will be able to
   a. Define and explain the following terms:
      (1) Task analysis.
      (2) Target population description.
      (3) Programmed instruction:
         (a) Linear text
         (b) Branching text
         (c) Adjunct text
         (d) Discrimination text
      (4) Criterion-referenced Instruction
      (5) Information mapping
   b. Explain the criteria for methodology selection.

Competency Tests.

1. In the space provided, define and explain the following:
   a. Task analysis.
   b. Target population description.
   c. Programmed instruction:
      1. Linear
      2. Adjunct
      3. Discrimination
      4. Branching

2. In the space provided, explain the criteria for methodology selection.
3. Using the task and data provided, select the appropriate delivery methodology for the task.

Task 10. Develop Course Procedures and Control Documents

Initiating Cues. Phases I and II are complete and methods have been selected.

Knowledges and Skills Sub-tasks List and Pyramid. See Figure 11.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a course outline and all required materials, the student will be able to develop all necessary course procedures and control documents.
2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given a course outline and all required materials, the student will be able to
      (1) Develop all necessary administrative procedures, to include analyzing constraints and making appropriate procedural changes.
      (2) Develop all necessary subject matter procedures, to include analyzing constraints and making appropriate procedural changes.

Figure 11. Skills and Knowledges Sub-tasks List and Pyramid for Task 10, Develop Course Procedures and Control Documents

Skills and Knowledges Sub-tasks List

1. Recall Phases I and II
2. Determine student requirements
3. Recall constraint identification procedures
4. Recall administrative procedures
5. Analyze administrative constraints
6. Develop administrative procedures
7. Recall subject matter procedures
8. Analyze subject matter constraints
9. Develop subject matter procedures
10. Analyze student constraints
11. Recall student procedures
12. Develop student procedures
13. Recall types of control documents
14. Recall document development procedures
15. Develop instructor control documents
16. Develop student control documents
17. Develop course procedures and control documents

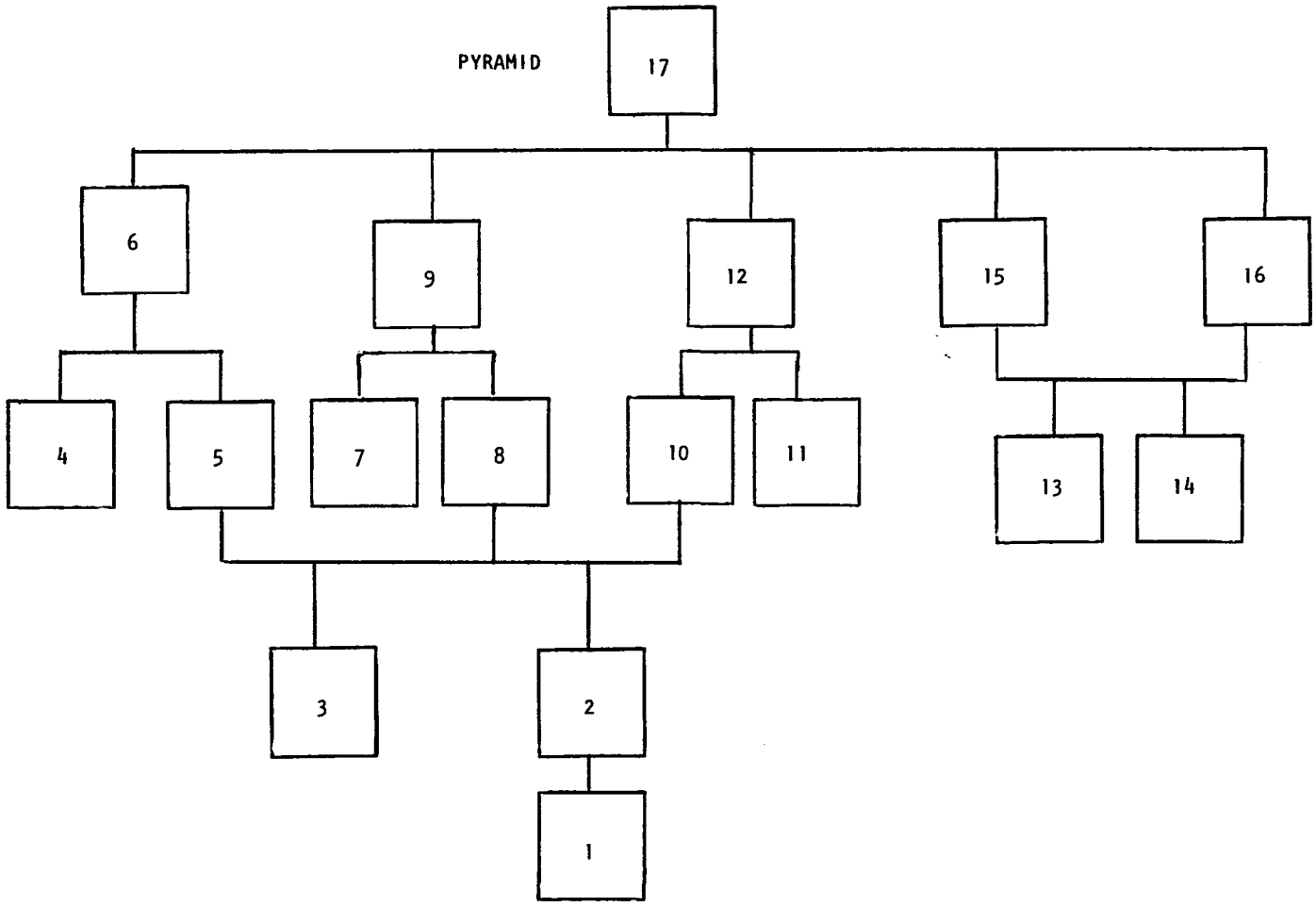

Figure 11. Skills and Knowledges Sub-tasks List and Pyramid for Task 10, Develop Course Procedures and Control Documents

(3) Develop all necessary student procedures, to include analyzing constraints and making appropriate procedural changes.

b. Given a course outline, developed procedures, and all necessary materials, the student will be able to

(1) Develop all required instructor course control documents.

(2) Develop all required student course control documents.

Competency Tests. Using the course outline and materials provided, develop

1. All necessary administrative procedures for the course, to include analyzing constraints and making appropriate procedural changes.
2. All necessary subject matter procedures for the course, to include analyzing constraints and making appropriate procedural changes.
3. All necessary student procedures for the course, to include analyzing constraints and making appropriate procedural changes.
4. All required instructor control documents.
5. All required student control documents.

Task 11. Write All Training Materials

Initiating Cue. Phases I and II have been completed and all course documents have been developed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 12.

Objectives.

1. Terminal Objectives. Upon completing this unit of instruction, given all necessary documents and data, the student will be able to write all training materials in the selected formats for the selected methodologies.
2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given a unit of written instruction, a selected media list, and all other necessary materials, the student will be able to integrate the media into the instruction.
   b. Given an outline, selected methodology, and all necessary materials, the student will be able to write the specified unit of instruction.
   c. Given all necessary materials for a unit of instruction, the student will be able to outline all requirements for that unit.

Competency Tests.

1. Using the instructional materials and media list provided, integrate the media into the instruction.
2. Using the outline, methodology, and materials provided, write the instruction for the unit specified.
3. Using the materials provided, outline all requirements for the specified unit of instruction.

Figure 12. Skills and Knowledges Sub-tasks List and Pyramid for Task 11, Write All Training Materials

Skills and Knowledges Sub-tasks List

1. Recall instructional formats
2. Recall methodologies
3. Recall media uses
4. Recall Phase I processes
5. Recall Phase II processes
6. Outline instruction
7. Write instruction
8. Integrate media with instruction
9. Write all training materials

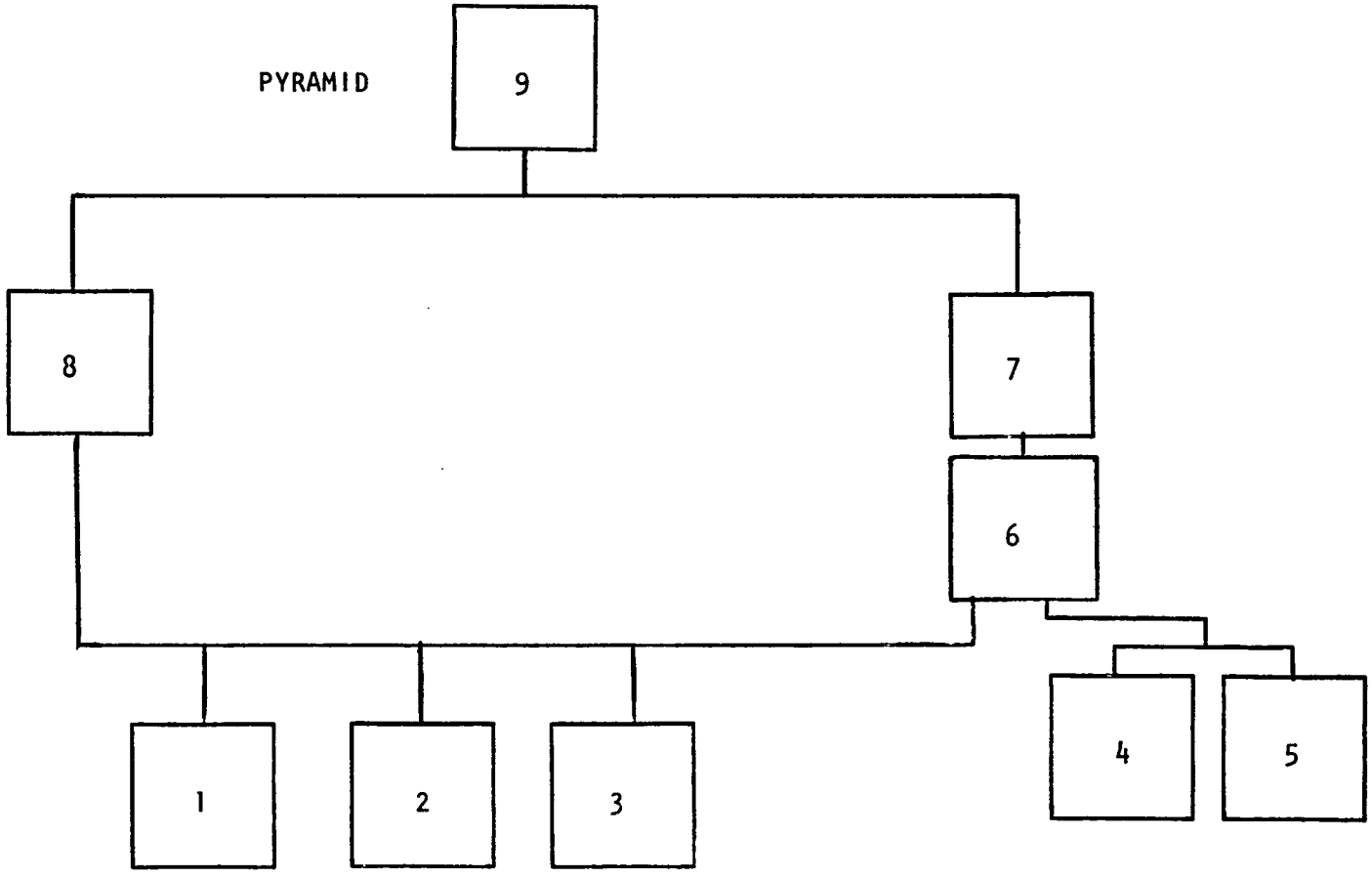

Figure 12. Skills and Knowledges Sub-tasks List and Pyramid for Task 11, Write All Training Materials

Task 12. Validate All Training Materials

Initiating Cue. All materials have been developed.

Skills and Knowledges Sub-tasks List and Pyramid. See Figure 13.

Objectives.

1. Terminal Objective. Upon completing this unit of instruction, given a set of training materials, the student will be able to validate all materials.
2. Subordinate Objectives. Upon completing this unit of instruction,
   a. Given a set of training materials, the student will be able to conduct an individual tryout validation on the materials.
   b. Given a set of training materials, the student will be able to conduct a group tryout validation on the materials.
   c. Given a set of training materials, the student will be able to conduct a field tryout validation on the materials.
   d. Given a set of training materials and tryout results, the student will be able to compile and analyze the results and then make the necessary revisions to the materials.

Competency Tests.

1. For the set of training materials provided, conduct:
   a. An individual tryout.
   b. A group tryout.
   c. A field tryout.

Figure 13. Skills and Knowledges Sub-tasks List and Pyramid for Task 12, Validate All Training Materials

Skills and Knowledges Sub-tasks List

1. Recall methodologies
2. Recall individual tryout procedures
3. Conduct individual tryouts
4. Recall group tryout procedures
5. Conduct group tryouts
6. Recall field tryout procedures
7. Conduct field tryouts
8. Recall validation procedures
9. Recall terminology procedures
10. Recall sequencing rules
11. Recall levels of difficulty
12. Recall pretest and posttest procedures procedures
13. Compile validation results
14. Analyze validation results
15. Revise training materials
16. Validate all training materials

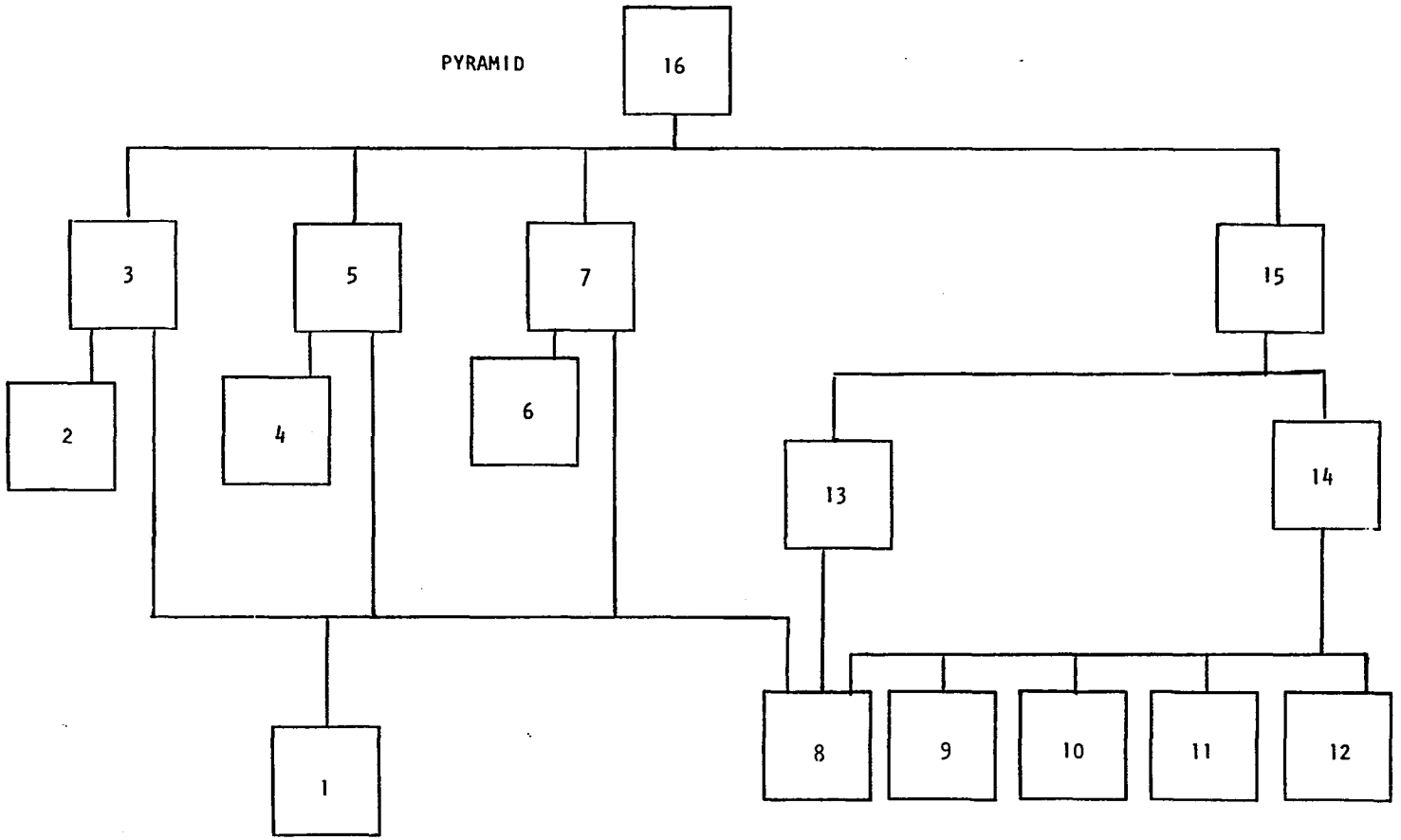

Figure 13. Skills and Knowledges Sub-tasks List and Pyramid for Task 12, Validate All Training Materials

2. For the set of training materials and tryout results provided:
    a. Compile the results.
    b. Analyze the results.
    c. Revise the materials as required.

Review of Results

The results presented in this chapter are the analysis of each of the twelve major tasks identified in the needs assessment.

1. Perform behavior analysis.
2. Perform analyses procedures.
3. Select tasks for training.
4. Perform all procedures in developing objectives.
5. Assess existing training materials.
6. Design and develop all tests.
7. Perform all sequencing procedures.
8. Develop job aids.
9. Select delivery methodologies.
10. Develop course procedures and control documents.
11. Write all training materials.
12. Validate all training materials.

These twelve tasks, along with the results of their analyses, form the framework for the development of an Instructional Systems Development course.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

As stated previously, the purposes of this study were the following:

1. To identify and address the need for training new systems contractors employed by the U.S. Army Intelligence Center and School in methods of Instructional Systems Development.
2. To perform a complete Instructional Systems Development analysis of the identified needs.
3. To produce a design for the instruction that could be used in the development of a comprehensive training program for said contractors.

Both the analysis and design procedures accomplished in this effort were performed using the methods discussed in the actual Instructional Systems Development process.

The needs assessment conducted provided the list of the twelve major tasks that civilian contractors must be able to perform in order to use the Instructional Systems Development model. These are:

1. Perform behavior analysis
2. Perform analyses procedures
3. Select tasks for training
4. Perform all procedures in developing objectives.

5. Assess existing training materials
6. Design and develop all tests
7. Perform all sequencing procedures
8. Develop job aids
9. Select delivery methodologies
10. Develop course procedures and control documents
11. Write all training materials
12. Validate all training materials.

Each task was then analyzed to determine the skills and knowledges required for its satisfactory performance. Thus, the results of the analysis portion of the study were a complete task listing and a compilation of all required skills and knowledges.

The design process heirarchically pryramided the skills and knowledges identified to graphically display their relationships. Three-part behavioral objectives were then written for the higher level skills of each pyramid. Competency tests based on the action, conditions, and standards of each developed objective were next constructed. The development of the tests at this point in the process ensures that only the objectives are tested and not any extraneous material that might be included by either a course writer or an instructor.

The final step in the process was to sequence the objectives into a learning order, with consideration given to student, facility, and equipment constraints. The products of this sequencing resulted in an instructional map diagramming how students should progress through the course.

Thus, the parameters for a course for contractors working with the U.S. Army Intelligence Center and School have been defined. These parameters represent the instructional framework for the construction of an Instructional Systems Development course.

Conclusions

Two conclusions were reached as a result of this study:

1. There exists a definite need for the development of an Instructional Systems Development course for civilian contractors who develop training for the U.S. Army Intelligence Center and School.
2. The systems analysis and design procedures performed on the identified tasks have resulted in an instructional framework suitable for the development of a contractor's Instructional Systems Development training course.

Recommendations

From the results of this study, it is recommended that a course be developed, validated, and implemented to train civilian contractors in the precesses of Instructional Systems Development. It is further recommended that the instructional framework developed as a result of this study form the basis for the aforementioned course.

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