TASK ANALYSIS METHODS FOR INSTRUCTIONAL DESIGN

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Task Analysis Methods for Instructional Design
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Task Analysis Methods for Instructional Design

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Introduction

The major premise of this book is our belief that task analysis is the single most important component process in instructional design process, whether that process is used to produce direct instruction, performance support, or constructivist learning environments. Yet there is less literature available on task analysis than any other component of instructional design.

Having identified learning needs in the instructional design process, instructional designers sometimes, though not always, conduct a task analysis. In conducting a task analysis, the designer should clarify the outcomes of instruction, decide which outcomes should be further analyzed and developed, analyze the components and requirements of those outcomes, arrange or rearrange those components into an instructional sequence, and determine the cognitive/affective/skill/learning requirements of those component tasks. The result of task analysis is a blueprint for instruction. Like an architect, the instructional designer uses task analysis as a framework for building an instructional lesson or a learning environment. Without a blueprint, important parts of the lesson may be ignored, or the components and activities may not support each other. After completing the task analysis, the designer usually identifies instructional strategies and activities to engage and facilitate the learning requirements that were identified by the task analysis. The instructional designer is also responsible for developing and producing instructional materials for the learners and evaluating the effectiveness of them. Task analysis orients these processes.

The second premise of this book is that task analysis, although the most important, is the most often misconstrued, misinterpreted, poorly executed, or simply ignored component of the instructional design process. Why? First, there is a dearth of literature available to designers. Second, task analysis receives insufficient attention in preparation programs in instructional design. Third, it is a complex process which is filled with uncertainty and ambiguity. Fourth, task analysis requires a lot of time, effort, and expertise. Because of these difficulties, task analysis is frequently ignored. Designers begin designing and producing materials without a plan or instructional blueprint. If a task analysis is conducted, it is often not allocated the time and resources necessary to perform it competently. Even if it is performed competently, task analysis doesn't guarantee good instruction. Good instruction design depends upon task analysis, but task analysis doesn't assure good instruction. There are too many other processes that affect instructional outcomes. In summary, we believe that task analysis is a necessary but not sufficient requirement of good instruction.

Our beliefs are tempered by the assumption that not all designers, managers, trainers, educators, and human resource developers believe our first two premises. Many educators and trainers do not believe that task analysis is worth the effort. Task analysis needs analysis, and other "front end" processes do not produce tangible instructional products or results, so trainers often do not believe that they are worth the effort. Instructional products are confused with the "bottom line." We believe that such thinking represents a false economy of effort. The real effects of deficient task analysis are not obvious until the learners have to perform, and they cannot because the instruction they received is inadequate. A poorly executed task analysis often results in gaps in the instructional sequence, because elements of the task were not revealed by the analysis. Gaps in the instructional sequence result in insufficient learning and subsequent deficient performance. Task analysis is frequently ignored or performed perfunctorily, because designers or supervisors do not believe that it is essential to good instruction. Even if they ascribe importance to task analysis, they seldom assign enough time and resources to conduct an adequate task analysis. The compulsion to provide training products often precludes careful task analysis.

The most difficult part of task analysis may be convincing your supervisor, manager, superintendent, or employer that a competent task analysis is necessary and
therefore important enough to commit adequate time and resources to. If you are
convincing enough, then this book is for you.

This book is designed to serve three purposes. The first purpose is to define task
analysis. In the Part I of the book, we define a structure and a definition of the process.
The definition includes a description of the functions of task analysis and the situational
variables that affect its performance. In Parts II to VI, the book describes most of the
recognized techniques used to perform task analysis. We describe job analysis methods in
Part II, instructional and learning analysis methods in Part III, cognitive analysis methods
in Part IV, activity-based methods in Part V, and subject matter or content analysis methods
in Part VI. In each chapter, we describe the purpose, background, assumptions, and
methods for performing each kind of task analysis. We also provide examples of each kind
of analysis. We evaluate each task analysis method by describing applications from the
literature, along with relative advantages and disadvantages of each method. In Part VII of
the book, we describe information gathering and knowledge elicitation tools that support
the task analysis techniques described in the previous four parts.

The second purpose of this book is to serve as an instructional text. In each
chapter, we provide examples and verbal descriptions of how to perform each task analysis
method. We have provided relatively skeletal representations. We preferred to provide
more examples, along with adequate practice and feedback, in order to make the book more
instructionally effective. To do so would have doubled or tripled the page length, making
this volume unaffordable to the audience for whom it was intended — students and novice
practitioners of instructional design. You can certainly learn about each of the methods
from this book. In order to become skilled, you will have to consult the references
provided in each chapter, and you will certainly have to practice using the techniques. We
urge you to go beyond this book in your learning.

The third purpose of this book is to serve as a reference book of task analysis.
Each chapter has a similar chapter structure with headings and other typographic cues that
help you to find information about each technique. These cues should enable you find the
information that you need when you want it. The book is, perhaps more than anything
else, a handbook.

So, if you agree with us that task analysis is an important component of
instructional design, we encourage you to use this manual to discover more about the many
ways in which it is performed.

Acknowledgements

We would like to acknowledge many of our more querulous students, whose
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the many practitioners and scholars who also have struggled through the years to articulate
the many analytic procedures represented in this book.
Part I

Task Analysis Processes

Introduction

In Part I of this book, we argue that task analysis is the most important albeit most often misunderstood and ineffectively performed process in instructional design. Instructional design is an analytic activity, and task analysis is the key to the process. Why? Because instructional design is premised on an inviolable assumption. The nature of instruction and assessment that we use to foster learning should be congruent with the nature of the learning required. Therefore, instructional and assessment strategies vary with the nature of the learning outcome. That is, different learning outcomes require different forms of assessment and different kinds of instructional or learning strategies to foster them. An essential skill of instructional designers, then, is the articulation of the kinds of learning outcomes for which they are assisting learners (i.e. task analysis). So, if you, as an instructional designer, are unable to articulate those learning outcomes (if you cannot describe how learners should be able to think and perform), how will you be able to design instruction or assessment?

Part I of this book describes the processes and underlying assumptions of the task analysis process. Chapter I articulates our assumptions about the task analysis process and then describes the important functions that are performed by task analysts. It concludes by providing some heuristics for selecting the task analysis methods that are described in Part II-VI of the book.

Chapter 2 more clearly describes an important function of task analysis — selecting which tasks or skills that have been identified by the process for further analysis. Why is this important? Because there are far more tasks and learning outcomes that need to be learned in any context than can be designed and developed. There are insufficient instructional designers, time, and resources to design and develop instruction or learning environments for every learning outcome. So we must often select the most important learning outcomes for development. Chapter 2 describes the criteria for making those selections and the process for applying those criteria.

Another important function of task analysis is to describe the learning requirements for any task or skill being analyzed. How do learners have to think? What do they have to know? How do they have to perform? Chapter 3 presents our taxonomy of learning outcomes that may be used to classify the kinds of learning that your task analysis identifies. Again, if we assume that instruction and assessment strategies need to be congruent with learning outcomes, then we need a way to differentiate those outcomes. Chapter 3 presents a method for doing that.

Part I of this book includes the following chapters:
1. What is Task
2. Selecting Tasks for Analysis
3. Classifying Knowledge and Skills from Task Analysis
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Chapter 1

What is Task Analysis?

Purpose of Task Analysis

"The first step in the design of any instruction is a task analysis to determine what should be taught" (Polson, 1993, p. 219). Task analysis for instructional design is a process of analyzing and articulating the kind of learning that you expect the learners to know how to perform. Instructional designers perform task analysis in order to determine:

- the goals and objectives of learning
- the operational components of jobs, skills, learning goals or objectives, that is, to describe what task performers do, how they perform a task or apply a skill and how they think before, during, and after learning
- what knowledge states (declarative, structural, and procedural knowledge) characterize a job or task
- which tasks, skills, or goals ought to be taught, that is, how to select learning outcomes that are appropriate for instructional development
- which tasks are most important - which have priority for a commitment of training resources
- the sequence in which tasks are performed and should be learned and taught.
- how to select or design instructional activities, strategies, and techniques to foster learning
- how to select appropriate media and learning environments
- how to construct performance assessments and evaluation

In order to design instruction that will support learning, it is essential that we understand the nature of the tasks that learners will be performing. This is true whether you are designing traditional, direct-instruction or problem-based constructivist learning environments. If you are unable to articulate the ways that you want learners to think and the act, how can you believe that you can design instruction that will help them?

Assumptions of Task Analysis

This book is premised on a few important assumptions.

Task analysis is essential to good instructional design. Intellectually and practically, task analysis is probably the most important part of the instructional systems design (ISD) process, and it has been thought so for some time. "If I were faced with the problem of improving training, I should not look for much help from the well-known learning principles like reinforcement, distribution of practice, response familiarity, and so on. I should look instead at the technique of task analysis, and at the principles of component task achievement, intratask transfer, and the sequencing of subtask learning to find those ideas of greatest usefulness in the design of effective learning" (Gagne, 1963). Task analysis provides the intellectual foundation for instructional design. It guides the process by articulating the goal or mission for the design process. Nearly every one of the instructional design models that were listed by Andrews and Goodson (1980), which is the most comprehensive list of ISD procedures, includes some task analysis process. Some prominent design models ignore task analysis, relying (we suppose) on inspiration to direct the design process. We have seen too many instructional design projects fail to produce effective instruction or learning because the designers did not understand the learning outcomes.
Although task analysis emerged as a process in the behaviorist era of instructional design, task analysis methods have followed the paradigm shifts to cognitive psychology and onto constructivism. We argue that task analysis is just as important to the design of constructivist learning environments as it is to direct instruction, performance support systems, or any other form of learning support. Obviously, designing learning environments to support constructive learning requires different analysis methods. However, whether designing programmed instruction, intelligent tutoring systems, or constructivist learning environments, designers must understand the nature of the learning they are directing, guiding, or supporting (depending on your philosophical perspective).

Task analysis is the least understood component of the instructional design process. Instructional design, as a process, is often generically described by the ADDIE Model—Analysis, Design, Development, Implementation, and Evaluation (Gustafson & Branch, 1997). Of those processes, implementation is probably the most poorly performed, however the analysis procedures are most often under-performed. Although analysis procedures, including needs analysis, learner analysis, context analysis (Tessmer & Richey, 1997) and task analysis are taught in most preparation programs, most instructional designers possess insufficient skills in performing task analysis methods. They learn about task analysis, but they too seldom do task analysis. Most programs provide insufficient design cases and practice in performing task analyses. When they do, they most often teach a single method. Probably two thirds of all task analyses that are conducted in practice use some form of procedural analysis, so most instruction is procedurally oriented despite the cognitive needs of the learner. Procedural analysis is the *methode de jour* not because it is the most appropriate, but because that is the only method the designers know. The primary purpose of this book is to show designers that there are numerous, more appropriate, and effective methods for conducting task analysis.

The apparent ambiguity of task analysis results from a lack of clear conceptions about the task analysis process. For instance, some (Miller, 1962) have argued that task analysis is an art, and as an art, is most dependent upon the skill of the task analyst. If task analysis is to be conceived of and performed scientifically, then some predictability needs to be added to the decision making process. Military and corporate operations reject the artistic conception, claiming that task analysis is a series of operations that must be performed in a consistent manner (too often defaulting to the procedural).

The ambiguity of task analysis also results from the confusing array of methods for performing it. Zemke and Kramlinger (1982) described the five most common ways of doing task analysis: the look-and-see (observation) approach, structure-of-the-knowledge (hierarchical analysis) approach, critical incident approach, the process/decision flowchart (information processing) approach, and the use of consumer research techniques (surveying, interviewing). In this book we describe these and many other task analysis methods.

Task analysis also appears ambiguous because there are so many applications that result in so many methods. Task analysis, in some form, is performed by personnel psychologists, human factors engineers (including human-computer interaction designers, occupational safety inspectors, and many others), curriculum developers, and, of course, instructional designers. Task analysis is recognized as an essential process in the design of human-computer interactions (Diaper, 1989). However, most of the methods used to design human-computer interactions focus on specific, procedural tasks to support computer interfaces and so do not transfer to instructional design. Task analysis methods for instructional design are relatively specific to instructional design.

The ambiguity of task analysis also results from the myriad of contextual constraints imposed by the setting in which the analysis is being performed. Task analysis is used in higher education resources centers, in training centers, and in management development and corporate board rooms. Instruction is needed in virtually every type of public and private agency. Where instruction is needed, task analysis should be performed.
What is Task Analysis?

However, each of these venues provides a different set of physical, sociocultural, organizational constraints. Tessmer and Richey (1997) have identified the range of factors that can affect the design process. The most troublesome constraint is the lack of commitment to task analysis. Too often training organizations design instruction without any comprehensive understanding of the nature of the learning outcome.

The values accorded to task analysis is often low. Even when designers are skilled in performing task analysis, time constraints prevent them from undertaking any kind of analysis. Project managers do not perceive the need or importance of adequately articulating tasks, preferring to begin development in order to make the process more efficient. We have seen too many elaborately packaged task analyses that clearly indicated an inadequate understanding of the cognitive and performance requirements of the task. Again, if you are unable to articulate how you expect learners to think and perform, how can you believe that you can design effective instruction?

Task analyses is uncertain. The irony of the ambiguity just discussed is that task analysis, as a process, seeks to reduce ambiguity in instruction by conscientiously defining the parameters of any performance or learning situation. Yet, instructional design is replete with uncertain knowledge and multiple interpretations. So is task analysis. Not every aspect of human thought and behavior can be identified or articulated. How can we reconcile this discrepancy? We cannot, so live with it. That is the nature of the design process.

If we attempted to eliminate all ambiguity in the task analysis, we would have to over-proceduralize a complex set of decisions — to develop a cookbook of task analysis. To develop recipes for task analysis would treat the vast variety of instructional problems the same. Although instructional design is not an art, McCombs (1986) claims that the success of the design process is largely dependent upon the reasoning ability of the designer. Instructional designers, including task analysts, need to be able to “think on their feet” in order to make effective decisions. Instructional design is a problem solving process, not a procedure. As part of this problem solving process, task analysis helps to identify and structure what must be learned. Task analysis, we assume, is most effective when the right techniques and tools are carefully selected and applied by intelligent and well-informed designers while solving instructional problems. Designers need to be informed about what task analysis procedures are available and given guidelines for selecting and using them. That is the purpose of this book.

Different contexts demand different task analysis methods; one size does not fit all. Again, instructional designers too often learn only one or two methods for performing task analysis and thereafter try to force-fit all learning situations into those methods, often without success. As we said before, different instructional goals and contents require different approaches to designing instruction, including task analysis. First, you need to decide what kind of analysis to perform (job analysis, learning analysis, cognitive, activity, or subject matter analysis) and to learn how to select the appropriate method. There are many methods for performing each. Then, you must decide which of the many methods will produce the most appropriate outcomes for the given context. Each method for performing task analysis yields a different outcome that will result in a different kind of instruction. It is important to keep in mind the goal of all forms of instructional task analysis — producing better instruction.

We are not suggesting that designers become skilled in every method described in this book. Rather, we believe that it is important that instructional designers learn to perform a variety of task analysis approaches (job, learning, cognitive, activity, and subject matter) and investigate specific methods once a decision about the kind of desired instruction has been made. This book is designed as a handbook in order to facilitate that process — to provide just-in-time instruction on how to perform a variety of task analysis methods for the purpose of designing different kinds of instruction. So, let’s begin with definitions.
Task Analysis: A Description

Task analysis has many definitions, depending on the purpose for conducting it, the context in which it is performed, and the performers involved. Definitions of task analysis range in clarity from "the breakdown of performance into detailed levels of specificity" to "front-end analysis, description of mastery performance and criteria, breakdown of job tasks into steps, and the consideration of the potential worth of solving performance problems" (Harless, 1979, p.7). Task analysis means many things because it is a complex process.

There are several purposes for conducting task analysis. Task analysis is used extensively in developing job descriptions (job analysis). While the time-motion studies used to decompose jobs into assembly-line activities are no longer prevalent, employers still systematically analyze the jobs that are performed in their organizations in order to integrate workers' efforts more efficiently, especially in the military. Task analysis is used extensively in designing human-computer interactions. Designing software interfaces requires detailed analysis of users' needs and actions. Finally, task analysis is used extensively in designing different forms of instruction, including performance support, direct instruction, and open-ended learning environments. This final application of task analysis is the focus of this book.

In this book, we describe five general classes or kinds of task analysis that have emerged: job or performance analysis, learning analysis, cognitive task analysis, content or subject matter analysis, and a new class of analysis, activity-based methods (see FIG. 1.1). Not only do these approaches involve different procedures for fulfilling the purposes of task analysis, they also make different assumptions about how people learn and so provide different recommendations for how they should be instructed. They also delineate the major parts of this book (see Table of Contents).

![FIG. 1.1. Domain of task analysis](image-url)
What is Task Analysis?

Job analysis is a broad category of processes that evolved from the industrial revolution. Industrialization brought about a reduction of jobs into elemental tasks that are performed by individuals in isolation. Industrial engineers used time-motion study techniques to reduce jobs to their simplest activities so that they could be learned quicker and performed more reliably. This approach produced a variety of job oriented task analysis techniques that were intended to describe the elemental behaviors involved in performing a job. Job analysis techniques (Part II) evolved as a planning tool for technical training. Although the trend in job design is to add complexity and constructive components to many industrial jobs, the same techniques can be used to describe those procedures.

Throughout the 1950s and 1960s, subject matter analysis evolved as the dominant curriculum planning tool in education. Bruner and his disciples focused on the structure of the discipline in order to plan curricula. This entailed analyzing subject matter content for its constructs and more importantly for how those constructs were related. The structure of subject matter became the focus of instruction. Subject matter remains a popular method for structuring instruction. Several methods are described in this book for performing subject matter analysis (Part VI).

The revolution in learning psychology in the 1960s focused the attention of designers on the way learners were processing information as they performed tasks. Techniques such as learning hierarchy analysis and information processing and path analysis were developed as part of this movement. Later, when learning psychology assumed a more cognitive psychological basis, methods for conducting cognitive task analysis (Part IV) emerged. The growth of cognitive task analysis methods was fueled by military efforts in designing intelligent tutoring systems. The human-computer-interaction research community contributed to the movement as well, albeit to a much lesser extent. Cognitive task analysis is a distinct enough kind of learning analysis with different enough assumptions and methods for other learning analysis methods, so we have included their chapters in a separate part of the book.

More recently, anthropological methods have been applied to analyzing the learning process, ushering in situated and everyday conceptions of the human activity, only some of which are briefly described in this book. These activity analysis approaches (Part V) analyze how people perform in natural, everyday settings. They attempt to document how humans act and the social and contextual values that affect that activity.

Each of these general approaches to task analysis focuses on a different aspects of the job or task being learned. Job analysis focuses on the behaviors engaged in by the performer. Content analysis examines the concepts and relationships of the subject matter. Learning analysis focuses on the cognitive activities required to efficiently learn. Activity analysis examines human activity and understanding in context. Cognitive task analysis focuses on the performances and their associated knowledge states. Each approach entails a different set of assumptions about how learners acquire skills and knowledge and how they ought to be instructed. Each of these approaches are represented by a variety of techniques that we describe in each section of this book.

Task Analysis for Instructional Design

Within the ADDIE Model instructional designers perform many different kinds of analysis, including needs analysis, task analysis, learner analysis, and context or environmental analysis. All of these forms of analysis are intended to define the requirements and parameters of the learning situation — who the learners are, what they need to know, how they should perform, what skills they need to develop, and how the context may affect the design and learning processes.

Task analysis is most often confused with needs assessment. Why? Sometimes task analysis (or job analysis) is considered a type or part of needs assessment (Rossett, 1987), while others (Kaufman, 1977, 1986) distinguish between needs analysis
Task Analysis Processes

(prioritizing needs and determining their training and non-training solutions) and needs assessment that generates the needs for analysis. Also, task analysis and needs assessment use the same knowledge elicitation tools (see Part VII) and frequently the same or similar techniques to produce the same or similar results. In many respects, needs analysis mirrors task analysis. However, there are two basic differences between task analysis and needs analysis: purpose or function and sequence.

The purpose of needs analysis is to determine if learning is a solution to an identified need, and if so, how serious the learning need is. The result is a prioritized inventory of learning goals. Essentially, needs assessment is the data gathering and decision-making process that instructional designers go through to determine the goals of any instructional system. Needs analysis identifies the present capability of prospective learners or trainees, the desired outcomes, and the discrepancies between those (Kaufman & English, 1979).

Task analysis, on the other hand, determines what must be learned to achieve those goals. So, starting with a statement of learning goals, task analysis is used to determine what actually gets taught or trained. It analyzes the learning situation for the purpose of making instructional design decisions. Its major function is organizing tasks and task components, as well as sequencing them.

Needs analysis first determines that an instructional need exists; task analysis analyzes that need for the purpose of developing the instruction and assessment. In cases where a needs analysis is not conducted, when training goals are mandated or already established, then the analysis process usually begins with task analysis.

Task Analysis Functions

Much of the confusion about task analysis that frustrates inexperienced instructional designers results from a lack of agreement about what the process of task analysis involves. What exactly do designers do when they conduct a task analysis? That varies greatly between situations and contexts. In some contexts, task analysis is limited to developing an inventory of steps routinely performed on a job. In others, task analysis may include all of the instructional design procedures prior to determining instructional strategies. Herschbach (1976) described task inventory, description and analysis as the fundamental activities. According to Romiszowski (1981), task analysis procedures pervade different levels of instructional design. At the course level, task analysis defines overall objectives. At the lesson level, objectives are refined and sequenced, and entry level requirements are specified by task analysis. At the instructional event level, the detailed behaviors are classified. And at the learning step level, task statements are elaborated on, as individual steps in the task are identified. Each step of this top-down, macro-to-micro instructional design process is heavily dependent on task analysis.

Task analysis occurs in two separate phases. The task description phase consisted of identifying, refining and ordering tasks. The instructional phase consists of the processes of (a) specifying goals, needs, and objectives; (b) developing analysis tools (such as taxonomies and learning hierarchies); and finally (c) identifying outcome specifications (such as product descriptions and training considerations). There is considerable disparity among instructional development models in terms of the components each includes as part of the task analysis process.

Next, we perform a simple task analysis of the task analysis process. We believe that task analysis consists of five distinct functions:

- Inventorying tasks
- Selecting tasks
- Decomposing tasks
- Sequencing tasks and task components
- Classifying learning outcomes
What is Task Analysis?

These are functional descriptions of what designers do while performing task analysis. The task analysis process, as performed in different settings, may involve some or all of these functions. The combination of functions that are performed depends upon the context or situation in which instruction is being designed. Likewise, each function may be accomplished by using the different techniques that we describe in this book. Just as the function being performed constrains the technique, each technique constrains each function. So we must exercise care in selecting a procedure for accomplishing each of the task analysis functions. But first, let us describe the task analysis functions.

**Inventorying Tasks and Content**

The task inventory involves a process of identifying or, in some cases, generating a list of the relevant tasks that should be considered for instructional development. This inventory may result from a variety of processes, such as job analysis, concept hierarchy analysis, needs assessment procedures, and so on. How we arrive at the list of topics or tasks to be included in our system depends on the instructional context, the sociocultural context, the audience we are training/educating, and the organizational context and the goal orientation of the educational system (Tessmer & Richey, 1997). The inventory function of task analysis (discussed earlier) frequently functions similarly to determining optimals in needs assessment (Rossett, 1987).

![Diagram](image)

FIG. 1.2. Task analysis and outcomes.

**Selecting Tasks for Analysis**

Some instructional development models, especially those in the military, include a separate procedure for selecting from the task inventory those tasks for which training should be developed. Since it is impossible to train every person on every task to a level of proficiency that might be required by the job, developers often must select certain tasks for training that are feasible and appropriate. According to Tracey, Flynn, and Legere (1966), tasks that are feasible and appropriate for on-the-job, school, and follow-up training should be selected. This selection process may also result from a consideration of various contextual constraints, such as available time and resources, and so on (Tessmer & Richey, 1997). In order to select tasks for training, developers need to rank or assign priorities to their training objectives. Task selection is also performed to avoid instructing or training students on material they already know. Thus, those tasks that have already been acquired
are eliminated from the list of training objectives. As illustrated in Figure 1.3, task selection normally follows the task inventory. It is not part of most task analysis methods. Rather it is part of the process of planning for task analysis and so is described in Chapter 2 in this first part of the book. There is no sense in describing or further elaborating tasks that learners do not need to know or which the organization cannot begin to train or assess. The result of the task selection is the final list of training objectives. In many design models, selection is an implicit function, not one that is performed systematically. Having selected tasks for development, they need to be described and later sequenced.

FIG. 1.3. Sequence of task analysis process.

Describing Tasks, Learning and Content

Task description is the process of identifying and describing the components of the tasks, goals, or objectives identified in the inventory. Task descriptions may include listing: (a) the tasks included in performing a job, (b) the knowledge required to perform a task, or (c) the enabling objectives for a terminal objective. The exact motive for performing the task description function depends upon the nature of the information provided in the inventory. Task description always involves an elaboration of the tasks/goals stated in the inventory to a greater degree of specificity or detail. The emphasis here is thoroughness—ensuring that important instructional components are not excluded. This, in fact, is a primary rationale for conducting the task analysis process.

Sequencing Tasks, Learning, and Content

Task sequencing is often implied by the inventory and description. However, the task sequence is more than a simple description of the sequence in which the task is performed. It indicates the sequence in which the instruction should occur. Frequently, the sequence for performing the task implies an appropriate instructional sequence. For example, in training employees to perform certain jobs, the most appropriate sequence of tasks may be the one that models the job. However, the task performance sequence does not always imply the instructional sequence. The instructional sequence may also be determined by the content analysis or learning analysis processes or by the design model being used. For instance, elaboration theory (Reigeluth & Stein, 1983) prescribes a specific top-down, general-to-specific conceptual sequence for presenting material. According to other taxonomies of
What is Task Analysis?

learning, the lowest levels of skills are taught first. Other methods suggest a procedural sequence identified in a flowchart form while other approaches, such as situated learning, prescribe a more concurrent learning of tasks and their subordinates, so the sequence is more simultaneous. The sequence that is recommended by any method depends on the assumptions that it makes about learning, which vary considerably.

Classifying Learning Outcomes

The final function in the task analysis process is where the performance and knowledge states required of learners are classified as to the kind of learning outcome required. What kind of information processing, cognitive activity, or physical performance is required to accomplish the task being analyzed? This usually takes the form of classifying the task statement using various learning taxonomies. Beginning with the lowest level or most fundamental forms of behavior (reflexes), they describe increasingly more complex mental responses or behavior (evaluation, problem solving, or strategies). The purpose of classifying learning varies with different instructional design models. Normally, however, taxonomic classification of tasks has at least three functions. Classifying learning tasks helps to ensure that there is (a) congruity between the tasks and the assessment; (b) congruity between the task and the instructional methods (especially practice) that support learning the task; and (c) prerequisite sequencing (not requiring more complex task performances prior to learning simpler, prerequisite skills and knowledge).

Classifying learning outcomes pervades the task analysis process. That is, it is performed throughout the process. The classes of learning outcomes may or may not be specific to the kind of task analysis being performed, but since it is a requirement of virtually all forms of task analysis, it is described in Chapter 3 in this first part of the book.

Objectives: The Outcome of Task Analysis

Another component of the task analysis process that could arguably be included in the list of functions is the writing of behavioral, instructional, learning, or performance objectives. They are the most common component of all instructional development models (Andrews & Goodson, 1980). However, objectives are not a process; they are an important product of the task analysis process. Learning objectives may result from task analysis or from some other process, such as needs assessment. Kaufman (1986) claims that needs assessment is the birthplace of objectives, that is, objectives are often determined by needs assessment prior to the instructional developer being consulted. However, task analysis also is frequently responsible for identifying the learning objectives that guide instruction. as well as the standards and conditions that should be specified in the objective. Task analysis may start with objectives, or task analysis may produce objectives, but objectives are an epiphenomenon of the task analysis process.

Sequence of the Task Analysis Process

Task analysis, as performed in various instructional development models, involves some or all of the functions that we just described. The point is that the task analysis process varies as it is performed in different settings. So performing task analysis may entail only one, a few, or perhaps all of these functions. Not all task analysis processes involve all five functions. However, we believe that all task analysis procedures, regardless of the design model employed, can be described by one or more of these functions. That is, these functions are distinct enough to be identified in any task analysis process. An analyst performing task analysis may perform two or more functions simultaneously.
A concern of this chapter is the sequence in which the functions are performed when conducting a task analysis. Romiszowski (1981) recommended a top-down sequence: inventory-sequencing-analysis-description. Many designers perform the inventory first, followed by a description. The point is that task analysis, however it is performed, includes one or more of the functions described above. Because the inventory, description, selection, sequencing and classification functions are the most universally performed, they are the ones that we recommend for conducting task analysis.

Although there is no universal temporal sequence in which task analysis functions are performed, we recommend the following as a general sequence that can be applied in most situations.

1) **Inventory Tasks**

The obvious first step is to identify the tasks for analysis. First, you must select a task analysis method that is appropriate for inventorying tasks (recommendations are available in each chapter). The inventory of training or instructional tasks frequently results from the needs assessment process. However, the inventory produced by the needs assessment process may be too vague. In other cases, training is mandated or automatic, so no needs assessment is conducted. The tasks involved in automatic training need to be identified. In many cases, an inventory results from the normal conduct of task analysis. Generally, when a needs assessment has not been performed, the first step is to inventory the tasks to be trained or taught.

2) **Select Tasks for Analysis**

Having identified all of the tasks involved in a job or curriculum, it is usually obvious that there are too many tasks to analyze or to develop training for, so the inventory needs to be evaluated in order to select the tasks. Feasibility is the primary concern here. Given limited resources, the analyst must evaluate the tasks identified in the inventory to determine which have priority in terms of criticality, frequency, or client preference (Chapter 2).

3) **Describe or Decompose Tasks**

Having decided which tasks to further analyze and develop, the next step is to break down those selected tasks into their component parts. This is the step or function that most people associate with task analysis. This is where the type of task analysis is selected one of its methods utilized for task analysis. First, you must select a task analysis method that is appropriate for describing tasks (recommendations are available in each chapter). In describing the task, you are identifying the operations (physical, mental, or activity) required to complete the task, the sequence of prerequisite tasks, or the constituent parts of a concept or principle. Description of a task is important because you want to avoid omitting an important part of the instruction.

4) **Sequence Task Components**

Having broken down the task into its components parts, you next need to determine the instructional sequence that best conveys the task or that best facilitates learning the task. It is important to note that the instructional sequence does not always recapitulate the sequence in which the task is performed. Many task analysis techniques recommend an instructional sequence that contradicts the task performance sequence. The instructional sequences most often recommended by task analysis techniques are top-down, bottom-up, or procedural.
5) Classify Learning Outcomes

Each of the tasks and task components need to be analyzed for the type of learning required. Analyzing tasks serves to verify the sequencing of the tasks, particularly bottom-up or prerequisite sequences. The types of learning are also used for determining appropriate instructional strategies, designing test items, and other instructional design operations. Analyzing tasks and components is used primarily to ensure that objectives, test items, and instruction are equivalent. Taxonomies for classifying learning outcomes are described in Chapter 3.

The sequence of task functions above provides a model which is applicable in many or most situations, but not all. As we indicated before, there is no universal temporal sequence in which task analysis functions are performed. Analyzing tasks frequently precedes the sequencing. In some cases, when tasks are already specified by a curriculum guide, the inventory and sometimes description and sequencing are not performed. The functions that are performed and their sequence are specific to the setting in which they are performed.

Selecting Task Analysis Methods

Parts II through VI describe 21 different methods for conducting task analysis for instruction design. There are many more methods for conducting task analysis that are described in the literature, but we believe that they are too task-specific and therefore not generally appropriate for instructional design. These 21 methods may be thought of as the best task analysis methods for instructional design (we did not address many of the knowledge elicitation methods used in artificial intelligence and expert systems design). Understanding of any combination of the methods that we describe will likely expand your repertoire. Our primary goal in this book is to convince you that there are many methods for conducting task analysis. You should become familiar or facile with as many as possible. At the very least, you should be familiar with one or more methods of each kind (job, learning, cognitive, activity, and subject matter).

Since we presume that you are currently familiar with only a few of these methods and therefore unable to accurately prescribe which method to use in any given instructional design context, an important question is probably which method should you use. Next, we briefly describe a decision-making process that reduces some, but not all, of the uncertainty in selecting a method for conducting task analysis. That is, we provide some suggested questions to ask. However, in order to make the best recommendation, you need to experiment with them. In order to select a task analysis procedure, you need to consider:

• What kind of instruction do you plan to design?
  - For performance support or procedural instruction, use a job analysis method.
  - For direct instruction, use a learning analysis method.
  - For problem solving or guided learning, use a cognitive task analysis method.
  - For more constructivist learning environments, use an activity-based method.
  - For content, subject, or topic-oriented instruction, use a subject matter analysis method.

• What task analysis function (described before) do you need to perform (inventorying, selecting, describing, sequencing, or classifying)? Most methods in this book focus on inventorying and describing tasks. Many of them also provide suggestions about sequencing tasks for instruction.

• What is the scope of the design - macro or micro (single task or complex performance involving many tasks)? The methods used to inventory tasks are more effective for macro-
level analysis, while the methods that focus on describing tasks are better for micro-level analysis.

- What context will instruction be delivered in? Learning situations vary dramatically from assembly lines to large classroom to independent home study.
  - For workplace learning, use a job analysis method.
  - For direct instruction, use a learning analysis or subject matter analysis method.
  - For more constructivist learning environments, use a cognitive task analysis or an activity-based method.
  - For information retrieval, use a subject matter analysis method.

- What experience or training do you or other designers have in conducting task analysis? Since most instructional design preparation programs provide limited opportunities to learn how to conduct task analysis and many design groups de-emphasize the importance of task analysis, this will vary. The more skilled that you are in task analysis, the better will be the instruction that you design.

- How much time and what resources are available in any instructional design context to support different forms of task analysis, since they vary in complexity. The more complex a process is, the costlier it will be to perform. Cost is closely tied to the time required for analysis, because analysis is a labor-intensive process. We believe that time invested in competent task analysis is easily justified. When instruction is inadequate, more often than not, it is because the task analysis did not identify important instructional requirements.

- What resources are available? Some TA methods will require access to subject matter experts, workplace observations, considerable time to analyze the data, or multiple participants at different stakeholder levels. Be sure that your project has the resources for the specific task analysis method chosen. Each chapter has an Advantages and a Disadvantages section to help you make this decision

**Conclusion**

Task analysis, we believe, is an essential part of any instructional design process, regardless of whether you are designing technical training or constructivist learning environments. Understanding and articulating the ways that learners need to think or perform is absolutely essential to designing effective instruction or learning environments. Too often, instruction fails to support learning because the instructional designers fail to perform a competent task analysis, resigning themselves to redundant, inappropriate, reproductive forms of instruction that do not support the kind of learning that the designers had really intended but were unable to analyze and articulate. Instructional design is premised on the congruity between learning objectives and instruction. That is, every theory and model of instructional design assumes that different learning outcomes require different forms of instruction. We argue that different learning outcomes require different forms of task analysis. Just as no form of instruction fits all objectives, no form of task analysis fits all objectives or instruction. So it is important that instructional designers become competent with a variety of different forms of task analysis. Why? If you, as an instructional designer, are unable to articulate the ways that learners need to think and perform using appropriate task analysis methods, you have no business designing instruction to support their learning or performance.

This chapter has described the purposes, assumptions, and kinds of task analysis. We intend this handbook to function as a resource for instructional designers — to introduce them to methods for conducting task analysis and provide informational supports to help them begin to better articulate learning outcomes during the instructional design process. If you are one of those people, we hope that we provide some assistance through this book.
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2 Selecting Tasks for Analysis


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8 Learning Hierarchy (Prerequisites)

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10 Learning Contingency Analysis


Part IV Cognitive Task Analysis Methods


11 Goals, Operators, Methods, & Selection (GOMS)


12 Prediction, Actions, Results, Interpretation (PARI)


13 Decompose, Network, and Assess (DNA)


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31 Structured Group Interviews: Delphi Technique


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