DEPARTMENT OF THE AIR FORCE
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Education/Training

INSTRUCTIONAL SYSTEM DEVELOPMENT

This manual describes the Instructional System Development (ISD) principles and processes for developing education and training programs in the United States Air Force. It presents an instructional design model for analyzing, designing, developing, and implementing effective and cost-efficient instructional systems. Applications of the principles and processes in this manual are found in the various volumes of Air Force Handbook 36-2235. This manual applies to all personnel who plan, design, develop, implement, approve, administer, conduct, evaluate or manage Air Force instruction. It also applies to Air National Guard (ANG) and U.S. Air Force Reserve (USAFR) units and members.

Table of Contents

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Chapter Page

Chapter Page

List of Figures Page

Chapter 1
INTRODUCTION

Overview

Purpose

Instructional System Development (ISD) is the official Air Force process for developing education and training for Air Force personnel. AFPD 36-22 directs the use of a systematic approach to Air Force instruction. This manual, AFMAN 36-2234, discusses the background of ISD, describes what it is, explains the ISD process, and provides guidance for finding additional information on specific areas of the process. It also provides the necessary theory and philosophy for developing effective, cost-efficient instruction. Specific applications of the ISD process are found in a series of handbooks (AFH 36-2235). A list of these handbooks and other ISD documents is in Attachment A.

Definition of ISD

Instructional system development is a deliberate and orderly, but flexible process for planning, developing, implementing, and managing instructional systems. It ensures that personnel are taught in a cost-efficient way the knowledge, skills, and attitudes essential for successful job performance.

Content

AFMAN 36-2234 covers the following content areas.

·The **Introduction** describes the background and basic concepts of Air Force ISD. It compares the original and updated Air Force ISD models. It outlines the activities comprising the ISD process and shows how they fit into a total instructional system with evaluation and the principles of quality applied throughout the process. It discusses differences among Air Force ISD applications and how the requirements of using commands drive ISD implementation.

·**Learning Theory** briefly reviews and updates instructional and learning theories that are incorporated in recent instructional design and suggests directions of future developments.

·**Planning** discusses the management and technical concerns that should be addressed before beginning an ISD project.

·**Analysis** describes the activities that occur during analysis of instructional need.

·**Design** covers the activities and products of the design phase.

·**Development** gives the techniques and activities used in producing instructional materials.

·**Implementation** describes fielding an instructional system and initiating instructional delivery.

·**Evaluation** discusses the various means of measuring effectiveness and efficiency at the different stages in the life cycle of an instructional program.

Air Force Training Doctrine

AFMAN 1-1 states that **people are the decisive factor in war**. It is imperative that people receive the right education and training at the right time. Education and training should:

·Prepare forces for combat.
·Be as realistic as possible.
·Be conducted for all forms and levels of war.
·Give special attention to training for joint and combined employment.

ISD can help ensure that you meet these objectives.

Introduction

This chapter provides information on the background of ISD, how it fits in the total instructional system, and how it relates to Quality Air Force (QAF).

Section A
Background

Roots Of ISD

The Air Force ISD process is an adaptation of the systems engineering process to problems of developing, implementing, and evaluating instruction. The ISD process assumes that alternative solutions to instructional problems will be more or less cost- efficient depending on the instructional need and environmental constraints, and that a systems approach to choosing among alternative solutions will produce the most effective results.

Four Generations Of ISD

According to Tennyson (1991), ISD is an evolving process. The following is a summarization of Tennyson's four generations of instructional development.

Generation	Description
First	The main focus of the first generation model was the implementation of the behavioral patterns of learning. The system had four components: objectives, pretest, instruction, and posttest. The system was complete with an evaluation loop for purposes of revision.
Second	Advances in instructional technology led to the need to increase the variables and conditions of the ISD model. The second generation adopted systems theory to control and manage the increasingly complex ISD process. The behavioral learning patterns remained, but were of secondary importance to the focus of the system— developing instruction.
Third	In practice, the ISD process was too rigid and did not account for the different situations and applications for which it had to be used. To account for the situational differences, the external control of the system (i.e., the boxes and arrows) gave way to phases of ISD that could be manipulated in any order by the instructional author. This model assumed that ISD was an interactive process that could be entered at any point depending on the current situation. Although learning theory was still considered behavioral, cognitive theory was beginning to have an impact, such as in the use of simulations for acquisition of cognitive skill in decision making.

Continued

Four Generations Of ISD (Continued)

Generation	Description
Fourth	Advancements in understanding how we learn and educational technology (e.g., management, delivery systems, cost effectiveness, content analysis, objectives, measurement, instructional strategies) provide major changes in many of the ISD variables, making the ISD model yet more complex. Employing technological developments from the field of artificial intelligence, the fourth generation model handles the complexity of ISD with a continuous evaluation and troubleshooting process.

Sources of Concepts

Concepts used in designing the ISD process have been drawn from the disciplines of:

·System engineering
·Behavioral and cognitive psychology
·Instructional technology

When the Air Force ISD process was originally defined it represented the then state-of-the art specification for the design and development of instruction. At that time, behavioral learning theory held that efficient job instruction could teach the behaviors directly without providing cognitive understanding of the theoretical foundations of the activity being performed. Behavioral learning has provided a successful approach for teaching procedural tasks. Though procedural tasks still account for the vast majority of Air Force jobs, the remainder requires concepts beyond behavioral learning theory. The concepts beyond behavioral learning theory are from cognitive psychology and systems engineering.

Goal

As originally adopted in the Air Force, the goal of instructional systems development was to increase the effectiveness and efficiency of education and training by fitting instruction to jobs, eliminating irrelevant knowledge from courses while ensuring that students acquired the necessary skills, knowledge, and attitudes to do the job. Instruction was to be provided in the areas most critical to job performance and was not to be wasted in areas having a low probability of meeting immediate or critical long-term needs. The ISD process prescribed a series of procedures which addressed decisions about exactly what, where, how, and when to teach the skills, knowledge, and attitudes needed to perform every task selected for instruction.

Effectiveness

The Air Force developed its first major instructional system in 1965. Application of the ISD process has consistently improved the quality of instruction in the Air Force. Use of the process:

·Increases the effectiveness of the instruction.
·Improves time-efficiency.
·Produces the best instruction for the lowest possible cost.

ISD Models

Over the years, the ISD process has been described graphically through a wide variety of models which call out the procedures in a number of phases or steps. Most models encompass the functions of analyzing instructional needs, and designing, developing, implementing, evaluating and improving instruction. The use of a systematic problem solving approach is the common thread that runs through all models.

ISD Is QI

ISD is a quality improvement (QI) process. The processes and products of the phases are continuously assessed for quality with emphasis on how well they meet the users' needs. Life cycle evaluation ensures continuous improvement of the instruction.

Original Air Force ISD Model

The original Air Force Model was a five-step process, shown in Figure 1.

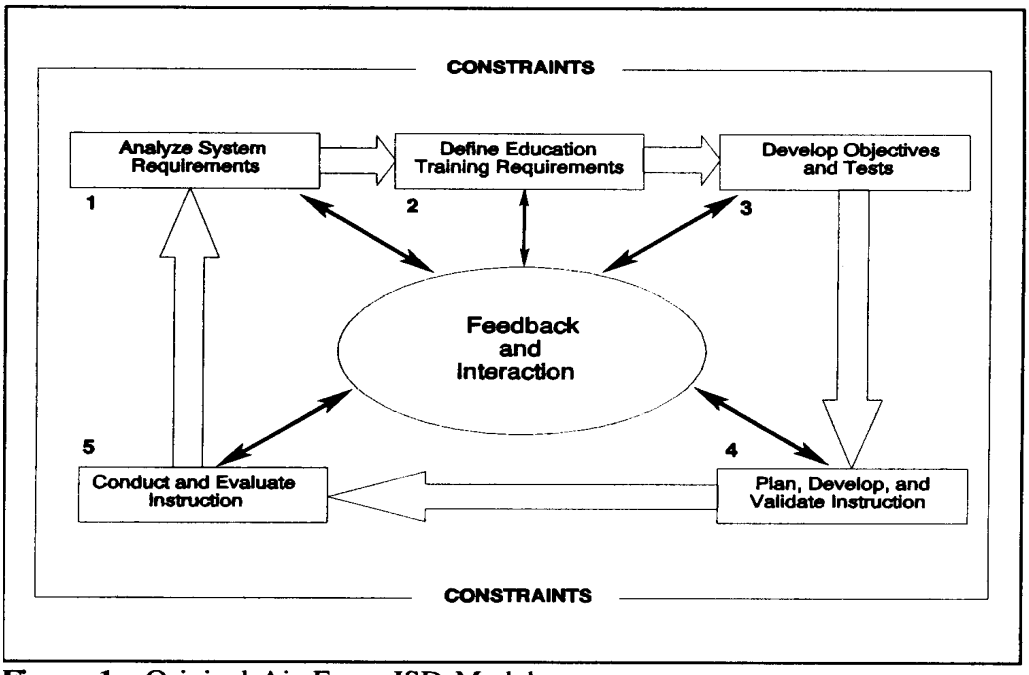


Figure 1. Original Air Force ISD Model

Description of the Model

The original Air Force model organizes the ISD functions into five steps.

1. **Analyze System Requirements**

   This is done through occupational, job, and task analyses which result in statements of behavior, conditions, and standards for task performances.

2. **Define Education and Training Requirements**

   This step includes a needs analysis to determine if training is needed, assessment of target population characteristics, and selection of tasks for instruction through consideration of such factors as criticality, learning difficulty, and frequency of performance.

3. **Develop Objectives and Tests**

   Here the developer writes the three-part objectives that define what the students should be able to do after instruction, the conditions under which they may perform, and the acceptable standard of performance. The developer then writes test items to measure student performance on each objective.

4. **Plan, Develop, and Validate Instruction**

   In this step, the developer designs and produces course materials. The developer tries these materials out on students using the criterion test items to ensure that the students can achieve course objectives.

5. **Conduct and Evaluate Instruction**

Here the course is fielded. Evaluation of instructional effectiveness continues for the life of the course and identifies needs that may develop for improving or updating the instruction.

Feedback and Constraints

This original model also shows (1) how the ISD process uses feedback and interaction among the functional blocks of activities to allow for continuous improvements to the products, and (2) how environmental constraints limit the designers' choices to what is possible.

Flexibility

The process allowed instructional developers to enter or reenter the steps of the ISD process as necessary to develop, update, or revise the instructional system. The Air Force model worked well and was considered adequaThe te. It supported an instructional system that was focused primarily on classroom education and technical training delivered by an instructor using the lecture/demonstration method.

Need for Updating

The Air Force instructional goals, which have not changed, are to field effective and efficient instructional systems that prepare individuals to meet Air Force performance requirements. However, the process, which served the Air Force well for many years, needed to be updated. Constant changes in the instructional environment, increasingly complex job requirements, new instructional technologies, and emerging automated instructional development tools, as well as other changes, stretched the capabilities of the Air Force ISD process. This led to a belief that the linear approach to ISD was not adaptable to today's conditions.

New Concerns

Today's concerns include not only classroom instruction, but also instruction that is exported to the job site using new delivery methods and technologies. New automated instructional development tools can make the instructional development more efficient. Building quality in instructional systems is a key concern. Other concerns are the concept of totally integrated training systems and how to do the ISD process in different applications such as systems acquisition, education, aircrew, and technical training programs.

Future Requirements

Principles of ISD have evolved over the past three decades from ISD as a tool for applying behavioral learning principles to classroom instruction, through models of step-by-step procedures designed to enable anyone to develop instruction, to sophisticated models concerned with complex technological as well as cognitive and attitudinal issues that require experienced instructional design experts to sort out.

Today instructional development, updating, and revision require expertise not only in instructional design but in media (e.g., computer hardware and software, video, interactive systems), cognitive learning theory, and vastly complex content areas. The scope of the expertise has gone beyond the capabilities of the single instructional design expert. It now requires a team of experts from any one of several disciplines.

Attempts are being made to use expert system techniques to help both the experts and novice instructional developers cope with contemporary advancements. If successful, these techniques will impact instructional design in fundamental ways, such as by providing ISD expert system tools.

It is clear that any new model of the ISD process should reflect the movement away from rigorously applied procedures and emphasize adaptability to changing environments. These concerns have become cornerstones in the revision of the Air Force's ISD process. Updating the process should allow the Air Force to meet today's need for effective and efficient instructional systems and continue to meet future challenges in instructional systems development.

One of the Air Force's greatest challenges will be to elevate the level of instruction, knowledge, and training which is currently being provided to personnel. It is not enough to enhance the methodology of an ISD system and its principles. Personnel must be trained in the multitude of disciplines and technologies which the Air Force is using and currently examining for future ISD use in order to accomplish the task.

Section B
Total Instructional System

Updated Air Force ISD Model

The updated ISD model has been designed to represent simplicity and flexibility so that instructional system developers with varying levels of expertise can understand the model and use it to develop effective, efficient instructional systems. This model depicts the flexibility that instructional developers have to enter or reenter the various stages of the process as necessary. Entry or reentry into a particular stage of the process is determined by the nature and scope of the development, update or revision activity.

System Functions

An extension of the systems approach places the ISD process within the functional design of a total instructional system. Figure 2 shows the basic top-level system functions of the instructional system: management, support, administration, delivery, and evaluation.

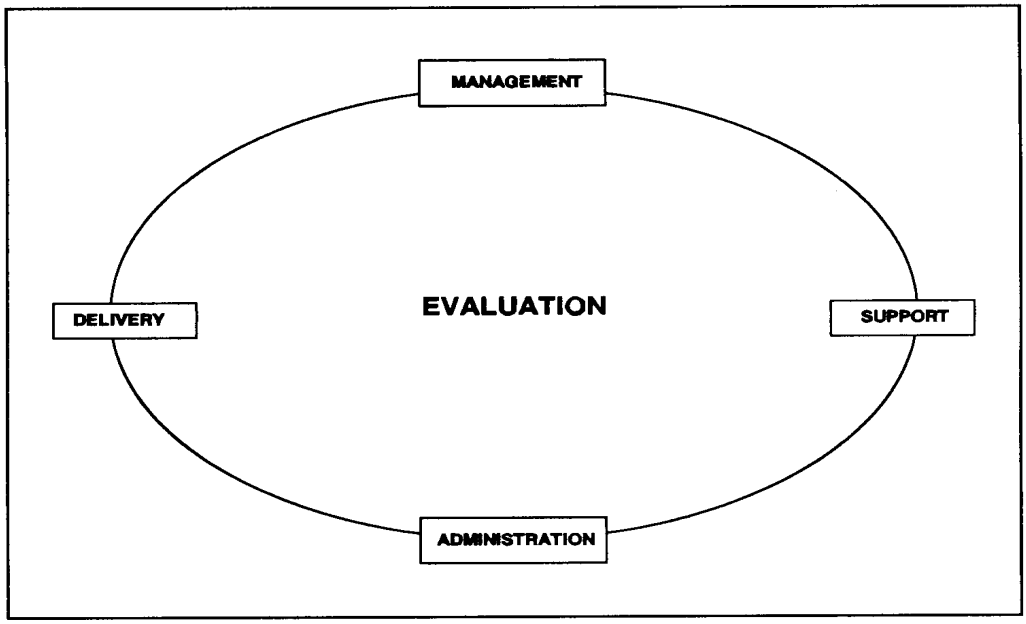


Figure 2. System Functions

What Are They?

The system functions of the ISD model are as follows.

·**Management**—the function of directing or controlling instructional system development and operations.

·**Support**—the function of maintaining all parts of the system.

·**Administration**—the function of day-to-day processing and record keeping.

·**Delivery**—the function of bringing instruction to students.

·**Evaluation**—the function of gathering feedback data through formative, summative, and operational evaluations to assess system and student performance.

Relation to ISD

Using these essential functions to design the overall instructional system architecture and then allocating them to the respective instructional system components, or people responsible, ensures that these functions are operational when the total training system is fielded. ISD products are integrated into the total instructional system, and aspects of the instructional system functions are active throughout all phases of the ISD process.

Figure 3 shows the phases most often used in the systems approach, which are analysis, design, development, and implementation, with the evaluation activities integrated into each phase of the process. The phases are embedded within the system functions. Evaluation is shown as the central feedback "network" for the total system.

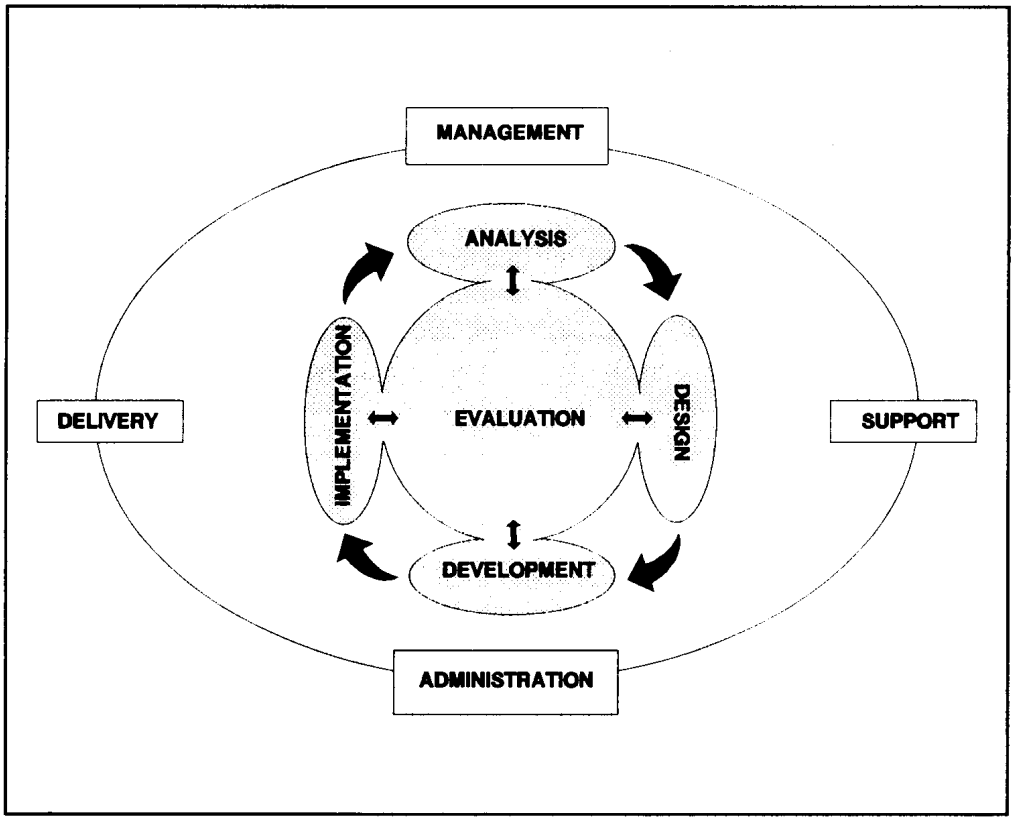


Figure 3. Functions with Phases

Relation To ISD (Continued)

The instructional development process, which the model summarizes, calls for instructional developers to:

- **Analyze** and determine what instruction is needed.
- **Design** instruction to meet the need.
- **Develop** instructional materials to support system requirements.
- **Implement** the instructional system.

Evaluation is a central function that takes place at every phase.

Symbolically, Figure 3 shows that all phases of the model depend on each of the other phases. The ISD process allows the instructional developer or design team to enter or reenter the various phases of the process as determined by the nature and scope of the development or revision activity. The phases of the updated model are described below.

Analysis Phase

In courses that tie the content directly to preparing a student to do a job, the instructional developer analyzes the job performance requirements and develops a task list. The developer then analyzes the job tasks and compares them with the skills, knowledge, and abilities of the incoming students. The difference between what they already know and can do and what the job requires them to know and be able to do determines what instruction is necessary. The activities of formative evaluation begin.

Design Phase

In the design phase, the instructional developer develops a detailed plan of instruction which includes selecting the instructional methods and media, and determining the instructional strategies. Existing instructional materials are reviewed during this phase to determine their applicability to the specific instruction under development. In this phase, the developers also develop the instructional objectives and test and design the instruction. The implementation plan for the instructional system is developed in this phase and a training information management system is designed, if required. Formative evaluation activities continue in this phase.

Development Phase

In the development phase, both the student and instructor lesson materials are developed. If the media selected in the design phase included items such as videotapes, sound/slides, interactive courseware (ICW), and training devices, these are developed. If a training information management system was developed for the instructional system, it is installed in this phase. As a final step in this phase, the implementation plan is updated. During this phase, instructional developers also validate each unit/module of instruction and its associated instructional materials as they are developed. They correct any deficiencies that may be identified. Validation includes:

·Internal review of the instruction and materials for accuracy
·Individual and small-group tryouts
·Operational tryouts of the "whole" system

Revision of units/modules occurs as they are validated, based on feedback from formative and summative evaluation activities. The final step in this phase is to finalize all training materials.

Implementation Phase

The instructional system has been designed and developed, and it is now time for the actual system to become operational. In this phase, the instructional system is fielded under operational conditions. The activities of operational evaluation provide feedback from the field on the graduate's performance.

Evaluation

Evaluation is a continuous process beginning during the analysis phase and continuing throughout the life cycle of the instructional system. Evaluation consists of:

·**Formative Evaluation**, consisting of process and product evaluations conducted during the analysis and design phases, and validation which is conducted during the development phase. Included are individual and small group tryouts.

·**Summative Evaluation**, consisting of operational tryouts conducted as the last step of validation in the development phase.

·**Operational Evaluation**, consisting of periodic internal and external evaluation of the operational system during the implementation phase.

Each form of evaluation should be used during development, update, and revision of instruction, if possible, and if the form of evaluation is applicable.

Updated AF ISD Model

Figure 4 depicts the completed ISD model. This completed figure shows the system functions and ISD phases embedded within the quality improvement (QI) process.

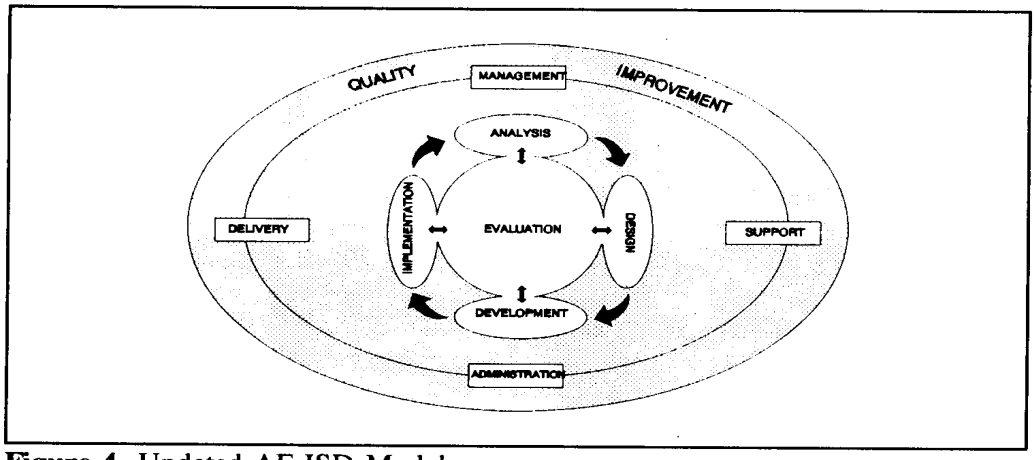


Figure 4. Updated AF ISD Model

The updated model graphically illustrates that:

·Evaluation is the "centerpiece" of the ISD process.
·ISD is a continuous process with the flexibility to enter and reenter the various phases, as necessary, to develop, update, or revise instruction.
·All ISD activities take place within and are dependent on the system functions.
·Teamwork is required between personnel performing system functions and those designing, developing, and implementing instructional systems.
·All ISD activities and system functions focus on continuous quality improvements in the system.

Section C
Quality Improvement

Introduction

The Air Force goal of continuous quality improvement is achieved in the ISD process. As can be seen in Figure 4, the entire ISD process takes place within the sphere of quality improvement. Throughout the process, each ISD activity and product is continuously covered in order to improve quality.

What It Is

Quality improvement (QI) is the continuous, organized creation of beneficial change to the system. The objective of quality improvement is to foster continuous improvement in the products and processes.

All of the principles of quality are implemented in the ISD process. The ISD process ensures total quality in the education and training environment by continuously evaluating the process and products. The relationship between the key concepts of QI can be easily seen in the ISD process. For example:

·Customers define quality. ISD emphasizes criterion-based instruction. The criteria are directly linked to performance requirements in the field. Field representatives identify education and training requirements which instruction providers such as Air Education and Training Command (AETC) or other training organizations are then under "contract" to satisfy. All evaluations are focused on the graduate's actual job performance.

ISD and Quality Relationship (Continued)

·Know your mission. ISD depends on mission and job analysis for the necessary data to design, develop, and implement instruction. All instruction should be based directly on mission or job requirements. The quality checks in the analysis process help eliminate instruction that is unrelated to the job.

Job analysis uses data from many sources, including mission statements found in regulations or locally developed statements. Instructional developers also make use of management engineering reports, occupational survey data, and direct observation to determine the actual job requirements.

As part of the job analysis process, an instructional needs assessment is conducted to determine what the actual performance problems are. In some cases, a problem is not due to a lack of instruction, but to deficiencies in the job structure or environment. The ISD process helps ensure that instruction is not developed for non-instructional problems. Instruction may also be developed as a "preventive" measure-that is, to prevent problems and to meet the informational and educational needs of Air Force personnel.

·**Know your customers.** The information gained in the mission/job analysis process gives the instructional design team information that defines the customer's expectations.

Everything that can be done to help students learn should be factored into instructional system design. ISD is based on the premise that what the person needs to do the job determines the instructional requirements.

·**Set goals and standards.** The goals and standards for an instructional development effort come in many variations. First, the job requirements and the impact of the performance deficiency determine the timing required for the development process and the conduct of the instructional program. Second, the content of the instruction is determined by the person's needs to do the job. The design team should directly translate the cues, conditions, and performance standards of the job directly into the instructional program.

·**Focus on customers.** As mentioned earlier, the gaining unit or work center needs determine instructional requirements. By continuing to trace the relationship between the job requirements and the person's needs to do the job, a continual focus on the actual field requirement is maintained. In addition, the ISD process requires that the capabilities, aptitudes, and attitudes of the target audience be considered.

·**Manage by fact.** Each phase of the ISD process requires constant evaluation against the job requirements identified earlier in the process. In addition, a variety of tools have been developed to ensure that design and development decisions are made with supporting data. For example, a number of media selection tools are being used which provide managers information to match training media with the instructional requirements. These matches are based on learning theories and development cost factors (money and time). ISD is designed to guide managers and developers to awareness of factors affecting their decisions.

Foster teamwork. An instructional program cannot be designed and developed in a vacuum. In order to develop effective instruction, the design team should be in constant touch with the work center and evaluation offices, to ensure that the training matches the performance requirements of the job.

·**Empower your people**. ISD is a problem-solving, decision-making model. Since ISD is flexible and there are any number of ways to solve a given instructional problem, a design team should be allowed freedom and authority in designing, developing, and implementing instruction that meets job performance requirements.

·**Integrate quality in all phases**. Evaluation is continuous quality checking. This is true during each phase of the ISD process, from analysis to implementation. Built-in checks in each phase ensure the quality of the ISD process and instructional products with emphasis on satisfying training requirements and producing graduates who can do their jobs.

. Evaluate quality constantly. The ISD process is a cyclic, ongoing process of continuous improvements. As instructional developers progress through the different phases of ISD, the process and products of each phase are constantly evaluated against the instructional requirements and principles of learning. The results of the evaluations determine which phase of ISD to enter next. Constant evaluation identifies changes in instructional requirements due to updates in equipment and personnel which result in new ISD efforts to provide the best possible instruction to Air Force Personnel.

Chapter 2
LEARNING THEORY

Overview

Definition

Learning theory is the body of principles proposed by psychologists and educators to explain how people acquire skills, knowledge, and attitudes.

Purpose in Instruction

Learning theory is used in formal instruction to facilitate and accelerate the learning process. When applied to the practice of instruction, learning principles, derived from theories, can guide the instructional developer in improving the effectiveness and efficiency of the learning activities of a program.

Relation to ISD

Learning theory impacts instructional systems development in several ways.

·Many of the products specifically called for in the ISD phases are derived from behavioral learning theory. In the 1950s, behaviorists developed procedures for designing "programmed" instruction that included:

··Analyzing and breaking down content into specific behavioral objectives.
··Determining procedures needed to achieve the objectives.
··Trying out and revising the steps.
··Validating the program against the objectives.

This approach was incorporated into the early ISD procedures.

·Instructional developers apply learning theory to select instructional strategies for the type of learning required. To the extent that there are real differences in the types of learning, e.g., intellectual skills, motor skills, or attitudes, cognitive strategies, different instructional techniques may be needed.

·Instructional developers look to learning theory to explain how individuals differ in the ways they learn. Understanding different learning styles, in order to target methods and materials to individual students, may become the most important theoretical area for enhancing learning.

Section A
Theoretical Approaches

Behavioral Theory

The behaviorist school says that learning takes place when the student makes an association between a **stimulus** or **cue** and the desired **response** behavior. When the behavior is given a positive reward, the learning is believed to be **reinforced**. Learning proceeds as students become able to distinguish among stimuli and make appropriate responses to them. Stimulus events or cues and the corresponding responses are combined into complex patterns. Learning to interpret complex cues and associate them with responses leads to comprehension of the total situation.

Cognitive Theory

Most current theories of learning are cognitive theories. Concern is focused on what is going on in the learner's mind. Two major models of cognitive theory are the information processing model and the social interaction model.

Information Processing Model

The information processing model says that the learner's brain has internal structures that select and process incoming material, store and retrieve it, use it to produce behavior, and receive and process feedback on the results.

A number of cognitive processes are involved in learning, including the "executive" functions of recognizing expectancies, planning and monitoring performance, encoding and chunking information, and producing internal and external responses.

Social Interaction Model

Social interaction theory says that learning and consequent changes in behavior take place as a result of interaction between the learner and the environment. Behaviors are modeled either by other people or symbolically. The environment demonstrates the consequences of the modeled behaviors, and the learner cognitively processes the observed behaviors and consequences, and changes his own behavior appropriately. The cognitive processes include attention, retention, motor responses, and motivation. Techniques for achieving learning include direct modeling and verbal instruction. Behavior, personal factors, and environmental events all operate together to produce learning.

Section B
Types of Learning

Introduction

In this section, learning is addressed in terms of the individual types of learning and the integration of human activities. Categories of learning types establish a framework for how learning takes place. In real life, these types of learning are integrated. This integration is discussed in terms of schemas, enterprise theory and metaskills.

Types of Learning

Learning theorists have categorized human activity into types of learned behavior. Gagné's (1985) categories of learning types are the most inclusive. They include intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. Gagné suggests that each type of learning requires different internal conditions for processing to occur. Internal conditions may be cued or prompted by external conditions present in the learning environment.

Intellectual Skills

Intellectual skills are the foundation for all higher learning. They consist of discrimination, concepts and rule-using. Cognitive strategies are often called a higher-order type of intellectual skill.

Intellectual skills are hierarchical in nature. For example, in order to learn a higher-order skill, the learner should possess the prerequisites and have already learned the lower-order skills such as discriminations, concrete concepts, defined concepts, and rule learning.

Discriminations

Discriminations are skills related to seeing differences between stimuli. Most adult problems in discrimination come from physical disabilities like color blindness, hearing loss, or some injury that affects sensory perception.

Concrete Concepts

Concrete concepts are skills related to categorizing physical objects into one or more classes based on their physical attributes. Identifying resistors from among other electrical components is an example of concrete concept learning.

Defined Concepts

Defined concepts are skills related to classifying symbolic objects into one or more classes based on a definition. The definition is actually a rule for classification. For example, classifying a verbal statement from an officer as a command is an example of a learned defined concept.

Rule Learning

Rule learning skills relate to applying principles or procedures to solve problems. Problem solving is the ability to recall relevant rules and use them to solve a novel problem. The product of problem solving is not only a solution to the problem, but also learning a new rule or procedure to be used if a similar situation should arise in the future.

Verbal Information

Verbal information is the learning of names and labels that can be verbalized. It is also called declarative knowledge. Verbal information learning requires some basic language skills. In addition, verbal information is more readily retained when it is learned within a larger context of meaningful information.

Cognitive Strategies

The basic premise of an information processing model is that individuals mentally process their environment. This process consists of a number of stages in which the stimuli become information, which is given meaning by previous knowledge and current expectations. Cognitive strategies are employed to maintain the knowledge in short-term memory and translate it to a structure that enters long-term memory as a type of knowledge in the form of propositions, productions or schemas.

Cognitive strategies are thought of as executive control mechanisms for learning. Monitoring the use of strategies is "metacognition." Cognitive strategies used in metacognition are called metacognitive strategies.

There are different types of cognitive strategies such as clustering items into similar groups to reduce memory load, reading strategies to increase comprehension, and others. Good learners have a variety of strategies they can use to process new information.

Motor Skills

Motor skills are learned behaviors that involve the smooth coordinated use of muscles. Motor skills most often involve a sequence of activities that may be described verbally as an "executive subroutine." This verbal information is learned to provide guidance for learning the execution of the motor skill. When the learner has acquired the motor skill, the verbal routine is no longer needed and the skill is performed in a smooth and continuous manner.

Motor skills may be learned by modeling, as when a coach shows a student how to swing a golf club.

Motor skills require practice and kinesthetic (natural) feedback. Verbal feedback from an observer also helps the learner make corrections in performance. Much of the instruction is aimed at getting the student to recognize the feel of the motor performance when it is executed correctly.

Attitudes and Motivation

The acquiring of particular attitudes may require the prior learning of intellectual skills or particular sets of information. For example, if a positive attitude toward safety is to be acquired, the learner should have (1) intellectual skills (concepts and procedures) associated with safety, and (2) a variety of verbal information about the advantages of following safety procedures or the consequences of not following them.

Attitudes have mutually supportive relationships. An individual generally tries to maintain consistency with regard to choice behaviors. However, attitudes are based on perceptions of reality. These perceptions are colored by misinformation or critical experiences.

Attitudes are learned or influenced by observing others and viewing the consequences of their behavior. This type of learning (vicarious) is a distinct principle of social learning. External conditions for learning attitudes include a human model.

Experiences play a major role in the formulation of attitudes.

Motivation plays a significant role in learning. Keller (1987) has developed a general model integrating the various sources of motivation for learning. He calls it the ARCS model, an acronym for the four sets of conditions that should be met to have a motivated learner:

·**A** for attention.

Attention involves grabbing the learner's interest at the beginning of instruction and maintaining that interest throughout the lesson and course.

·**R** for relevance.

Relevance is the personal significance and value to the learner of mastering the learning objectives.

·**C** for confidence.

Confidence relates to the learner's expectancy of success.

·**S** for satisfaction.

Satisfaction comes from achieving performance goals.

Integration of Human Activities

In real life, the types of learning are integrated. This integration is discussed in terms of schemas, enterprise theory and metaskills.

Schemas

Intellectual skills should be integrated into existing knowledge to be remembered and recalled. They are thought to be stored as schemas and as part of propositional networks. A schema is a structured set of memory elements, (propositions, images, and attitudes) representing a large set of meaningful information pertaining to a general topic. The topic may be an object, such as a jet fighter, weapon, or officer. Or it may be an event, such as a preflight check or preventive maintenance procedure. Regardless of type, schemas contain information on certain well-understood features of the object or event. These features, called slots, are filled in by the learner when encountering new information that relates to the schema. Schemas are acquired through experience and may be the greatest benefit of apprenticeships.

Recent theory proposes that intellectual skills are "situated." That means their utility is in a large part a function of how they are learned. In order that they do not become "inert knowledge," they should be learned and practiced within a broader context.

Enterprise Theory

Gagné and Merrill (1990) proposed a method to identify learning goals that require an integration of multiple objectives. They proposed that such an integration of multiple objectives be conceived in terms of the pursuit of a comprehensive purpose in which the learner is engaged, called **enterprise**. An enterprise is a purposeful, planned activity that may depend for its execution on some combination of verbal information, intellectual skills, and cognitive strategies, all related by their involvement in the common goal. A task for the instructional developer is to identify the goal of a targeted enterprise along with its component skills, knowledge, and attitudes, and then to design instruction that enables the student to acquire the capability of achieving this integrated outcome.

Metaskills

The metaskill concept (Spears, 1983) refers to the complex skills of adapting, monitoring, and correcting the use of individual skills in complex performances that integrate cognitive, perceptual, and motor processes. Proficiency in metaskills depends on the number of individual skills practiced. Plateaus in performance are related to the intervals required for students to put together new sets of metaskills.

Processes involved include:

- Gaining organic knowledge of the effects of actions on overall goals.
- Organizing knowledge hierarchically to include cause-effect rules.
- Developing monitoring procedures that incorporate outcome expectancies.

Alternative Learning Strategies

The types of learning previously discussed in this section include more traditional behavioral outcomes as well as some of the newer cognitive outcomes. These learning outcomes, as well as others, are being enhanced by new alternative learning strategies. A brief discussion of accelerated learning is provided as an example of an alternative learning strategy.

Accelerated learning is a method of using traditional and non-traditional techniques to increase instructor and student motivation. The principles of accelerated learning apply to classroom instruction as well as individual multimedia methods. In the accelerated learning environment, students and instructors tend to be more creative, motivated, team-oriented, and willing to try different things.

In the classroom environment, where possible, instruction is put into a social context to enrich mental performance and help supply diversity. Classroom activities involving **interpersonal** skills such as role playing, games, and skits provide students with an opportunity to interact and express themselves. These activities also allow students to strengthen their **intrapersonal** skills by interpreting information in light of their own personal experiences.

With accelerated learning techniques, the environment in which students receive instruction plays a key role in the learning process and should be attended to when developing instruction using the principles of accelerated learning. For example, lighting, temperature, decorations, and seating arrangements should be adjusted and controlled to enhance learning.

Some of the other alternative learning strategies being used in today's learning environment include:

·Cooperative learning
·Situated learning
·Constructive approach
·Cognitive apprenticeship
·Scaffolded instruction
·Reciprocal teaching
·Concept mapping

Section C
Applying Theory to the Learning Situation

Introduction

Within real-world constraints, instructional developers design instructional programs and select learning contexts and materials to implement learning principles contained in a given theory. The learning context relates to the external situation that enables new learning to be associated or connected to previous learning. For example, if students are to learn a list of names, associating them with a previously learned list is often very effective.

Context Variables

The context in which something is learned determines not only what is learned but how it can be used in the future. Learning is situated in the context and gains meaning from that context. For example, problem solving should occur in an authentic context. The information and principles learned when solving real problems may be better remembered by the student.

Cooperative Learning

Social cognition psychologists feel that a context promoting cooperative learning is more helpful to students than one promoting individual work, especially with regard to learning attitudes.

Other psychologists see cooperative learning situations as effective when the interaction among students can supply learning support through tutoring and feedback. For example, peer tutoring is a technique for improving learning in a particular type of context.

Learning Activities

Students learn as they confront the response demands built into activities. Good activities are built around the attainment of multiple goals. They engage students in active forms of learning, help develop values and critical thinking skills, are built around important content, and are well matched to the learner's abilities, interests, and learning style. Different types of instructional delivery systems have been associated with particular instructional contexts. For example, computer-assisted instruction was considered most appropriate for individualized instruction because it could be personalized, test for misunderstandings, and provide feedback. However, it has been determined that the computer can be an important part of cooperative learning environments.

Technology Changes Context

Emerging ICW technologies such as CD-ROM, videodisc, fax, conference phones, and two-way satellite TV change the context of instruction. This is because technology not only delivers information, but is also a tool that can be used to enable information retrieval from knowledge databases in ways different from printed text. The encyclopedia on a CD-ROM is not likely to be used in the same way by a learner as the same encyclopedia in the form of printed text.

Materials

The nature of the materials affects the stimuli with which the learner interacts during the process of learning. Instructional materials are often used in the broader context of an instructional delivery system. A textbook, for example, is meant to be used with a teacher. The textbook does not provide, in most cases, enough learning support to complete the learning process. Most students cannot learn from it without additional information. These broader instructional delivery systems often provide a variety of materials in what is called a "multimedia" environment. This environment might include a live instructor or might be totally mediated as in a computer-interactive video.

Emerging technologies make distinguishing between different types of materials difficult, but the features of the delivery systems can be described in terms of their capabilities for providing different stimuli and different "events" of instruction. For example, using interactive video as the delivery system can provide several sources of stimulation for the students, such as "multiple learning tracks" and "self-pacing," both of which serve to stimulate the students. Interactive courseware also has many applications in the "events" of instruction. For example, interactive courseware can be used to "stimulate recall of prerequisites" while providing feedback at the same time at the appropriate points in a lesson.

One-on-One

It is believed that the most capable delivery system would be the expert (instructor) working one-on-one with the learner on real problems in a real situation. For example, if the skill to be learned were maintaining a plane's fuel system, the ideal situation would seem to be to pair a novice with an expert and have the expert explain the procedure while the novice performs it. In this case, the instructor can provide for the occurrence of all the events of instruction.

Mediated Materials

Different mediated learning systems have different capacities for providing these events. For example, a videotape can elicit learner responses to a question but it is only capable of giving rhetorical feedback. It is incapable of correcting learner misunderstanding because it is incapable of judging whether the response to a question was correct.

Physical Objects

Situations that contain physical objects are the most concrete and easy to understand because they don't require the translation of symbols. When instruction is done with real objects, all the cues for later performance are available. However, real situations may be very complex or hazardous, and it may be simpler to gain information from a simplification of the real situation in the form of a mock-up or simulation.

Learning situations utilizing physical objects call for the learner to manipulate the objects. Through handling them the learner gains much information about their size, sturdiness, complexity, and other features. By handling the object, the learner is building schemas of the experience that may be important in future learning.

Real materials are often used in demonstrations by instructors. A demonstration makes the learner an observer of the expert handling the equipment. This instructional technique usually involves the transmission of a great deal of declarative knowledge about the object being discussed, which the learner encodes and stores with greater rapidity than in the handling environment.

Film and Video

Media-type materials such as film and videos are more abstract than physical objects. These media generally have a linear format, and information is paced by the delivery system. They usually present a visual image from an objective rather than a subjective point of view, and they are edited to compress time. This removes cues that are available from the real equipment and handling activities.

Pictures and Text

Most abstracts are still pictures, diagrams, and printed text. In order to understand text you very often need to look at the real object, and to understand the real object you have to read the text. The text is providing what Reigeluth (1983) calls an instructional overlay that provides the learner with the events of instruction that cannot be provided by the object itself. On the other hand, the real object provides the context for using the information from the text. Both are more efficient when used together.

Printed Text

The most abstract medium is printed text. To gain meaning from printed text and illustrations, the learner should be able to read (that is, decode) words. Furthermore, the learner should be able to comprehend what is being said. Learning is more difficult because physical cues are absent. The learner cannot query the author when there is ambiguity in the message.

Printed text is generally "formal" and follows different rules for communication than demonstrations or video instruction. This formality makes printed text more difficult to understand. Authors also vary in their ability to write clearly and use illustrations to provide learning guidance.

Internal Events of Information Processing

Events of learning are a set of communications embedded in instructional activities. They serve the function of activating internal events of information processing. The learning process is shown in the following table.

Learning Process	Learning Phase
Expectancy	Motivation
Perception	Apprehending
Working Storage	Acquisition
Encoding	Processing
Storage	Retention
Learning Process	**Learning Phase**
Validation of Understanding	Feedback
Transfer	Generalization
Valuing	Personalizing

Guidelines for Application

The model addresses procedures for developing instruction and this chapter addresses learning theory. Together they provide an orderly method for systematic decisions in an integrated design.

The procedure for developing instruction is guided by the application of learning theory based on known approaches that work. Instructional designers use "what works" for a given application. Once an approach has been selected, you need to be consistent in the learning analysis, development of objectives and choice of instructional strategy.

Additional Information

For more information on applying learning theory to learning, see:

·AFMAN 36-2236, Handbook for Air Force Instructors.

·Gagné, R. M. and Merrill, M. D. (1990). Integrative Goals for Instructional Design. *Educational Technology Publications*, 38(1), 1-8.

·Keller, J. M. (1987). The Systematic Process of Motivational Design. *Performance and Instruction*, 26(9), 1-8.

·Merrill, M. D., Tennyson, R. D. and Posey, L. (1992). *Teaching Concepts: An Instructional Design Guide* (2nd Ed.). Englewood Cliffs, New Jersey: Educational Technology Publications.

·Merrill, M. D., Lee, Z., and Jones, M. K. (1990). *Second Generation Instructional Design (ID_2).* Englewood Cliffs, New Jersey: Educational Technology Publications.

·Reigeluth, C. M. (1983). Instructional Design: What Is It and Why Is It? In C. M. Reigeluth (Ed.), *Instructional Design Theories and Models: An Overview of Their Current Status*. Hillsdale, New Jersey: Erlbaum Associates.

·Spears, W. D. (1983). *Processes of Skill Performance: A Foundation for the Design and Use of Training Equipment*. (NAVTRAEQ-VIPCEN 78-C-0113-4). Orlando, Florida: Naval Training Equipment Center.

·Tennyson, R. D. and Michaels, M. (1991). *Foundations of Educational Technology: Past, Present and Future*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Chapter 3
Planning

Overview

Introduction

Planning the instructional system structure and functions includes determining ISD process management and evaluation strategies, and estimating resource requirements and constraints. It also includes determining the instructional needs and concepts. This planning should take place before developing an instructional system or revising existing courses can begin.

The instructional developer or design team may be responsible for doing the preliminary planning activities, or some of the planning decisions may have been made by another Air Force organizational level or sometimes a contractor. Although not a specific phase of the ISD process, planning is a key event and occurs throughout the process.

Note: During this discussion on planning and throughout this manual, several plans are frequently mentioned. Though mentioned, proliferation of documentation is discouraged. A minimal record of decisions made for future reference is often sufficient. Also, in some organizations a single plan with subsets may be adequate.

Additional Information

For more information on planning, see:

- Briggs, L. J. and Wager, W. W. (1981). Handbook of Procedures for the Design of Instruction (2nd Ed.). Englewood Cliffs, New Jersey: Educational Technology Publications.
- Dick, W. and Carey, L. (1990). The Systematic Design of Instruction (3rd Ed.). Glenview, Illinois: Harper Collins Publishers.
- Knirk, F. G. and Gustafson, K. L. (1986). Instructional Technology: A Systematic Approach to Evaluation. New York: Holt, Rinehart and Winston.
- Rossett, A. (1987). Training Needs Assessment. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section A
Determine Instructional Need

Introduction

The first activity before entering the ISD process is to determine that personnel need some kind of instruction. Assessing instructional need is a critical activity that should be performed before any other planning occurs or additional resources are committed to a project. A good assessment should tell you if the "need" can be satisfied with instruction or may require some other solution such as a policy change, new procedures, better working conditions, or others which are normally solved by management.

What Are Instructional Needs?

The term "instructional need" has several definitions (Stufflebeam, 1985). The definitions most often used are:

·**Discrepancy view**. A need is the difference between "what is" and "what should be." In this definition, the difference between what "is being taught" and what "should be taught" is the discrepancy.

·**Democratic view**. Needs are identified by a group of experts (instructional developers, project managers, and others) who, by the democratic process of majority rule, determine what changes need to be made to the instruction.

·**Diagnostic view**. Need is determined by identifying concepts, principles, and procedures whose absence or deficiency would hamper the students in meeting job performance requirements.

·**Analytic view**. Need is determined by accurately predicting the future instructional needs based on the current instructional situation.

How To Identify Instructional Needs

Instructional need is identified when there is a lack of skill, knowledge and attitudes that personnel should have in order to perform an activity adequately.

Examples of types of skills, knowledge and attitudes that personnel may not have are:

·Behavioral - skills in using tools and test equipment
·Cognitive - knowledge of information
·Affective - knowledge of effective interpersonal skills

Who Determines Instructional Needs?

Instructional developers or the design team can receive a statement of instructional need from any Air Force organizational level, or the instructional developers may perform an instructional needs assessment in response to a performance problem, or it may be part of a statement of work for a new acquisition.

What Signals Instructional Needs?

Instructional needs may be present when:

·A problem surfaces in an area where there is no current instruction.
·Technical or doctrinal changes make existing instruction obsolete.
·A new weapon system is planned.
·Instruction in a topic is mandated.
·Educating for future assignment.

Stages of Assessing Instructional Needs

The four stages involved in assessing instructional needs are:

·Planning the assessment.
·Defining the problem.
·Documenting the deficiency.
·Developing the solution.

How To Do It

Instructional needs assessment is the means of identifying whether there is a need to develop or revise instruction to solve an identified problem. A performance problem might be related to a design in which the instructional strategy does not support the learning process. The steps of instructional needs assessment are:

St ep	Activity	Purpose
1	Determine and state purpose	·Determine purpose and objective of the assessment. ·Develop plan for conducting the needs assessment. ·Document the plan.
2	Identify data requirements	·Identify data that describes the actual performance and the desired performance.
3	Select data collection method	·Select appropriate method of collecting data such as: ··Interview ··Questionnaire/survey ··Records and reports ··Group discussion ··Work samples ··Observation
4	Collect and analyze data	·Collect sufficient data to document the performance deficiency. ·Analyze data to identify the performance deficiency.
5	Develop instruction	·Develop or revise appropriate instruction to solve the performance deficiency.

Section B
Determine Instructional System Concepts

Introduction

The total instructional system concept provides the framework for applying the ISD process. The instructional system concept provides your best initial estimate of what the instruction should do and what it should look like. Determination of an instructional system concept is guided by the determination of the needs and the application of learning theory.

Instructional Concep Elements

When planning the instructional system concept, make a preliminary estimate of the requirements and constraints to be considered in fielding the total instructional system. These should include requirements for the system functions of:

·Management - directing and controlling instructional system development and operations
·Support - providing for and maintaining all parts of the system
·Administration - day-to-day processing and record keeping
·Delivery - means of bringing instruction to the student
·Evaluation - assessment of how well the system and the students perform
·Quality improvement - process and product compliance with approved plans, procedures, and processes

What the Instructional Concep Covers

When conceptualizing the overall instructional system, address:

·Overall description of the instruction
·Mix of instructional methods and media
·Overall length of instruction
·Location of the instruction
·Anticipated student load
·Alternative solutions to resource constraints

Planning Considerations

The instructional system concept is determined from information about:

- ·Type and amount of instruction that may be needed
- ·Target audience
- ·Estimated funding requirements
- ·Equipment likely to be needed
- ·Type and size of facilities that may be needed
- ·Appropriateness of conducting training on-site
- ·Estimated time required to deliver the system
- ·Possible impact on personnel
- ·Use of existing and/or modified training equpment

Sources of Information

Concept planning information may be obtained from:

- ·Existing courses
- ·Subject matter experts
- ·Learning principles
- ·Higher level functional or policy guidance

Ensuring That the Concepts Meet the Needs

Achieving an instructional aim accomplishes the goal of meeting the need. When developing the overall description of what instruction should do and look like (the concept), consider each instructional aim to ensure that you meet the need. The following table describes the instructional aim for each learning phase.

Learning Process	Learning Phase	Instructional Aim
Expectancy	Motivation	Build relevancy and communicate the goal.
Perception	Apprehendin g	Focus attention.
Working Storage	Acquisition	Present information in manageable units.
Encoding	Processing	Build upon existing knowledge.
Storage	Retention	Merge new information with existing knowledge.
Retrieval	Recall	Attach new skills, knowledge, or attitudes (SKA) to environmental cues.
Validation of Understandi ng	Feedback	Test accuracy of new SKA.
Transfer	Generalizati on	Allow for generalization of recall cues.
Valuing	Personalizin g	Reinforce meaningfulness of new SKA.

Output

Training system concepts provide the structure for organizing and integrating all of the activities required by a total instructional system.

As planning proceeds, you should adjust the parts of the system concept to fit real-world constraints or take advantage of opportunities that may arise.

Section C
Determine Resource Requirements and Constraints

Introduction

The instructional system concept may suggest major considerations from which you can estimate the requirements for equipment, facilities, personnel, and time, which, along with funding, should translate into the ideal instruction for meeting the identified need.

All of these requirements categories are subject to constraints that may limit your design and cause you to look for alternatives.

Early Planning

You need to include resource requirements and constraints in your early planning to ensure that you have enough time to secure the resources, or in the case of a constraint, you have time to solve or "work around" the problem.

Requirements Categories

The resource requirements for an instructional system should generally fall into the following categories:

·**Equipment** - How many personal computers will you need? Will you need special equipment to be built? When will you need it?

·**Facilities** - How large should the facility be? What are the power requirements? Are you involved with the facility design reviews?

·**Personnel** - How many instructors/instructional developers will you need? What experience do they need? Will instruction/courseware be contracted? If so, to what degree?

·**Time** - How much lead time do you need to procure the equipment, facilities, and personnel? How long will it take to complete course development? How long will the instruction take?

·**Funding** - What are the funding requirements to obtain the equipment, facilities, and personnel you need to develop and operate the instructional system? What will be the life cycle costs to operate and maintain the system? If training on-site, what are temporary duty costs?

Who Is Responsible?

Although other activities may have responsibilities for providing resources, the instructional systems manager has the overall responsibility for securing needed resources.

If You Can't Get Resources

If you can't get the required resources, you should work around the constraint or select another alternative. For example:

- If you can't get your part-task trainer, borrow operational equipment from the using command.
- If you need eight computer terminals and only have four, operate the course on two shifts.
- If you need hand tools and test sets that are required by technical order, borrow or use substitute equipment.

Section D
Develop ISD Management Plan

Introduction

As previously stated, planning is the keystone of instructional development. When planning to develop an instructional system, you need to develop an ISD management plan. The ISD management plan is a subset of the system training plan (STP).

Why Have a Plan?

A properly developed ISD management plan ensures that you have a "roadmap" to keep the instructional development process on course.

Information in the plan is periodically compared to the actual progress to ensure that the intent of the plan is being carried out and that a quality instructional product is delivered on time and within budget. The ISD management plan meets milestones set out in the STP.

Who Is Responsible?

Managers are responsible for developing an ISD management plan for each instructional development project. Everyone involved in the project is responsible for doing their part to keep the project on course.

What Is in the Plan?

Content of the ISD management plan is determined by managers in the instructional activity. However, the plan should contain adequate information to manage the instructional development project.

The plan may contain information such as:

·Approval dates/signature
·Definition of the project
·Overall project responsibility
·Individual task responsibilities
·Milestones
·Identified constraints
·Support requirements

Section E
Develop ISD Evaluation Plan

Introduction

Evaluation should be integrated throughout each activity of the ISD process. Whether you call it evaluation or quality improvement— *it's important*. As a manager, one of your top priorities is to develop an ISD evaluation plan to ensure that the instructional development process and products are of high quality. Criteria for evaluation and acceptance are the key to evaluation. These criteria should be specific enough to be used to measure the quality of products submitted by a contractor. Training effectiveness standards are **crucial**.

Quality Concerns

Quality is your first and last concern when making plans to develop a new instructional system or revise an existing system. The concern for quality continues throughout each phase of the development process.

Evaluating or assessing the quality of the process and products of each phase of instructional development is the centerpiece of ISD.

Why Have a Plan?

An ISD evaluation plan is necessary to establish what and how you are to evaluate during the instructional development process. The plan, which is the "benchmark" for quality, ensures that the ISD process results in a total quality system.

Who Is Responsible?

Managers (such as project officers, supervisors, or training specialists) are responsible for developing a comprehensive ISD evaluation plan. Some organizations may have an evaluation office prepare this plan. However, everyone is responsible for quality.

What Is in the Plan?

The ISD evaluation plan includes information sufficient to ensure that the ISD process results in total quality in both process and products. The plan may include, but is not limited to, the following information:

·Identification of responsibilities including taskings
·Scope and purpose of the evaluation
·How and when the evaluation activities are to be accomplished
·Documentation and report requirements

Chapter 4
ANALYSIS

Overview

Introduction

When a needs assessment has indicated a need for some form of instruction, and the necessary ISD project planning has been done, it is time to enter the **analysis phase** of instructional development. During this phase, instructional developers conduct various forms of analyses such as occupational, job, mission, task, learning, resource, and target analyses. The nature and scope of each ISD project determines which of the various analyses you conduct. For example, revising an existing course to cover a new piece of equipment would not require another job, learning, or target audience analysis. Instructional systems that are developed or revised based on objective, valid and reliable analysis are likely to be more accurate and appropriate than instruction that is not.

Managers should evaluate products of the analysis activities in terms of the initial evaluation plan for the ISD project and update the evaluation plan as required. Also, since the management plan ensures that the project remains on course and schedule, the management plan should be updated to reflect any necessary adjustments.

Where Are You in th Process?

In order to better visualize the process, an ISD model with analysis highlighted is provided in Figure 5.

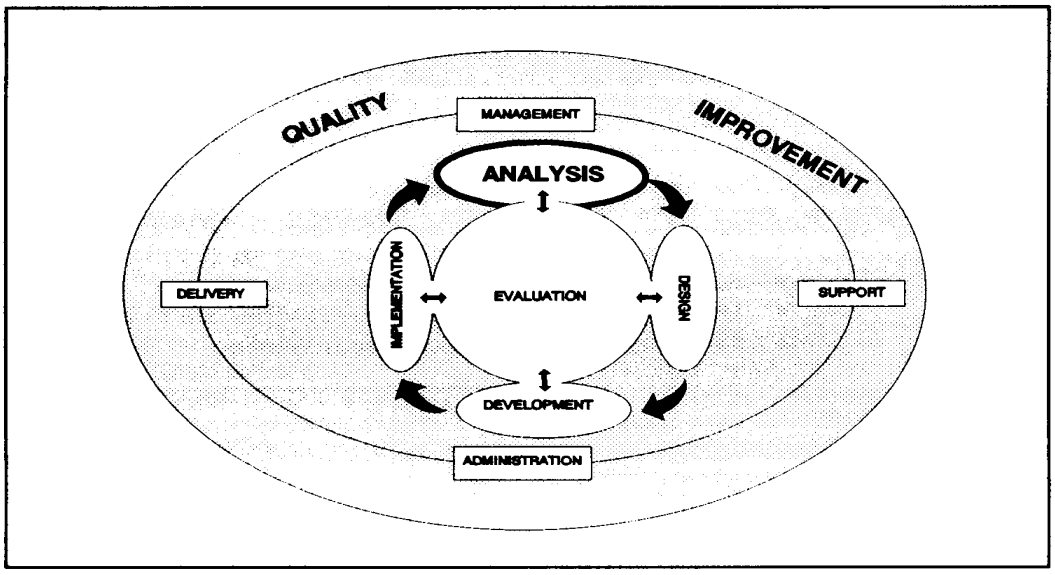


Figure 5. Analysis Phase

Objectives

The objectives of this chapter are to:

- Explain the various types of analyses that may be conducted in the analysis phase.
- Explain update of the ISD evaluation plan.
- Describe update of the ISD management plan.

Additional Information

For additional information on the analysis phase of instructional development, see:

- Beckschi, P. F., Lierman, B. C., Redding, R. E. and Ryder, J.M. (1993) *Procedural Guide for Integrating Cognitive Methods into Instructional Systems Development Task Analysis*. Brooks Air Force Base, Texas: Air Force Materiel Command.
- Briggs, L. J. and Wager, W. W. (1981). *Handbook of Procedures for the Design of Instruction* (2nd Ed.). Englewood Cliffs, New Jersey: Educational Technology Publications.
- Dick, W. and Carey, L. (1990). *The Systematic Design of Instruction* (3rd Ed.). Glenview, Illinois: Harper Collins Publisher.
- Gagné, R. M. (1985). *The Conditions of Learning* (4th Ed.). New York: Holt, Rinehart and Winston.
- Leshin, C. B., Pollock, J. and Reigeluth, C. M. (1992). *Instructional Design Strategies and Tactics*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section A
Occupational/Educational/Mission Analysis

Introduction

Normally, the analysis phase begins with an occupational, educational, or mission analysis. The term used to identify this first stage of analysis should depend on where your ISD project resides, i.e., in the aircrew, acquisition, education, or technical training community. The requirement to conduct this form of analysis may depend on the application, scope, and nature of the project. This level of analysis identifies the duties and tasks of an occupation or job, the goals and content area of an educational requirement, or the characteristics of a mission. A needs assessment should already have been conducted to determine if there is a problem for which instruction is the appropriate solution. If the assessment confirmed an instructional need, you would usually begin instructional development at the analysis phase. However, in some cases, you may be able to enter directly into the design phase of ISD. This section addresses the first stage of analysis.

Why Analyze?

The initial analysis of the occupation or job, educational, or mission requirement provides you with information needed to begin to determine instructional requirements. For example, during the occupational or job analysis you identify the duties and tasks to examine during task analysis. From a mission analysis you should be able to identify such characteristics as mission role diversity, equipment utilization requirements, or danger associated with equipment operation, which you should use to specify training equipment or skill integration requirements. Instructional developers or the design team should refer to the USAF Occupational Measurement Squadron where a wide variety of support information resides.

What Are They?

Occupation, educational, and mission analysis are defined as follows:

- **Occupational/Job Analysis** - Identifies the jobs which define an occupational entity and identifies duties and tasks which comprise each job.
- **Educational Analysis** - A process of reviewing the educational requirements, developing educational goals, and developing statements of how to achieve the goals.
- **Mission Analysis** - A process of reviewing mission requirements, developing collective task statements, and arranging the collective tasks in a hierarchial relationship.

Who Is Responsible?

Managers are responsible for ensuring that the necessary analyses are conducted. In most cases, other individuals such as instructional developers, subject matter experts (SME), or system analysts should conduct the actual analyses or at least provide technical assistance. Assistance may be needed from one or more of the following:

- SMEs
- Occupational Measurement Squadron (OMS) personnel
- System engineers
- System analysts
- Contractors
- Standing committees (e.g., Commission Education Committee)

Responsibility is to ensure that the data needed for further analysis and course design work have been obtained.

Sources of Analysis Data

Some sources of data for occupational, educational, or mission analysis are:

- Existing Occupational Survey Reports (OSR)
- Job inventories
- Technical orders (TO)
- Air Force (AF) directives
- Department of Defense (DoD) directives
- System or equipment specifications/requirements
- System Program Office (SPO) input
- Major Command (MAJCOM) input
- Maintainability and reliability data
- Mission Task Analysis Report (MTAR)
- Contractor data
- Subject matter literature

Other data sources will likely exist depending on whether a job, educational, or mission analysis is being conducted.

How To Conduct the Analysis

The process of conducting an analysis involves a number of steps. The actual number may depend on the type and scope of the analysis being conducted. During the analysis, you may perform some of the steps concurrently, others sequentially.

Note: Before collecting and analyzing data, check to see if an OSR already exists that covers the desired area. A survey report serves the following purpose:

- List the tasks.
- Identify who performs the tasks.
- Indicate which tasks are difficult to learn and perform.
- Identify which tasks should be emphasized in training.
- Show who and how many people are performing the tasks.
- Indicate how often the tasks are performed.
- Establish a priority for training.

Normally you should do the following:

·**Collect data**. Data may be collected using several methods such as:

··Interviews with experts
··Job inventories
··Interviews with incumbents
··Observations
··Questionnaires
··System comparisons (new system to existing similar system)
··Publication reviews
··Tasking orders

·**Identify the duties**. Analyze the data to identify the duties and write duty statements to describe the work activity. Organize the data by referencing each duty to a source document, indexing the duties and using a cross-reference system if necessary.

·**Identify the tasks**. Analyze the duties to identify the tasks that make up each duty. Write a task statement for each task.

·**Validate the list**. Once the list has been developed, review and validate with SMEs to ensure completeness and accuracy.

·**Prioritize the tasks**. Select tasks in order of importance for instruction on the basis of:

··Task learning difficulty
··Criticality of task
··Frequency of performance

·Assign preliminary instructional method.

·Document the results. The results of the analysis should be documented in some traceable form such as a print-based report or computer database.

Section B
Task Analysis

Introduction

When the instructional goal is to produce a capability to perform a particular job, the instruction developed should be tied directly to the job tasks. Task analysis is a method for describing the actions or behaviors that make up the tasks the student should learn to perform. A detailed task analysis identifies the behavioral elements the student should exhibit to demonstrate task mastery. Not all ISD instruction is based on task analysis. For example, in Air Force educational courses, the translation of educational goals into measurable behaviors usually does not involve traditional task analysis, but sample behaviors are derived from analysis of the type and level of learning required and the knowledge content of the subject area.

Where task analysis is performed, it is important to accurately and completely describe all of the tasks, since these task descriptions or "statements" should be used to develop the instructional objectives which constitute the framework for instruction.

Good task analysis is key to the design, development, and delivery of effective and efficient instructional systems. A thorough analysis of all tasks should identify which tasks need to be taught, under what conditions, and what standard of performance should be achieved.

What It Is

A **task** is an observable and measurable unit of work activity or operation which forms a part of a duty, with one or more duties making up a job. Most tasks in the Air Force are procedural, consisting of a series of steps performed to produce a specific outcome. For example, aircraft fuel systems technicians have many tasks as part of their overall duties. One of their tasks may be to fuel an F-16, but to fuel that aircraft requires many tasks. These tasks could include grounding the aircraft, positioning the fuel hose, and so on.

Task analysis is the process of breaking a task down to identify:

- Component steps of a task
- Sequence of those steps
- Condition(s) under which the task should be performed such as tools, equipment, and materials required to perform the task
- Standard of performance that should be achieved to produce a satisfactory outcome

Purpose of Task Analysis

Instructional developers, during the task analysis, examine each task in order to determine the job performance requirements. This includes identifying which tasks should be performed, under what conditions they are performed, and the standards of acceptable performance. This information becomes the training requirements for the system. These training requirements are stated in terms of task statements which are used to develop the instructional objectives for the course, construct a hierarchy of objectives, sequence the instruction, and determine resource requirements.

Who Does Task Analysis?

Instructional developers or the design team are normally responsible for conducting the task analysis. However, in the case of contractor-developed instruction, contractors are responsible for conducting task analysis and providing the results of the analysis to the Air Force.

How To Conduct the Analysis

A task analysis involves many activities that the instructional developer should accomplish. If an occupation, job, or mission analysis has identified the tasks for which instruction is needed, the task analysis process begins by analyzing the task statements to identify subtasks or steps. If the job or mission analysis has not been conducted, then data should be collected to identify the duties and tasks. Refer to Section A for how to do job/mission analyses. This discussion assumes that this analysis has been done. The steps that are normally performed in task analyses are as follows.

- **Identify subtasks**. Use the task list that has been prepared and validated in the job analysis to identify the subtasks. Subtasks are work activities that combine to make up a task. Some reasons for identifying subtasks are:

  - Subtasks are more easily analyzed to identify supporting knowledge and skills.
  - Instruction is easier to sequence when the tasks are broken into subtasks.

- **Identify subtask relationship**. Some subtasks should be performed sequentially, while other subtasks can be performed independently.

- **Validate the subtasks**. The subtasks should be validated to ensure that the right tasks are identified and the right relationship made. Validation can be done by interviewing SMEs or by observing tasks performed on the job.

- **Select the tasks for instruction**. After the subtasks have been thoroughly analyzed and the results validated, the next stage of task analysis is to select the tasks to use in the instruction. There are several factors you should consider:

  - Can most job incumbents perform the task without instruction?
  - How often is the task performed on the job?
  - Will job degradation occur if there is no instruction?
  - Is the task critical to the job or mission performance?
  - Is it economical to teach the task?
  - Is there sufficient time to teach the task adequately?
  - Is the task difficult to learn?
  - How soon will the graduate be required to perform the task on the job?
  - What percentage of the personnel are required to perform the task?
  - Will geographical, procedural, or environmental conditions make it unreasonable to teach all job incumbents to perform the task?
  - If individuals have been taught to perform another task, should they be able to transfer what they have learned to this task?

- **Document the tasks**. A variety of formats can be used to document your analysis of the tasks. As a minimum, identify support information for each task. Documenting the task should ensure traceability of the quality improvement (QI) during the task analysis process. Adequate documentation ensures that you will have the information for developing the objectives in the design phase of the ISD process.

Additional Information

For additional information on task analysis, see:

- Carlisle, K. E. (1986). *Analyzing Jobs and Tasks*. Englewood Cliffs, New Jersey: Educational Technology Publications.
- Wolfe, P., Wetzel, M., Harris, G., Mazor, T. and Riplinger, J. (1991). *Job Task Analysis: Guide to Good Practice*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section C
Learning Analysis

Introduction

After the task analysis has been completed and the tasks to be taught have been selected, you are ready for the next stage in the analysis phase, **learning analysis**. The results should enable the instructional developer to design an effective and efficient instructional system based on the desired learning outcomes.

What It Is

Learning analysis is the process of analyzing the tasks to be taught to establish learning outcomes in terms of types of learning involved and level of learning desired.

When Should You Do It?

Learning analysis should be done immediately after the task analysis has been completed and before designing the instructional system. However, this analysis may also be conducted while the objectives are being developed.

Who Should Do It?

Instructional developers or the design team are responsible for conducting the learning analysis. It is likely that the developer may require the assistance of SMEs in order to do a good learning analysis.

Learning Analysis Steps

When you conduct a learning analysis, you should:

- Identify the skills and knowledge needed to support performance.
- Build a learning hierarchy of knowledge and skills to be taught.
- Identify the types of learning involved.
- Determine the level of learning needed.
- Identify prerequisite knowledge and skills required.

Conducting Learning Analysis

The learning analysis should differ depending on whether the instruction is performance-oriented or knowledge-oriented. In the latter case, rather than listing the skills and knowledge needed to support a task performance, the instructional developer looks directly at categorizing type and level of learning needed to satisfy the instructional goal.

- **Identify knowledge and skills**. Analyze each task and subtask to determine supporting skills and knowledge needed to enable task performance.

- **Categorize types of learning**. There are many ways of categorizing types of learning. Some of the most common are:

  - Intellectual skill
  - Cognitive strategy
  - Verbal information
  - Motor skill
  - Attitude

- **Identify prerequisite knowledge and skills**. The next stage of learning analysis is the thorough analysis of each task statement. This analysis should allow the instructional developer to identify any prerequisite learning that may be necessary, such as skills, knowledge, and attitudes that the students should have before they can master the tasks to be taught in the course.

Integration of Type and Level of Learnin

As discussed previously, types of learning are integrated. As an instructional designer, you will do more than simply analyze individual tasks. The integration of multiple objectives in terms of a comprehensive purpose in which the learner is engaged is called **enterprise**.

During learning analysis, especially of complex performances, you will identify learning goals that require the integration of multiple objectives in order to accomplish a purposeful planned learning activity.

Additional Information

Additional information on tasks, prerequisite learning, and the hierarchy of learning is provided in Chapter 5 under the discussion on developing objectives.

Section D
Resource Analysis

Introduction

Resources are **critical** factors in the instructional system, from the initial planning, through instructional development, to operation and maintenance of the system. During the initial planning stage, long-lead items such as equipment and facilities will need to be identified in order to ensure that there is sufficient time to secure these and other resources. If you are faced with a resource constraint, you may need time to select an alternative to some planned strategy or delivery approach. Remember that instruction, whether an entire course or a module of a course, is limited by many factors including budget, personnel, maximum course length, and others. The instruction should be carefully designed to fit these resource limits.

What It Is

Resource analysis is the process of determining the type and quality of resources that are required to design, develop, operate, and support an instructional system.

Resource Categories

Resources for the instructional system include:

- Equipment
- Facilities
- Funds
- Personnel
- Time

Why Analyze Resources?

Resources should be analyzed in order to identify:

- Course development resources
- Quantity of those resources
- When the resource is needed to meet the scheduled training delivery date
- Total cost of resources
- Resource constraints

Who Is Responsible?

Managers of the instructional system have the overall responsibility for identifying and securing the needed resources. There are many training and support organizations involved in analyzing, identifying, and providing resources for instructional systems. For example, resource management, support services, and contractors are responsible for analyzing and identifying the resources they may need to meet their responsibilities for designing, developing, implementing, supporting, operating, and maintaining the instructional system.

Scope of Resource Analysis

The scope of resource analysis includes both long-range and day-to-day concerns.

Conducting Resource Analysis

The resource analysis results in an estimate of resource requirements for the instructional system for both development and operation. One of the simplest ways to conduct the initial resource analysis is to look at each task and ask a series of questions to estimate what resources may be needed. Sample resource categories and questions are provided below.

Resource	Questions
Equipment	·What types of equipment may be needed (training, support, test)? ·Will training equipment need to be developed? ·Is the equipment classified? Will it require TEMPEST/COMSEC requirements? ·What are the specific equipment requirements (computers, maintenance stands, multimeters, etc.) ·How will the equipment be used in the course? ·What quantities will be required? ·What is the lead time for equipment and parts? ·Will safes be required to store classified documents? ·What is the life cycle of the equipment? ·If faced with an equipment constraint, can alternative equipment be used? If so, what equipment?
Facilities	· What type of facilities will be required (classroom, laboratory)? ·Will a vault be required for storing classified material? ·Will the vault require certification by an outside agency? ·Will it be necessary to have secure classrooms? ·How much space will be required? ·Are facilities available? ·If facilities are available, will they require modification? ·Are there special environmental requirements? ·Are there maintenance and repair facilities available and are they adequate?
Funds	· What will the initial personnel, equipment, and facilities cost? ·What are the recurring costs associated with the system?
Human Resources	· How many instructional developers, computer programmers, video production personnel, etc., will be required to meet the training delivery date? ·Will instructors be needed? If so, how many? ·What are the student load/throughput requirements?
Time	· What is the scheduled delivery date? ·How much time will be required to develop the instruction? ·Are there any equipment lead time requirements? ·If facilities need to be constructed or modified, how long will it take? ·What is the estimated module or course length? ·How much time will be required to add instructors?

. Finding answers to these and other questions should help you estimate the resource requirements for the instructional system

Resource Alternatives

During the instructional development process you may encounter some type of resource constraint. In order to deliver an effective, cost-efficient instructional system on time you may find the needed resources or a suitable alternative. The following table provides several alternatives to consider.

Constraint	**Alternatives**
	·Borrow or share equipment belonging to other school organizations or MAJCOMs. ·Use prototype equipment. ·Use trainers or simulators rather than the actual equipment. ·Increase group size on the equipment. ·Operate multiple shifts. ·Increase class intervals.
Facilities	•Borrow or share equipment belonging to other school organizations or MAJCOMs. Use temporary facilities. ·Use MAJCOM or other school organization facilities. ·Operate multiple shifts. ·Decrease group size. ·Increase class intervals.
Funding	·Reduce the resource requirements. ·Seek alternative funding sources.
Human Resources	·Reduce the number of graduates produced. ·Borrow instructional developers and instructors from other training organizations or MAJCOMs. ·Reduce multiple instructor requirements.
Time	·Borrow additional personnel in order to complete instructional development more quickly. ·Reduce course length. ·Select alternative methods or media.

Updating Resource Requirements

In the initial planning stages of the ISD project you may have been able to identify some of the resources that were required for the instructional system, and during resource analysis you were able to identify or estimate most of the resources required. However, it is unlikely that you can completely and accurately identify everything you may need. Therefore, as the instructional development process continues there may be a continuing need to update the resource requirements to ensure that adequate resources are available.

Section E
Target Audience Analysis

Introduction

The learning analysis identified the skills, knowledge, and attitudes the students needed to have before starting the course. You need to conduct a **target audience analysis** to determine student characteristics before you start designing the instructional system.

What It Is

Target audience analysis is the process of determining the entry-level skills or behaviors that students should have prior to entering a course of instruction. Entry-level skills or behaviors are determined during task analysis. This analysis also identifies the general characteristics they should have such as reading grade level, physical strength, attitude, and previous experience. This information facilitates instructional design considerations such as instructional content, level of content, motivational needs, and instructional methods.

Why Analyze?

Conducting an analysis of the target audience allows the designer to base the instructional system on the skills, knowledge, and attitudes of the target audience. This reduces the likelihood that the instruction will be inadequate. For example:

You design a unit of instruction based on the assumption that the students know basic algebra. However, when the students arrive, you quickly learn that they do not know basic algebra; therefore, the instruction is probably inadequate.

Goals of Target Audience Analysis

Target audience analysis produces various data depending on the nature and scope of the analysis. Examples of the data produced are:

- Range of aptitudes
- Previous background and experiences
- Previous education
- Interests
- Size of target audience
- Demographics
- Computer literacy

Goals of Target Audience Analysis

The goal of target audience analysis is to develop a complete and accurate description of individuals in the target group.

Use of the Data

The data produced during analysis of the target audience is used to determine:

- Course content
- Media
- Delivery methods
- Course length
- Equipment needs

Section F
ISD Evaluation Plan Update

Introduction

One of the key activities in planning was the development of the ISD evaluation plan. The plan ensures that the principles and concepts of the Quality Air Force (QAF) are carried out in the process and products of each ISD phase. Thus, this plan becomes the benchmark for evaluating the instructional system. The evaluation plan is updated at the end of the analysis phase as applicable. Since this plan was developed during initial project planning you may need to update the plan periodically.

Assessing Quality

ISD is a quality management process. In the analysis phase, there are different ways to assess quality. It is possible for ISD projects to have different quality indicators depending on the nature of the project itself. One of the easiest and simplest ways to assess the quality of the analysis phase is to develop a job aid using questions that are focused on quality improvement issues. Some examples of questions that would be appropriate for a job aid on the analysis phase of ISD are:

·Does the evaluation plan address quality of both the analysis process and products?

·Is the evaluation plan for the analysis phase both effective and cost-efficient?

·Are the metrics or standards for the analysis process and products realistic and adequate? If not, what should be changed to ensure that the standards are both realistic and adequate?

·Can the analysis process be improved? If so, how?

·Do the products of the analysis phase provide adequate and reliable data for analysis?

·Does the analysis phase result in sufficient data to design the instructional system?

Why Update the Plan?

Each ISD evaluation plan should be different. It would be difficult to develop an evaluation plan that is "on target" throughout the entire life cycle of the instructional system. Therefore, when the analysis phase is completed, you may need to update the plan to reflect the results of the evaluation activities. An updated plan should ensure that you have the most current and accurate evaluation information as you enter the design phase of ISD.

Who Is Responsible?

The manager of the instructional system has the overall responsibility for updating the ISD evaluation plan at the end of each phase of the process.

What Should Be Updated?

Updating the ISD evaluation plan may include, but is not limited to:

- Adding or deleting information.
- Revising evaluation schedules.
- Documenting results of analysis phase process and products evaluation.
- Adding additional analysis products for evaluation.
- Providing rationale for changes made to the plan.

Tracing the Quality Process

The quality of the analysis process and the resulting products is very important to the instructional development process. Therefore, the products of the analysis phase should be evaluated to ensure tha they meet the original intent of the program. The plan traces the quality process throughout instructional development.

Section G
ISD Management Plan Update

Introduction

During your initial planning of the ISD project, the managers developed an **ISD management plan** t serve as a roadmap to manage the instructional development process and the instructional system. As you complete the analysis phase of the ISD project, you may have gathered additional and better information on which to base your management decisions, so the management plan may need to be updated.

When Should the Plan Be Updated?

Since the management plan is a "tool" for managing the instructional development process and the instructional system, update it at the end of each phase of instructional development, or when any significant change occurs that impacts planning.

Who Is Responsible?

The manager of the instructional system is responsible for updating the plan at the end of each phase of ISD or after any significant change has occurred that impacts the current planning.

What Should Be Updated?

Update the plan to include the latest information, such as:

- New or revised milestones
- Refinements to project definition
- Changes in project constraints
- Revisions to support requirements
- Identification of new taskings
- New information resulting from analysis that impacts project management
- Other pertinent areas

Chapter 5
DESIGN

Overview

Introduction

At this point in the process, you have completed the required analyses and updated the evaluation and management plans. You are now ready to enter the **design phase** of ISD. In this phase the instructional design is determined. This should play a key role in the effectiveness and efficiency of the instructional system. A continuing effort in the design phase is quality of the design process and products, with an emphasis on improvements wherever possible.

Where Are You in th Process?

An ISD model, with the design phase highlighted, is provided in Figure 6 in order for you to better visualize where you are in the process.

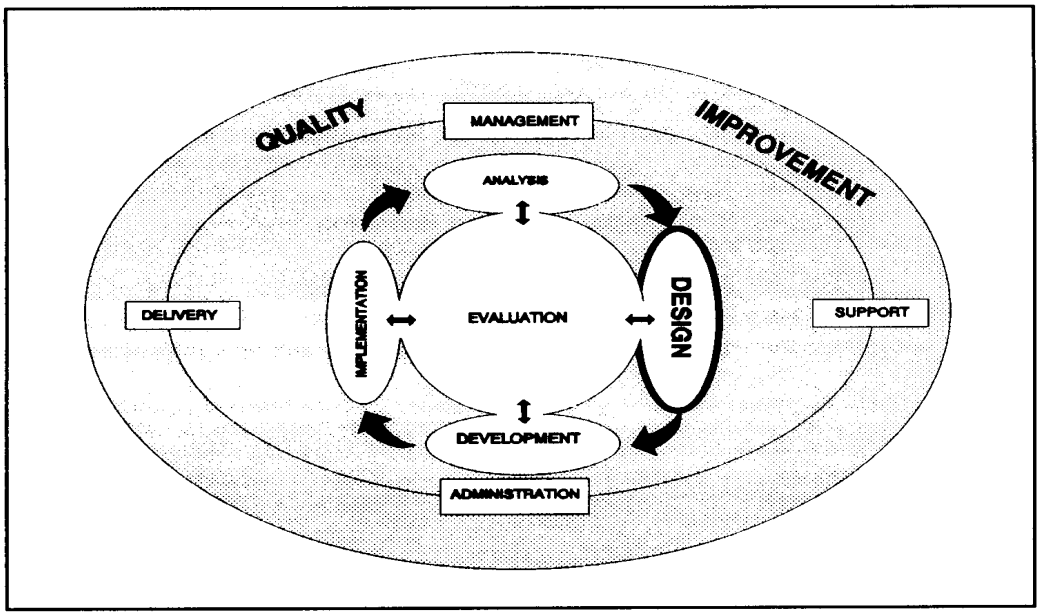


Figure 6. Design Phase

Objectives

The objectives of this chapter are to:

- Discuss elements of instructional design.
- Explain the process of designing instruction.
- Describe planning activities in the design phase.
- Explain the QI process in the design phase.

Section A
Develop Objectives

Introduction

The first activity in the design phase is to develop objectives for the tasks that were identified as requiring instruction in the analysis phase. During learning analysis, you categorize tasks into types of learning outcomes. When you develop objectives, it is important that they are consistent with the instructional need as presented in the overall system concept.

What It Is

An objective is a precise statement of the learned capability—skills, knowledge or attitudes (SKA)—a student is expected to be able to demonstrate, the **condition** under which the SKA is to be exhibited, and the minimum **standard** of acceptable performance.

Purpose

The purpose of an objective is to:

·Serve as the foundation for instructional design.
·Provide the basics for instructional strategy decisions.
·Establish clear, concise student goals.
·Determine content of the instructional system.
·Serve as a basis for criterion tests.

Parts of an Objective

Most objectives are made up of three parts:

·Learned capability (behavior)
·Condition
·Standard

The three parts are discussed in detail later in this section under "Characteristics of Objectives."

Levels of Objectives

Learning hierarchies use various terms to describe levels of objectives. The most common terms used to distinguish the levels are:

·Top level
··Terminal
··Primary

·Lower levels
··Enabling
··Secondary
··Supporting
··Subordinate
··Developmental

The purpose of different levels of objectives is to show the hierarchical relationship of the objectives, such as which objectives are prerequisite to another objective.

Additional Information

For additional information on objectives, see:

·AFMAN 36-2236, Handbook for Air Force Instructors.
·Davies, I. K. (1976). *Objectives in Curriculum Design.* London: McGraw Hill.
·Kibler, R. J. (1981). *Objectives for Instruction.* Boston: Allyn and Bacon.
·Mager, R. F. (1962). *Preparing Instructional Objectives* (2nd Ed.). Belmont, California: Fearon Publishers.

Introduction

Objectives need to be worded carefully so that all readers or listeners have the same understanding. To ensure this clarity, the instructional developer should be thoroughly familiar with all parts of the objective.

Learned Capability

Introduction

The **capability** part of an objective states what the students will be required to do to demonstrate that they have learned a specific skill, knowledge, or attitude. Clearly state the capability so that everyone—instructional developer, instructor, and student—can understand it.

What It Is

A capability is defined as a skill, knowledge, or attitude that is observable and measurable. Learned capability is closely associated with what is normally referred to as the behavioral part of an objective. However, using verbs that are related to specific learned capability helps clear up some of the ambiguity arising about what learning outcome the demonstrated behavior actually represents. Clearly indicating the type of learned capability to be demonstrated helps clarify the intended learning outcome; thus, the behavior is more clearly communicated in the objective.

Things To Consider

When writing the capability part of an objective, use descriptive statements that are:

·Observable
·Measurable
·Verifiable
·Reliable

Use the job behavior in the objective, when possible. Do **not** use statements that are so general that they don't describe the observable behavior, such as:

·Know engineering.
·Learn about systems.
·Understand basic circuits.

Examples of Learned Capability Statements

Several examples of learned capability statements are provided below.

Examples of Learned Capability Statements
"... the formula, **compute the exact surface of the sphere** ..."
"... checklist, **perform a preflight on the T-38 aircraft** ..."
"... reference, **list the nine events of learning** ..."

Condition

Introduction

The second characteristic or part of an objective to be discussed is **condition**. A thorough understanding of the conditions under which a task may be performed and a clear statement of those conditions should make a more effective objective. The actual conditions under which the job will be performed should be used in the objective, if possible.

What It Is

A condition(s) identifies the situation under which a task is to be per formed. A properly prepared objective clearly states the limits and/or conditions of student performance, such as:

·Does the student understand how to use technical orders?
·Is the student allowed to use a checklist?
·What tools/test equipment should a student be allowed to use?
·May students use notes they have taken during instruction?
·May students ask questions?

Things To Consider

There are things to consider when determining conditions.

·Specify the objects, events, human behavior, words, or symbols which should be presented to the students.
·State the situation under which the task is performed.

Examples of Condition Statements

Several examples of condition statements are provided below.

Examples of Condition Statements
"**Given the diameter of a sphere and the formula,** compute the ..."
"**Using the preflight checklist,** perform a ..."
"**Without reference,** list the nine events ..."

The condition statements can be derived from the task analysis work sheet or equivalent.

Standard

Introduction

The **standard** of performance is the final part of the objective. The student's performance results in an output, the quantity or quality of which is compared to the standard of performance. The standard of performance specified in an objective should be the same as the standard specified for on-the-job performance, unless there is a valid reason for setting a higher standard.

What It Is

A standard defines the criteria for acceptable performance by the student. It is stated in such terms as completeness, accuracy requirements, time constraints, performance rates, or qualitative requirements. It identifies the measure of proficiency the students should achieve when they perform the behavior under the specified conditions.

Determining the Standard

When developing the task list, you probably found that some of the tasks did not have the standard of performance specified. The standard for many tasks is go/no go. If no standard is specified for the performance, you may be required to set the standard in the objective based on other sources such as experience, similar tasks, or expert opinions. Once the standard of performance has been determined for these tasks, you should verify it against on-the-job performance standards.

Things To Consider

When establishing standards, consider that:

·Without a standard you cannot determine when the student achieves the objective.
·The criteria for a good standard are completeness and accuracy.
·Standards can be classified in one or more of six types, as shown below.

Describe Standards By	Example
Referring to standard operating procedure	"... will comply with Air Force directives and local regulations."
Implying standard of "Without Error"	"... state the five principles of CPR (cardiopulmonary resuscitation)."
Specifying minimum acceptable level of performance	"... compute the answer to the nearest tenth."
Specifying time requirements	"... minimum speed of 35 words per minute."
Specifying rate of production	"... at a minimum of 20 units per day."
Specifying qualitative requirements	"... to idle smoothly..."

Examples of Standards

Some examples of standards that may be used in objectives are given below.

Examples of Standards
"... compute the exact surface of a sphere." **(without error implied**
"... owed from last quarter **to the nearest dollar.**"
"... measure the resistance of series circuit **with no more than 5% error.**"
"... principle of leadership **as defined in Air Force Leadership Pamphlet."**
"... field-strip and reassemble an M-16 rifle **within 15 minutes.**'

Guidelines for Developing Objectives

Introduction

Once you understand the components of an objective, you are ready to start formulating objectives from the list of task statements, skills, and knowledge behaviors developed during task/learning analysis. Using the information on the task list, what you have learned about objectives to this point, and a few guidelines, you should be able to develop effective objectives.

Guidelines for Developing Objectives

Several guidelines for developing objectives are provided below.

Type	Guidelines
Genera	· Use task descriptions developed during the analysis phase. ·Analyze each task or knowledge item on the task list to determine objectives that are required for each item. ·Document each objective on a worksheet. ·Use learning analysis results to assign skills and knowledge to support each objective and subobjective. ·Document results on worksheet.
	· Ensure that capability statement is the same as that required on the job, if possible. ·State the capability in terms that everyone under stands. ·Use an active verb to describe the desired capability. ·Don't use ambiguous verbs such as "know," "understand," etc. ·Use capability statements that are: ··Observable ··Measurable ··Reliable ··Verifiable
	· Select conditions that match job conditions as closely as possible. ·Ensure that conditions are realistic.
	· Use a standard that meets job performance requirements, if possible. ·Use a standard that is clear and understood by everyone. ·Use a standard that accurately measures student achievement of the objective. ·Ensure that the standard is complete. ·Ensure that the standard is accurate.

Writing Objectives for Types of Learning

Introduction

Types of learning outcomes were described in Chapter 2. The section on learning analysis discussed tying tasks to types of learning outcomes. In writing objectives to specify these outcomes, verbs may be used to classify each type of learning outcome. By including one of these verbs in the objective, the intended capability is more clearly communicated and the conditions of learning appropriate to that type of learning outcome are more readily applied. The learning capability verbs are shown in the table below.

Capability	Capability Verb
Intellectual Skill	
·Discrimination	Discriminates
·Concrete Concept	Identifies
·Defined Concept	Classifies
·Rule	Demonstrates
·Higher-Order Rule (Problem Solving)	Generates
Cognitive Strategy	Adopts
Verbal Information	States
Motor Skill	Executes
Attitude	Chooses

Hierarchy of Objectives

Introduction

During task analysis, you identified the steps or procedures that make up a task. In order to properly teach these steps or procedures, additional objectives had to be developed. These different levels of objectives, which go by various names, can be structured into an objective map that depicts the relationship of the objectives and their sequence in the course. This map is sometimes called an objective hierarchy.

Purpose

The purpose of the hierarchy is to design the instructional system and sequence learning.

Sequencing of Objectives

A curriculum or course requires decisions about the sequencing of objectives. The goal of good instructional design is to establish sequences within courses that promote effective learning. The sequence and lessons within a course should be based on the prerequisite relationship among the objectives. The most obvious sequence follows the order from simple to complex or fron general to specific. The table below summarizes the major considerations regarding sequential arrangement within a topic for each type of learning outcome.

	Major Principles of Sequencing	Related Sequence Factors
Intellectual Skills	Presentation of learning situation for each new skill should be preceded by prior mastery of subordinate skills.	Verbal information may be recalled or newly presented to provide elaboration of each skill and conditions of its use.

Cognitive Strategies	Learning and problem-solving situations should involve recall of previously acquired relevant intellectual skills.	Verbal information relevant to the new learning should be previously learned or presented in instructions.
Verbal Information	For major subtopics, order of presentation is not important. New facts should be preceded by meaningful context.	Prior learning of necessary intellectual skills involved in reading, listening, etc., is usually assumed.
Attitudes	Establishment of respect for source is an initial step. Choice situations should be preceded by mastery of any intellectual skills involved.	Verbal information relevant to choices should be previously learned or presented in instructions.
Motor Skills	Provide intensive practice on part skills of critical importance and practice on total skill.	First of all, learn the executive subroutine (rule).

Source: Gagné, M. R., Briggs, L. J., and Wager, W. W. (1992). *Principles of Instructional Design* (4th Ed.). New York: Harcourt Brace Jovanovich College Publishers.

Levels of Objectives

Objectives can be categorized into two levels, as shown below.

Level	Description	Other Names
Terminal	An objective the learners will be expected to accomplish when they have completed the instruction. Made up of subordinate objectives.	·Primary ·Main ·End
Enabling	An objective that should be attained in order to accomplish a terminal objec tive.	·Secondary ·Subordinate ·Supporting ·Developmental

Progression from Simple to Complex

The figure below shows the progression from simple individual objectives to the more complex end goal or terminal objective. The integration of multiple objectives, or enterprises, are developed along this simple to complex continuum. The highest plateau on this continuum is the **metaskill**. At this point all of the individual skills, knowledge, attitudes and cognitive, perceptual, and motor processes required for performance are integrated.

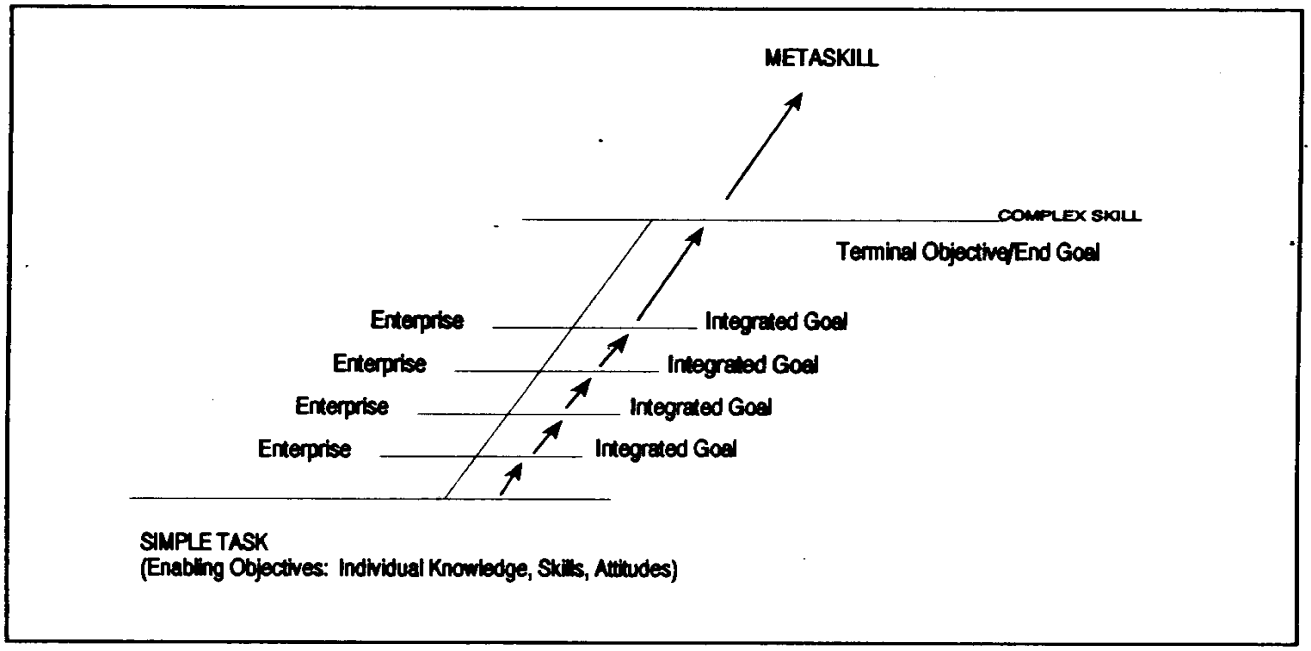


Figure 7. Simple to Complex Continuum

Example of Objective Hierarchy

Figure 8 is an example of an objective hierarchy.

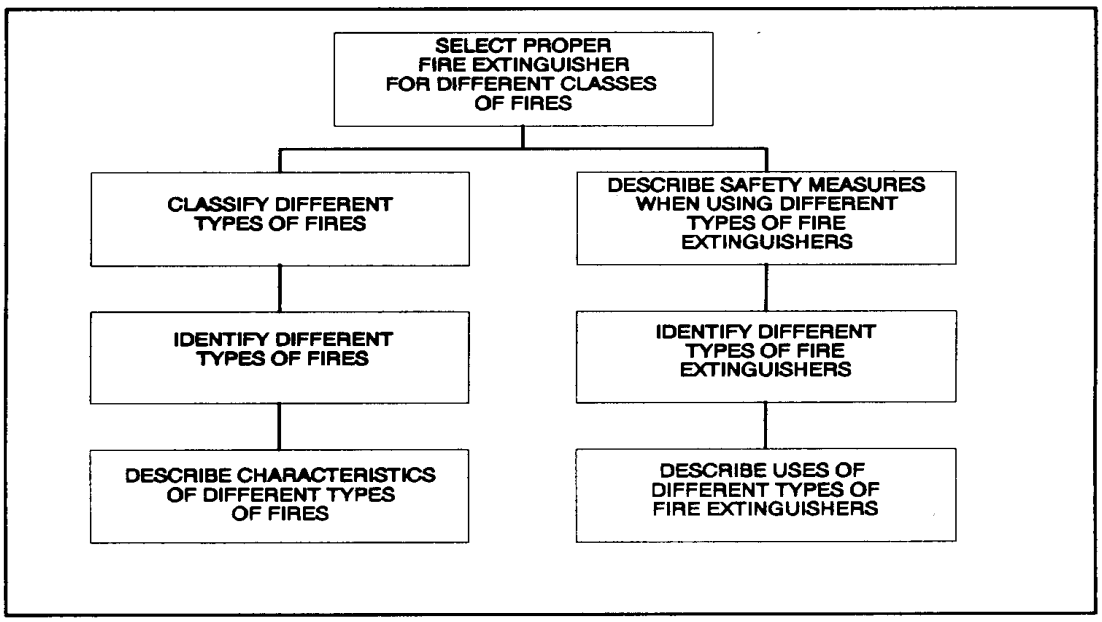


Figure 8. Objective Hierarchy

Prioritizing, Clustering, and Sequencing Objectives

Introduction

Once the terminal and enabling objectives have been developed, it is necessary to prioritize, cluster, and sequence them into units of instruction. A unit of instruction may be defined as any module, block, or lesson. Effectiveness and efficiency of the instructional system should depend, in part, on how well the units of instruction are structured.

Prioritize Objectives

Prioritizing objectives may not be required in all instructional development projects. However, there may be times when you may be unable to train all of the needed tasks due to some resource constraint.

For example:

"You need 25 days to cover all objectives to the level specified. However, due to a student workyear constraint, the course can be only 20 days in length."

Guideline

Have the user prioritize the line items in the training standard. Then the objectives are prioritized to meet the user's need.

When Should You Prioritize?

If the instructional developer expects that a resource constraint may prevent you from providing all of the instruction that is required to meet job performance requirements, request that the standard line items be prioritized during meetings such as the Utilization and Training Workshop (U&TW) or Training Planning Team (TPT). Another way is to have the users prioritize their requirements during coordination of the standard.

Who Is Responsible?

Users are responsible for determining the priority of their needs. Instructional developers or the design team should advise and make recommendations to the user, as necessary.

Clustering Objectives

Clustering or grouping objectives enables the instructional developer to develop logical and meaningful instructional units. Without this clustering, it would be impossible to structure an effective and efficient instructional program. The basic guidelines for clustering objectives are explained on the next page.

Guidelines For Clustering Objectives
Cluster objectives that are prerequisites to other objectives. For example, basic electronic skills and knowledge may be required for many tasks in a course; therefore, they may be clustered in the same unit and taught in the core area of the course.
Cluster objectives that are related to the same system or engage the same type of action. For example, several tasks related to performing a particular maneuver in an aircraft may be clustered into a single instructional unit.
Cluster objectives with common skills and knowledge. For example, some maintenance tasks require identical skills and knowl edge across different systems such as computer maintenance or aircraft refueling.
Cluster objectives with potential for the same instructional method or delivery system. For example, knowledge objectives utilizing a method such as lecture may be clustered together. Also, objectives with the same type of learning may be grouped together to facilitate learning.

Sequencing Objectives

Effective and efficient instruction depends on properly sequenced objectives. Sequencing objectives should be accomplished within the unit or module, as well as the course itself. Note that simplifying conditions as a step of sequencing will help ensure that the simplest tasks are taught very well. Two basic guidelines for properly sequencing objectives are provided below.

Guidelines For Sequencing Objectives
Teach prerequisite skills and knowledge first. For example, students should be taught to solder before they are required to perform tasks requiring that skill.

Follow the fixed sequence or logical order in performing a task. For example, the step-by-step procedures of performing a preflight should be taught before the student is taught to taxi the aircraft.

Section B
Develop Tests

Introduction

Tests serve many purposes in the Air Force. Tests may have already been used when the target audience analysis was conducted, or pretests may have been developed as a prerequisite for attending a course. To ensure that tests adequately measure the objectives they support, the performance required in the test should match the performance required in the objective. A good way to develop tests that measure the objectives is to prepare them **immediately** after the objective is written.

Note: Test item format, and the actual wording of objectives for that matter, depends on the media having been selected by prior analysis or directed by content. Otherwise, rewrites may become a major problem.

Purpose

The primary purpose of testing is to assess the student's attainment of the behavior specified in the objective.

Tests also serve several secondary purposes such as to:

·Identify problems or weaknesses in the instruction.
·Indicate whether a class is performing up to standards on specific objectives.
·Indicate instructor proficiency.

Type of Learning Outcome	Best Method of Testing	Activities That Indicate Achievement of Objectives
Intellectual Skills: ·Discriminations	Multiple choice and true/false	Detect similarities or differences
·Concepts	Constructed response (labeling, sorting, matching)	Recognize examples or non-examples
·Rules	Performance of integrated tasks or constructed response (short answer)	Apply rule, principle or procedure
Verbal Information	Constructed response (fill in the blank, essay questions)	Recall information
Cognitive Strategies	Student explains process to examiner	Self-report or audit trail of work done
Motor Skills	Performance test	Perform smooth, coordinated action
Attitudes	Observe student in different situations	Observe actual situated behavior

Types of Tests

The basic types of tests used in the Air Force are described below.

Type of Test	Purpose of Test

Criterion	· Used to measure the student's attainment of the objective ·Used to measure the effectiveness of the instruction.
Pretest	· Used to measure the student's ability to attain each objective. ·Used after the instructional system becomes operational to determine how much instruction individual students need. **Diagnostic** ·Used to determine attainment of supporting skills and knowledge necessary to perform the terminal objective. ·Used during validation to predict success, to identify and correct weaknesses in the instruction. **Survey** ·Used to determine what prospective students already know and can do before receiving instruction. ·Used during development of instruction to gather data for design of instruction.

These tests are described in more detail below

Criterion Test

Criterion tests are prepared and used to evaluate the students' attainment of the criterion objective and to measure the effectiveness of the instructional system. Each criterion test is based solely on the requirements specified in the objective which it is intended to measure. The test should measure each objective within the parameters established by the objective. To show that they have attained the objective, the students must meet or exceed the standard specified in the objective.

Pretest

Pretests are designed to measure the students' ability to achieve each objective. Generally, a pretest is used after the instructional system is in operation. When some form of planned pacing is used to accommodate the varying needs of students, the pretest is administered to each student just prior to the instructional activity to determine the extent of existing skills and knowledge. How well the student performs on the pretest determines what and how much instruction is then required.

Diagnostic Test

As indicated, the criterion test is used to enable the instructional system designers to evaluate the students' attainment of the objective and to help validate the instructional system. Test items should also be prepared to determine attainment of the supporting skills and knowledge which contribute to the ability to perform the criterion objective. This is the purpose of diagnostic testing.

During validation, the instructional system designers can effectively use diagnostic test items to predict success, to identify problem areas, and to adjust instruction for individual differences. If testing is limited to criterion tests only, it might be difficult to determine specifically what students have not learned.

Survey Test

Survey tests are designed to determine what prospective students already know and can do before receiving instruction. The survey test is administered while the instructional system is being developed and provides important design data. The results of the survey test will aid the instructional system designers in deciding which objectives require instruction and how much, and which can be deleted because the target audience has already learned them.

Test Construction for Types of Learning

The outcomes of planned instruction consist of student performances which show that various kinds of capabilities have been acquired. The types of learning have been identified and discussed: intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes. There is a need to assess student performance to determine whether the newly designed instruction has met its design objectives. Assessment may also be done to learn whether each student has achieved the set of capabilities defined by the instructional objectives. The table below lists the types of learning outcomes and describes the best method of testing and the activities that indicate achievement of objectives.

Type of Learning Outcome	Best Method of Testing	Activities That Indicate Achievement of Objectives
ctual Skills: ·Discriminations ·Concepts ·Rules	Multiple choice and true/false Constructed response (labeling, sorting, matching) Performance of integrated tasks or constructed response (short answer)	Detect similarities or differences Recognize examples or non-examples Apply rule, principle or procedure
Verbal Information	Constructed response (fill in the blank, essay questions)	Recall information
Cognitive Strategies	Student explains process to examiner	Self-report or audit trail of work done
Motor Skills	Performance test	Perform smooth, coordinated action
Attitudes	Observe student in different situations	Observe actual situated behavior

Characteristics of Tests

There are several characteristics to be considered when developing tests. These characteristics ensure that the tests measure what is intended each time they are administered. The characteristics are shown in the following table.

Characteristic	Definition
Validity	**Content** ·Degree to which the test measures what it is intended to measure **Predictive** ·Degree to which the test predicts performance
Reliability	·Degree to which the test yields the same results consistently **Test-Retest** ·Consistency across two administrations to the same students **Split-halves** ·Consistency across two forms of the same test
Usability	· Tests that are easy to administer, score, and interpret

Assessment Method

Most Air Force tests can be classified into two main groups: performance and predictive tests. A common question is: When should designers use performance tests and when should they use paper-pencil tests? These are the wrong categories for comparison. The comparison should really be between performance tests and predictive tests.

Performance Test

A performance test is one in which the student actually performs the skill required by the terminal objective. If the objective of the lesson is to recall information, then a test where the student has to recall the information by writing it on a piece of paper is a performance test. Many concept and rule-using-type performances are tested with paper-and-pencil tests. For instance, many problem-solving skills involving the use of scientific principles can be observed from written performance tests.

Many types of tasks, especially equipment operation tasks, involve many different capabilities that have to be performed in an integrated manner. For example, the task of bleeding a hydraulic brake system involves recall of a procedure (information learning), physical performance of the steps (motor performance), recognition of the parts and tools (concepts), observation of the brake fluid conditions in the system (rule using), and attitudes (cleanliness and safety). In these types of tasks, performance cannot be measured by a paper-and-pencil test. A performance test would require a real or operational mock-up of a brake system. Because performance tests require the student to demonstrate mastery of the task previously learned, they are said to have content validity. Content validity is based on objective-to-test correlation. For a test to be considered as content-valid, there must be a high objective-to-test correlation. This is true in both performance and predictive testing.

Predictive Test

Performance tests of integrated tasks are generally time-consuming because they often have to be conducted one-on-one with real equipment or simulators. If the actual behavior cannot be tested in a performance test (because it is too costly, dangerous or impractical), the next best option is to test the behaviors that enable performance of the desired skill, and from that information make a prediction as to whether the student would be able to perform the task. For example, if a student could write the steps for bleeding a brake system, there is a better probability that the student could actually perform the task than someone who didn't know the steps. Tests that do not test the actual behavior, but test component or related behaviors, *are valid to the extent that they predict student performance on the actual task*.

Types of Tests

In the past, most predictive tests were written paper-and-pencil type tests, because they are easy to produce, administer and score. The most common types of written test questions are essay, short answer, fill-in-the-blank, labeling, multiple-choice, matching, and true-false. Today's media provide other testing options. Computers provide different types of input systems that can have a high degree of fidelity with real-world tasks. Even a simple input device such as a joystick or a mouse allows for identification by pointing with a cursor. More elaborate devices such as magnetic field detectors, infrared detectors, etc., allow the computer to detect even more complex behavior.

How does an instructional designer decide what type of test to construct or what type of item to use? The best type of test is one which gives the decision maker the best information regarding the student's mastery of the objective. Different types of test items have advantages and disadvantages with regard to good test construction. These advantages and disadvantages have to be considered in terms of validity and reliability of the test.

Comparison of Performance and Predictive Tests

Performance and predictive tests are compared below.

Predictive Test Item	Performance Test Item
Requires students to demonstrate knowledge by responding to various types of written questions.	Requires students to accomplish a job-like task under controlled conditions.
Emphasizes verbal or symbolic aspects.	Emphasizes nonverbal aspects.
May require students to find, read, and use technical materials.	May require students to find, read, and use certain technical material (job aids, for example).
Items are knowledge the student should learn to perform or make decisions on the job.	Items are skills that students should perform, or the decisions they may make on the job.
Items are normally independent questions and are not dependent on sequence. However, in some cases such as scenario-based testing, it may be necessary to develop test items that are dependent on sequence.	Items are dependent on sequence in which they are presented.
Errors on one item should not affect performance on another item.	Errors early in the sequence may affect final outcome of the task.

Test Construction Factors

- What to measure. Analysis of objectives should identify what should be measured. To determine what to measure, list the tasks to be performed or objective statements to be covered by the test. One or more test items may be needed to adequately measure each objective. Tests should measure application of principles, knowledge of factual information, ability to perform task, and transfer of knowledge and skills to solve similar problems.

- Testing level. The level of testing (know, comprehend, etc.) should correlate with the stated level of learning for that portion of the instruction being tested no higher and no lower.
- Test length. Adequate coverage of the objective is the major factor in determining the length of test that is required. Longer tests are normally more reliable since they usually cover the material better.

- Selection and arrangement of test items. Select test items that cover the most essential and significant portions of the material. Test items selected should be clear, concise and well-written to minimize misunderstandings. Items of the same type should be grouped together in a test, if possible. Individual test items should also be arranged in approximate order of difficulty, which allows the students to progress as far as they can without spending excessive time on difficult items at the first part of the test.

Test Review and Analysis During Summative Evaluation

Review and analysis of tests or measurement devices during the summative evaluation process ensures that they measure what they are supposed to measure. Normally, data from the first several administrations (classes) of the test will provide sufficient data to complete the summative evaluation process. However, if the development team is not confident that adequate data has been collected, the summative evaluation process can be extended until the necessary data has been collected.

During the summative evaluation period, it is suggested that data be collected and analyzed after each administration of the test. Analysis of the data should identify any potential problems with the testing instrument. For example, if a test item is a high-miss (usually 50 percent or more) or students fail to perform the specified task within the prescribed time limit, the item should be analyzed to determine if there is a problem. Analysis may identify a problem with the test item or it could be that the instruction being provided does not adequately cover the objective that the test item is to measure. Regardless of the source of the problem, action should be taken to correct any identified problem to ensure quality of the process and products of the summative evaluation process.

Test Review and Analysis During Operational Evaluation

Once the summative evaluation process has been completed, which includes test validation, the instructional system is placed into an operational status. Once the system is operating under normal conditions, curriculum developers or the instructional staff should periodically review and analyze the composite data resulting from all administrations of the tests since the instructional system became operational or the last time the data was analyzed. It is suggested that the frequency of the test data review cycle be based on the number of times the test is administered (student flow). However, if student flow through a course is low, it is suggested that the composite test data be reviewed at least once each year. The number of versions of a particular test will impact how often data needs to be analyzed. The review and analysis during this period is part of the operational evaluation process which ensures the quality of the instructional system under normal operating conditions.

As with test item analysis during the summative evaluation process, all test items should be analyzed to determine if there are problems with any of the test items. For example, are there any identifiable trends such as low-miss or high-miss items? Are most students having difficulty completing one particular task? Any item identified as a potential problem should be analyzed and the necessary corrective action taken.

Section C
Review Existing Materials

Introduction

After developing the objectives and tests, you should determine if materials already exist that may support the objectives. It is possible that some of the material found during the review may not totally satisfy the need. In this case, don't hesitate to modify the materials. Even the use of some portions of existing materials may be economically advantageous.

Why Review Existing Materials?

Several benefits to be gained from using existing material are:

- Time - Developing instructional materials is time-consuming. Therefore, using existing materials should save time.
- Personnel - Using existing materials saves duty hours that can be spent developing other portions of the instruction.
- Material - Valuable materials may be saved.
- Money - Time, human resources, and materials cost money.

Where Can You Find Materials?

Materials exist to cover almost every subject. Several sources of existing materials are:

·DoD
·Other services
·Other federal agencies
·Industry/commercial organizations
·Colleges and universities

Types of Existing Material

Existing materials can be found in many different forms, for example:

·Textbooks/publications/technical orders/handbooks
·Slides/video
·Audio cassettes
·Computer-based (ICW, CAI)
·Job aids
·Training aids

How To Select Materials

In order to select the appropriate materials, a deliberate and thorough review of existing materials should be conducted. After it has been determined what instructional materials are needed to support the objectives and materials have been gathered for review, the review process is ready to begin. A good way to conduct a review is to use a job aid. The job aid should help standardize the process and allows a comparison between materials under review. Following are examples of job aids for the review of existing materials.

Job Aid For Existing Material Reviews
·Does the material meet the requirements of the objective(s)? ·Is the content level of the material appropriate? ·Is the material accurate? ·Is the material current? ·Does the material address motivational factors? ·Is the material properly sequenced? ·Does the material provide sufficient guidance? ·Are sufficient practice exercises provided? ·Are the measurements adequate?·Is the material proprietary or copyrighted?

Other types of job aids or forms can be used to review and select materials. Keep the job aids or forms as simple as possible.

Job Aid Material Review Form

Evaluator: Date:

1. Objective:
2. Type of Media:
3. Evaluation of Material

	Poor		Good		Excellent
Content					
·Accuracy	1	2	3	4	5
·Currency	1	2	3	4	5
·Level	1	2	3	4	5
Structure					
·Organization	1	2	3	4	5
·Sequence	1	2	3	4	5
Suitability					
·Supports Objective	1	2	3	4	5
·User Friendly	1	2	3	4	5
·Pace	1	2	3	4	5
·Guidance	1	2	3	4	5
·Feedback	1	2	3	4	5
·Motivational	1	2	3	4	5
·Measurement	1	2	3	4	5

4. What do I like about the material?
5. What do I dislike about the material?
6. Can the material be modified to improve its utility? If so, what should be done?

Finding the Right Material

The exact materials needed may or may not exist, or, if they do, may require modification before they can be used in course development. If this is the case, consider modifying or updating the material, since it is normally more cost-effective and efficient to do so.

Modification of existing materials may include:

·Adding new material
·Expanding the existing material
·Deleting material
·Updating material
·Resequencing material

Copyrighted Materia

If existing material is copyrighted, you should obtain permission of the publisher before using it.

Additional Information

For additional information on reviewing existing materials, see:

·Dick, W. and Carey, L. (1990). *The Systematic Design of Instruction* (3rd Ed). Glenview, Illinois: Harper Collins Publishers.
·Knirk, F. G. and Gustafson, K.L. (1986). *Instructional Technology: A Systematic Approach to Education.* New York: Holt, Rinehart, and Winston.

Section D

Design Instructional Plan

Introduction

Once the objectives and tests have been developed and existing instructional materials have been reviewed for usability, you are ready to start designing instruction. The effectiveness and efficiency of the instructional system may depend, to a large degree, on how well the instruction is designed.

Select Instructional Method

Introduction

In the design phase, one of the first and most important tasks is that of selecting the **instructional method**. The method selected may directly impact both the quality of the instructional system and its cost-effectiveness. In order to select the most appropriate method, several key factors should be considered.

What It Is

Instructional method is the procedure or process used to attain an objective. Examples of instructional methods are:

·Lecture
·Demonstration
·Self-study
·Computer-based training (CBT)
·On-the-job training (OJT)

Who Is Responsible?

The instructional developer has the overall responsibility for selecting the instructional method. However, in cases where the design team approach is used, team members play an active, vital role in selecting the most effective, cost-efficient method of instructional delivery.

Instructional Methods

There are a variety of instructional methods which can be selected. The most common methods are shown below:

Method		Definition
PRESENTATION METHODS	Lecture	A formal or semiformal oral presentation of information by a single individual; facts, concepts, problems, relationships, rules or principles presented orally either directly (as by classroom instructor) or indirectly (as by video).
	Demonstration	Presentation or portrayal of a sequence of events to show a procedure, technique, or operation; frequently combines an oral explanation with the operation or handling of systems equipment or material. May be presented directly (as by a classroom instructor) or indirectly (as by video).
	Exhibit	A visual or print display used to present information; for example, actual equipment, models, mockups, graphic materials, displays, chalkboard, or projected images.

	Indirect Discourse	Verbal interaction among two or more individuals which is heard by the student; may be a dramatization, such as role playing, or a dialogue between panel members, or a teaching interview (a question and answer session between instructor and visiting "expert").
	Assigned Reading	Printed verbal materials such as books, periodicals, manuals, or handouts. Reading may be course-assigned or self-assigned.
	Teaching Interview	Question and answer session between the instructor and visiting "expert" following a highly structured plan.
INSTUDENT INTERACTION VERBAL METHODS	Questioning	An instructor- and/or courseware-controlled interactive process used to emphasize a point, stimulate thinking, keep students alert, check understanding, or review material. Questioning may be direct, as by a classroom instructor, or may be designed into a film or television presentation.
	Programmed Questioning	An instructor and/or courseware controlled interactive process used to systematically demand a sequence of appropriate student responses; may be used directly (as by an instructor in a classroom) or indirectly (as by programmed booklets or teaching machines, including computers).
	Student Query	The provision by which students are given the opportunity to search for information, as by questioning a classroom instructor, tutor, coach, or an appropriately programmed computer.
	Seminar	A peer-controlled group interactive process in which task- or objective-related information and experience are evoked from the students. Questions may be used to evoke student contributions, but the seminar is distinguished from questioning.
	Discussion	An instructor-controlled interactive process of sharing information and experiences related to achieving a training objective.
ASKNOWLEDGEMENT PROMPTING OR FEEDBACK	Performance	Student interactions with things, data, or persons, as is necessary to attain training objectives; includes all forms of simulation (for example, games and interaction with hardware simulators) and interaction with actual equipment or job materials (for example, forms). Performance may be supervised by classroom instructor, tutor, coach, or peer to provide needed feedback.
	Case Study	A carefully designed description of a problem situation, written specifically to provoke systematic analysis and discussion.

Selection Considerations

Several factors, categorized in three major areas, should be considered when selecting the instructional method. The examples below are not meant to be all-inclusive.

Constraints

·**Geographical spread of target audience**. If the target audience is widely spread, it may not be feasible to bring students to a central location for instruction. If this is the case, classroom instruction may not be the appropriate method. You may want to consider other methods such as OJT or self-study. Self-study is individual study on the job site or duty location using instructional methods such as career development courses (CDCs) or interactive courseware (ICW). Also, you may want to consider some other form of distance learning such as satellite.

·**Availability of students**. If there will be an insufficient flow of students due to constraints such as lack of travel funds, if the number of students to be trained is low, or if workload requirements will not allow students to be away from the work center for long training periods, it is not likely that formal classroom instruction is appropriate. Again, a better method may be OJT or self-study. Also, you may want to consider ICW or satellite if the design and development cost can be justified.

·**Availability of instructors**. If the necessary instructors are not available at the resident training center or field unit, you may want to consider other methods such as self-study or satellite.

·**Availability of facilities and equipment**. If there is a lack of facilities or equipment to handle the student flow, consider using OJT, self-study, or ICW.

·**Development time**. Methods such as ICW require considerable development time. If there is limited time for development or only a few students are scheduled to receive the instruction, consider using other methods such as self-study or OJT.

Cost-Effectiveness

·**Trained personnel requirement (TPR)**. Relatively expensive delivery systems such as ICW may be justified if the TPR is large and instruction is required for a long period.

·**Content stability**. If the content requires frequent updates or revisions, ICW is less suitable than classroom, OJT, or self-study.

·**Amount of practice required**. If practice is required, consider ICW, since practice time is limited only by student and equipment availability, whereas in the classroom or OJT, an instructor is required.

Instructional Considerations

·**Task criticality**. The criticality of a task is determined by two basic factors: whether the task is done under emergency conditions and how serious the results are if it is not done right. If task performance is critical, consider classroom instruction or OJT. ICW is also being used to learn critical tasks; however, using other self-study methods to learn critical tasks is questionable.

·**Learning difficulty**. The difficulty of learning is related to the complexity of the task (task difficulty) and to the types or levels of performance and knowledge needed to meet task requirements. Tasks that are difficult to learn may be taught using the classroom, OJT, or ICW.

·**Instructional fidelity**. If the requirement for instructional fidelity (the degree to which training should represent actual defense system performance) is high, select a method that uses the actual equipment, simulators, part-task trainers, or ICW to teach the process or procedures.

·**Interaction level**. If the learning process requires a great deal of interaction, OJT is probably the best, since it is highly interactive. If the group size is small, classroom instruction can provide moderate interaction. The use of ICW may also be considered. Except for ICW, self-study is an unsuitable method if the process requires high interactivity.

Select Media

Introduction

No single medium is the most appropriate choice for every instructional situation. Selecting the appropriate media ensures that the information to be learned is presented to the students by the most effective and efficient means possible.

What Are Media?

Media are the means, instrument, or material used to communicate information; in other words, a means used to give information to the students. Examples of media range from the classroom instructor to study guides, CBT, satellite training, interactive video, or numerous other types of media.

Who Is Responsible?

Selecting media for the instructional system is the overall responsibility of the instructional developer. If the design team approach is used, the appropriate team members will assist the designer in selecting the most effective, cost-efficient media for the system.

Media Types

Many different media exist for delivering instruction. Some of the most common types are shown below. Note: If copyrighted media are selected, get copyright permission.

INSTRUCTIONAL MEDIA TYPES

Instructional Media Group	Representative Examples
Classroom instructor with classroom aids ·Classroom instructor ·Instructional aids	Lecturer Demonstrator Tutor/coach Overhead projector Film strip (silent) Slides Chalkboard
Multimedia	Prenarrated slides Prenarrated film strips Slide/workbook/tape recorder combinations Video cassette television Interactive courseware (ICW)

Print	Books Computers Programmed instruction booklets Microfiche
Peer (or peer group)	Role playing Discussion groups Tutoring/coaching
Training devices and simulators	Actual equipment trainers Gaming Interactive computer (simulation) Flight training simulators

Media Characteristics

Media characteristics make them either suitable or unsuitable for particular instructional situations. These characteris tics should be considered to ensure that the appropriate media are selected to deliver the instruction. Following are the characteristics of the most common media.

CHARACTERISTICS OF INSTRUCTIONAL MEDIA

Material	Advantages	Limitations
Printed Media	1. Include common types of materials 2. Wide variety of applications 3. Simple types quick to prepare	1. Sophisticated types more costly to prepare 2. Require suitable reading ability
Overhead Transparencie	1. Can present information in systematic, developmental sequences 2. Use simple-to-operate projector with presentation rate controlled by instructor 3. Require only limited planning 4. Can be prepared by variety of simple, inexpensive methods 5. Particularl y useful with large groups	1. Require special equipment and skills for more advanced preparation 2. Are large compared with other projectors
Audiotape Recordings	1. Easy to prepare with regular tape recorders 2. Can provide applications in most subject areas 3. Equipment for use is compact, portable, easy to operate 4. Flexible and adaptable as either individual elements of instruction or in correlation with programmed materials 5. Duplication easy and economical	1. Have a tendency for overuse, as lecture or oral textbook reading 2. Fixed rate of information flow 3. Low fidelity of small portable recorders
35-mm Slide Series	1. Require only filming, with processing and mounting by film laboratory 2. Result in colorful, realistic reproductions of original subjects 3. Prepared with any 35-mm camera for most uses 4. Easily revised and updated 5. Easily handled, stored, and rearranged for various uses 6. Increased usefulness with tray storage and remote control by presenter 7. Can be combined with tape narr ation for greater effectiveness 8. May be adapted to group or individual use	1. Require some skill in photography 2. Require special equipment for closeup photography and copying 3. Can get out of sequence and be projected incorrectly if slides are handled individually
Multimedia Presentations	1. Can demand attention and create strong emotional impact on viewers 2. Can compress large amounts of information into short presentation time 3. Provide for more effective communications in certain situations than when only a single medium is used	1. Require additional equipment, complex setup, and careful coordination during planning, preparation, and use 2. Equipment and production costs high for complex programs
Video and Film	1. Particularly useful in describing motion, showing relationships, and giving impact to topic 2. Allow instant replay of video recording 3. Video tape reusable 4. Easy to record lip sync on videotape 5. May include special filming techniques (animation, time-laps) 6. Combine stil l and motion on videodisc 7. Standardized film projector available everywhere	1. High cost for studio production equipment 2. Resolution limited with video for fine detail 3. Incompatibility of some video format types 4. Value of investment in motion picture equipment reduced as video replaces film Note: Videotape fast replacing 16mm film medium.
Interactive Courseware	1. Presents text information and graphic images 2. Interacts with learners on individual basis through asking questions and judging responses 3. Maintains record of responses 4. Adapts instruction to needs of learner 5. Controls other media hardware 6. Can interface computer and video for learner-controlled programs	1. Requires computers and programming knowledge 2. Requires essential hardware and software for development and use 3. Incompatibility of hardware and software among various systems

Media Selection by Learning Outcomes

During the initial stages of media selection many of the types of media available were excluded as being inappropriate. The following table (Reiser and Gagné, 1983) takes media exclusion and selection a step further. The table provides the implications for excluding and selecting media based on the desired learning outcome of the objective of the instruction.

Learning Outcome	Exclusions	Selections
Intellectual Skills	· Exclude media having no interactive feature ·Exclude printed discourse for nonreaders	· Select media providing feedback to learner responses ·Select audio and visual features for nonreaders
Cognitive Strategies	· Exclusions same as for intellectual skills	· Select media with same features as those for intellectual skills
Verbal Information	· Exclude only real equipment or simulator with no verbal accompaniments. Exclude complex prose for nonreaders	· Select media able to present verbal messages and elaborations. Select audio and pictorial features for nonreaders
Attitudes	· Exclusions same as for verbal information	· Select media able to present realistic pictures of human model and the model's message
Motor Skills	· Exclude media having no provision for learner response and feedback	· Select media making possible direct practice of skill, with informative feedback

Media Selection by Learning Outcomes

The media selected to deliver the instruction should determine, to a great degree, the effectiveness and efficiency of the instructional system. Some media selection guidelines to be considered are:

·Design of the specific instructional environment in relation to system constraints and instructional objectives.
·Instructional strategy that has been planned, based on the types of learning involved.
·Extent to which individualization of the instruction would be cost-effective.
·Availability of the work-hours, know-how, and funds required to develop, produce, and maintain instruction using the selected media.
·Availability of the resources needed to deliver the instruction.
·Impact on cost-effectiveness of the instruction.

Select Media for Integrated Activities

Introduction

Most types of complex skills involve multiple objectives from different domains of learning. A skill that involves two or more objectives from different learning domains involves integrated learning activities. Media selection for integrated learning activities must take into consideration the enterprise and the learner's schema, metaskills, and experience.

Enterprise

An enterprise is an integrated, purposeful activity that usually leads to accomplishment of a goal. For example, an individual might have an enterprise to construct and implement an air campaign plan in a war situation. An individual does not have to have all the prerequisite skills to engage in an enterprise. The importance of an enterprise is that it is purposeful and relevant to the learner. This motivates the learning behavior necessary to complete the component tasks.

Schemas

A schema is an individual's organization of knowledge. Schemas may take the form of scripts (a kind of story or scenario that organizes information) or frames (a structure that looks like a table or matrix into which information fits). Different levels of learners have different types of schemas. A novice learner (in a particular subject area) has a very sketchy schema or structure into which new information can be placed. An experienced learner (one who has had some training in a subject area) has a better structure and therefore is a quicker learner than the novice. Finally, an expert has a very highly developed schema and is probably capable of rapid learning with very little learning support.

Metaskills

Metaskills are cognitive strategies that an individual applies to the processing of new information in a novel situation (a scenario not previously experienced). These skills include chunking or organizing new information, recalling relevant schemas, adding the new information to the old schemas, and creating new schemas. Although metaskills are probably subject-independent, different individuals have different metaskill capabilities depending upon their experience with a particular subject content. For example, an expert has developed metaskills and can relate better to a novel situation than a novice. An expert is more efficient at processing new information and applying it to the novel situation.

Learner Experience

It is helpful to know how experienced a learner is when selecting media or teaching strategies. The more experience, the higher the level of metaskills and strategies the learner will be able to employ. Experienced learners can deal with larger steps of instruction and more complex learning environments. Novices, on the other hand, require simplification of complex contexts so they don't experience information overload while learning.

Media Selection Guidelines

When designing learning environments, the fidelity of the training situation should take learner experience into consideration. It is generally better to teach a novice in a simplified context, so that the amount of information and noise is reduced to a manageable level. At this level, part-task trainers (PTT) are often used to teach component skills that will be integrated later as the learner becomes more experienced.

Experienced learners can handle greater information loads and can disregard noise, so the context should be more lifelike, yet not full-fidelity. Here, training aids with integrated subsystems are often used so the learner can learn how they work together and how procedures that involve more than one subsystem are performed.

Experts are capable of learning very quickly in high-fidelity environments. They transfer their knowledge from other similar environments and actually enjoy learning using real equipment or very high-fidelity simulators. For instance, if you are training an F-14 pilot to fly an F-16, you don't have to go back over what is already known; the learner simply has to know the differences between the planes that will affect how they are flown.

Media Selection for Integrated Activities

The chart below shows approaches to consider when selecting media for integrated learning activities. Examples of learning activities for each approach are provided with possible media for supporting the activities.

Consider the learning activity for which you are developing training and select the appropriate media to achieve the integrated goal, end goal, or terminal objective.

Approach	Example of Activity	Example of Media
Provide alternate media for presentation and practice	Function of Parts	CBT
	Procedures	PTT or Simulator
Provide multiple media fo the same task	Emergency procedures	Classroom, CBT, Simulator
Provide intermediate practice exercises	Air refueling	PTT, Simulator, Aircraft

Provide repeated, spaced practice	Landing an aircraft	Simulator, Aircraft

Determine Instructional Strategies

Introduction

Now that the instructional method and media have been selected and the various types of learning have been considered, the instructional strategy can be determined. Determining the instructional strategies enables the instructional activities to be designed. Selection of the instructional strategy needs to be consistent with the prior learning analysis and objectives hierarchy decisions. It also needs to support the instructional aims and overall instructional concept.

What Are Instructional Strategies?

Chapter 2 on learning theory described how the events of instruction are related to the internal processes of learning. From a learning theory perspective, the purpose of instruction is to activate internal processes in order to facilitate the acquisition of new skills, knowledge, or attitudes (SKA). Different kinds of learning outcomes require different means for activating the internal processes. These means are called instructional strategies.

The following table shows the relationship between learning processes and phases and provides examples of general strategies to support learning. These are activities that support cognitive strategies, which were discussed in Chapter 2.

Learning Process	Learning Phase	Instructional Aim	Strategies to Support the Processes	Examples
Expect-ancy	Motivation	Build relevancy and communicate the goal.	· Set the stage. ·Personalize the context. ·Create uncertainty.	· Tell a story. ·Provide a demonstration. ·Ask leading questions.
Perception	Appre-hending	Focus attention.	· Use novel or interesting examples. ·Activate the learner's senses.	· Use color. ·Use print techniques such as bold face type or italics. ·Introduce sounds, smells, real objects, video.
Working Storage	Acquisition	Present information in manageable units	· Organize the content. ·Produce a visual image that illustrates abstract information.	· Use mnemonics. ·Chunk the information. ·Outline the information. ·Use imaging techniques (such as concept mapping and Information Mapping®).
Encoding	Processing	Build upon existing knowledge.	· Put content into meaningful context.	· Provide analogy, metaphor, simile. ·Provide meaningful examples and nonexamples.
Storage	Retention	Merge new information with existing knowledge.	· Encourage rehearsal. ·Provide for spaced review.	· Create new examples. ·Paraphrase the information. ·Have learner verbalize new SKA.
Retrieval	Recall	Attach the new SKA to environmental cues.	· Provide situations in which new information should be used.	· Practice application of new SKA. ·Have learner teach the new SKA.
Validation of Under-standing	Feedback	Test accuracy of new SKA.	· Compare performance to acceptable standard.	· Provide feedback to learner.

Transfer	Generali-zation	Allow for generalization of recall cues.	· Provide collaborative learning exercises (team problem solving). ·Provide alternative context in which SKA can be used.	· Illustrate how new SKA might be used in new situation. ·Have learners generate new ways to use SKA.
Valuing	Personali-zation	Reinforce meaningfulness of new SKA.	· Utilize SKA as context fo new learning. ·Apply SKA in authentic activities.	· Reinforce behavior by making it relevant to work or another new SKA to be learned.

Purpose of Instructional Strateg

The purpose of instructional strategy is to outline how instructional activities will relate to achievement of the objectives.

Determining Strategies

Several key learning concepts that should be considered when determining instructional strategies are:

·Active student participation
·Student feedback
·Planned pacing

Active Student Participation

When determining the instructional strategy, the concept that **active student participation** is required for effective and efficient learning to take place should be considered. Individuals learn by doing, thinking, and feeling—by answering questions, discussing, computing, manipulating, putting ideas together, etc. Thus, to ensure that learning has taken place, the instructional strategy should ensure that students are active in the learning process and that they can apply or demonstrate what they have learned. When determining the strategy, there are several considerations.

Type of Learning	Consideration
Skill	· Demonstrate task which the student is to perform. ·Have each student perform each step of the task.
Knowledge	· Use questions throughout the lesson. ·Each question should support objectives. ·Each student should participate in the questions.
Attitude	· Use human modeling to shape student attitude. ·Use guided discussions for affective lessons. ·Give or withhold rewards.

Student Feedback

Students actively participating in the teaching-learning activity may require **feedback** on how well they are doing. Feedback not only informs the students how well they are doing, but also serves as a valuable source of motivation. The instructional strategy should be to provide each student with adequate feedback, whether it be the results of a written test, instructor comments, ICW responses, etc., during the performance of a task.

Key points to remember about feedback are:

- During the early stages of instruction, feedback should be provided often to keep students informed of how well they are doing and to build their confi dence.
- During the latter stages of instruction, feedback should be provided as necessary.
- Timing, responsiveness, and being constructive are critical.

As part of determining instructional strategy, instructional developers should determine what follow-through activities are required. For example, if a student fails to meet the established standards after receiving instruction, will remediation be provided? If so, have the remedial instructional activities and materials been prepared in order toprovide additional assistance to the student? Likewise, if a student does exceptionally well during the instructional period and finishes ahead of other students, are
enrichment materials or instructional activities available for the student to participate in until the other students reach mastery?

Follow-through activities are an essential part of determining the overall instructional strategy for instructional systems.

Planned Pacing

A key strategy that should be determined along with student participation and feedback is that of **planned pacing**. Pacing is the rate at which students go through the instructional sequence. There are several ways to pace the students' progress.

- **Group-paced** - Students are given the instruction and progress through the sequence as a group, at the same rate. This is a very effective method when teaching groups of students. It allows the group to progress faster or slower than the predetermined rate depending on the ability and need of the group.

- **Group lock-step** - The group progresses through the instructional sequence at a predetermined pace, completing the instructional sequence on schedule. Normally this is the most costly form of pacing. However, in cases where students' flow through the training sequence is critical, it is very effective. This method is useful when there are constraints such as equipment or facilities that require the students to flow through the sequence on schedule to avoid conflicts.

- **Self-paced** - Students are allowed to work at their own pace through the instructional sequence within certain parameters. This form of pacing is very effective in courses using CBT, interactive video, self-study, etc.

- **Combination pacing** - Any of the above-mentioned forms of pacing may be used in combination with another in an instructional sequence. Some of the instruction may be group-paced while other instruction may be self-paced.

There are several techniques which can be used to provide planned pacing to meet the individual needs of the students.

- **Proficiencty advancement -** This technique is used to advance students who have prior knowledge or practical experience, or who are exceptionally fast learners. Students show their proficiency by passing a criterion test afor the instructional sequence. Students may be advanced through each sequence in which they have passed the criterion test.

- **Multiple track -** The instructional sequence may be divided into various tracks of learning, which allows students to track through portions of instruction that are best suited to their abilities and needs. The best track for a student is uaually determined by administering a pretest.

- **Modular scheduling -** The instruction is divided into different modules and students are pretested to determine which modules they need. Modular scheduling is normally used only when the learning sequence is not critical.

Design Instructional Activities

Introduction

Once the instructional strategy has been determined, the instructional activities can be designed. Design of the activity depends largely on two factors, sequence of instruction and size of the instructional unit.

Reasons for Sequencing

There are several reasons for sequencing instruction.

·**Student motivation** - Students learn best when they are motivated to do so. In most cases, motivation depends on a sense of direction. Properly sequenced instruction should provide this direction, and give the students a "mental roadmap" of where they are going and how they are going to get there. With this mental roadmap, students are less likely to be confused.

·**Meaningful relationship** - A proper sequence can provide the students with a pattern of relationships so that each instructional activity will have a purpose. If instruction is meaningful to the students, they should learn more easily and quickly.

·**Consistency in content** - Proper sequencing helps to avoid inconsistencies in the training content. Consistency of content ensures that skill progres sion is orderly and that prerequisite knowledge and skills have been acquired.

Sequencing Instruction

There are several methods of sequencing instruction.

·**Job performance order** - The order in which the tasks and subtasks are performed on the job.

·**Psychological order** - Arranges the instructional content based on the ease of learning. Students are taught the easier tasks first, then progress to the more complex tasks.

·**Logical order** - Normally, instructional activities should be designed to proceed from the simple to the complex or from the known to the unknown. However, instructional activities may not always lend themselves to these design meth ods. In such cases, you may want to design the activity using both the performance order and the psychological order. This arrangement normally includes the whole-part-whole concept, showing the whole, breaking it down into parts, then back to the whole.

Guidelines for Sequencing

Various methods of sequencing can be used to design the instructional activity based on the content of the instruction and resource availability. When selecting methods to design the activities, consider the following:

- ·Place easily learned objectives early in the instructional sequence.
- ·Provide any common or "core" instruction in the early part of the sequence.
- ·Sequence subobjectives with the objective they support.
- ·Place skills and procedures within each objective in job order when possible.
- ·Introduce concepts at the first point where the understanding of those concepts is a prerequisite for successful performance.
- ·Provide instruction on prerequisite skills before the time where they should be combined as required on the job.
- ·Introduce a knowledge or skill in the task in which it is most likely or most frequently to be used.
- ·Provide for practice of skills and concepts in areas where transfer of like or related skills is not apt to occur.
- ·Design and provide intermediate practice exercises to allow the student to gain proficiency of a particular enterprise due to difficulty or newness.
- ·Provide for repeated, spaced practice to gain and maintain proficiency.
- ·Place complex and cumulative skills late in the sequence.

Optimum Size of Instructional Unit

The best approach to designing the proper size or increment of instruction is to start with minimal instruction, and rely on validation to show if more instruction is needed in a particular unit. This method combined with feedback from training evaluation may indicate the need for more instruction. If you provide more instruction than is necessary in the beginning, you may not have a good indication that you have done so.

Section E
Develop Implementation Plan

Introduction

Once the instructional system has been designed and before the development phase begins, the implementation plan for the instructional system is developed. It is important for management and control purposes to have a plan documenting the instructional system.

What Is An Implementation Plan?

An implementation plan documents the design of the instructional system and how the system will be used. Plans may include, but not be limited to, information such as:

·Identification
·Parameters of instructional system
·Type of instruction
·Instructional methods
·Instructional content
·Resource requirements
·Design, development, and implementation milestones

Implementation plans may include resource and control documents such as:

·Tasking letters, messages, etc.
·Equipment lists
·Personnel documents
·Facility requirements
·Plans of Instruction (POI) and syllabuses
·Training standards
·Course maps
·Course charts
·Resource constraints

Purpose

Implementation plans that are well developed have several purposes, which include:

·Document the instructional system.
·Identify resource requirements/constraints such as personnel, equipment, facilities, etc.
·Set the design, development, and implementation milestones.
·Serve as the approval document for operation of the instructional system.
·Serve other purposes as determined by the particular system.

Who Is Responsible?

Implementation plans are the direct responsibility of instructional systems management. Managers should develop a plan that describes or documents the instructional system. In order to develop this plan, input may be required for other organizations such as instructional staff, resource managers, or civil engineers.

Section F
Design Instructional Information Management System

Introduction

Effectively and efficiently managing information is one of the more difficult tasks in instructional systems management. There are always records to be updated, students to be scheduled, equipment to be tracked, and budgets to be met. Regardless of whether the task is accomplished using pencil and paper or computers, it is a task that should be done well. During the initial stages of ISD project planning, management strategies should have focused on managing instructional information.

Purpose

The purpose of an automated instructional information management system is to better manage the system. For example, the automated system can be used by:

- Instructors to update student status
- The registrar to track student status
- Instructional developers to update instructional materials
- Managers to manage resources

Who Is Responsible?

Responsibility for designing an instructional information management system normally falls on a project manager or officer. However, course managers have the responsibility to ensure that the instructional information is adequately managed for their instructional system. In most cases, managers may not have an option as to whether an automated information management system is designed or not. The decision is normally based on the availability of a management system. If a system does exist, it may be used by all who are involved in the instructional system.

Designing a Management System

There are many things to consider when designing or redesigning a management system. Some of these are:

- What is the system cost?
- What are the hardware capabilities?
- Are there any special environmental requirements for the hardware?
- What are the software capabilities?
- Is the system documentation adequate?
- Are the hardware and software user-friendly?
- Does the system have proven reliability?
- Is the system maintainable?
- Will the system interconnect/interface to existing systems?
- Is the system software compatible with other software?
- Does the hardware have expansion capability?
- Can the software be upgraded or modified easily?
- What instructional information will the system be able to manage?

Other considerations include:

- Who are the system users?
- What information will they need to manage their jobs?
- What information is common/unique?
- How long should the information be maintained?
- What reports will be required? Standard? One-time?
- What outside agencies need information? Frequency?
- What information will be needed for each training system function?
- What interfaces will be required?

Section G
Update ISD Evaluation Plan

Introduction

In the initial stages of ISD project planning, the **ISD evaluation plan** was developed. The emphasis of the evaluation plan is to ensure total quality in the instructional system, the instructional development process, and the products of that process. To ensure that the ISD evaluation is effective throughout the life cycle of the project, the plan may need to be updated periodically.

Assessing Quality

ISD is a quality management process. There are different ways to assess the quality of the design phase. One of the simplest ways is to develop a job aid using questions focused on quality improvements. Examples of questions are:

- ·Does the ISD evaluation plan assess the quality of both process and products in the design phase?
- ·Is the instructional design effective and cost-efficient?
- ·Can the instructional design process be improved? If so, how?
- ·Are the metrics or standards for the design process and products realistic and adequate? If not, why not?
- ·Are the performance standards correct?
- ·Can the products of the design phase, such as objectives and tests, be improved? If so, how?
- ·How can the instruction be better accomplished?
- ·Are the products of the design phase accurate?
- ·Do the products of the design phase contain adequate information? If not, what information should be added?
- ·Do the products of the design phase contain information that is not needed?
- ·Are products being developed during the design phase that are not needed?

Why Update the Evaluation Plan?

Updating the plan keeps the evaluation process "on track" and effective through the remainder of the ISD process. Therefore, it is necessary to update the plan with the results of the design phase to keep the information current and accurate in order to effectively evaluate the development process and products.

Who Is Responsible?

Management has the overall responsibility of developing and updating the evaluation plan.

What Should Be Updated?

Updating the plan may include, but not be limited to:

- ·Changes in the scope of the evaluation strategy resulting from the design phase such as:
  - ··Procedures to be used in evaluating the design process and products
  - ··Design products to be evaluated such as objectives, test items, etc.
  - ··Standards to be used to evaluate the design process and products
- ·Revisions to the evaluation schedule such as:
  - ··When the design process and products should be evaluated
  - ··When SME or other expertise is required
- ·Documenting the evaluation results of the design phase
- ·Providing rationale for changes made to the evaluation strategy
- ·Lessons learned during the evaluation of the design process and products

Tracing the Quality Process

Quality of the design process and the resulting products is very important to the instructional development process. Therefore, document the evaluation of the design phase to the point that the quality process can be traced throughout the entire ISD process, including the design phase.

***Caution**: Document **only** what you need—never document more than you need*

Section H
Update ISD Management Plan

Introduction

When the design phase is complete, it is likely that the plans for managing the instructional system will require updating. An updated management plan should guide system and instructional development during the design phase. During the design phase, if changes are made that impact management strategies, the plan may again need to be updated to reflect the current information.

Importance of Management Plans

Current management plans are essential to ensure that the instructional system continues to be developed according to the predetermined plan, instruction is designed using the ISD process, and the entire effort is on schedule and under budget.

Purpose

The management plan has several purposes:

·It serves as a tool for managing the system and the instructional development process.

·It establishes milestones for system and instructional development.

·It ensures that effective and efficient instructional systems are developed.

Why Update Management Plan?

Management plans are continually updated to reflect current status of the project. The plan should be the latest roadmap showing where the project is, where it is going, and how it's going to get there.

Who Is Responsible for Updating?

Management is responsible for seeing that the management plan is updated with the most current information and status. The information necessary for updating the plan should be provided by the organizations responsible for supporting, operating, and maintaining the instructional system.

What Should You Update?

Include the latest information resulting from the design phase, such as:

·Changes to the overall management strategy for the system and instructional development process
·Refinements to project definition
·Revisions to the resource requirements
·Changes in resource constraints
·New or revised milestones
·Addition or deletion of taskings

Chapter 6
DEVELOPMENT

Overview

Introduction

At this point, objectives have been specified, tests developed, training strategies and activities planned, and you are ready to implement your design in the development phase. Adequate planning, analysis, and design should make it easier to develop instruction. Some of the tasks to be discussed in this phase include developing plans of instruction, writing lessons, producing instructional materials, and developing interactive courseware.

Where Are You in the Process?

In order to visualize the ISD process, a model with the development phase highlighted is provided in Figure 9.

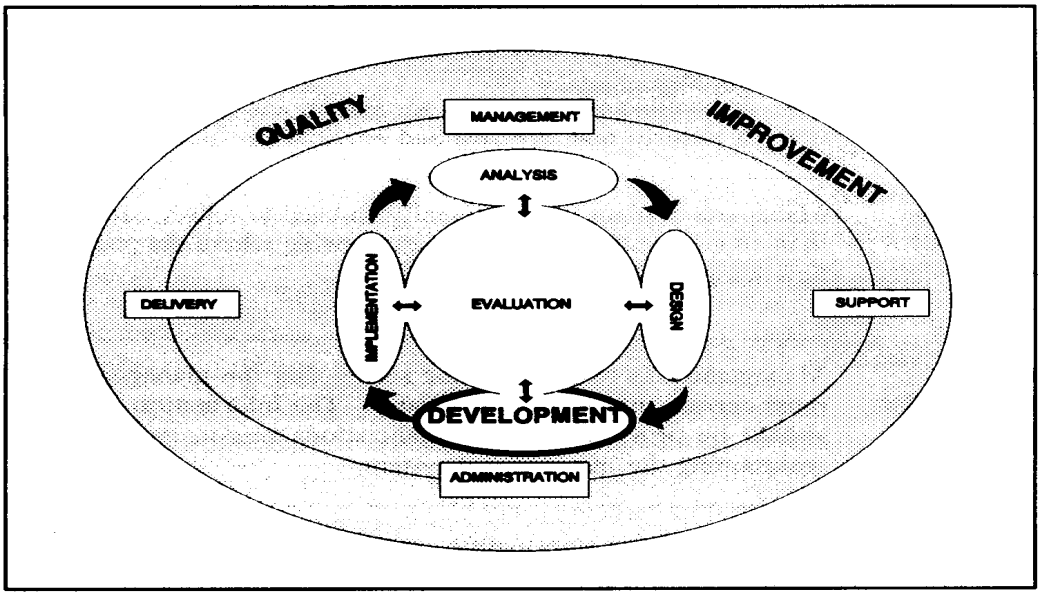


Figure 9. Development Phase

Objectives

The objectives of this chapter are to:

- Explain the tasks involved in developing instruction.
- Discuss installation of instructional information management systems.
- Define planning requirements for course development.
- Explain the validation process.
- Discuss finalization of instructional materials.

Section A
Prepare Plan of Instruction/Course Syllabus

Introduction

Once the instruction has been designed, a plan of instruction (POI) or course syllabus should be prepared. The POI or syllabus serves as the overall plan for conducting instruction in a particular course; therefore, careful preparation of these documents should help ensure the effectiveness and efficiency of the instructional system. They help standardize the instruction while controlling the quality of the teaching-learning activity.

Purpose

The POI or course syllabus is a control document used for planning, organizing, and conducting instruction.

Description

The POI/course syllabus documents the instructional events of a course. It expands the basic course control documents and provides detailed information needed to provide the instruction. Although POIs or syllabuses can be in different formats, they are normally organized by units or modules of instruction with each unit containing information such as:

- Course description, such as title, number, and security classification
- Statement of objectives
- Preferred instructional sequence
- Instructional hours and approximate allocations of those hours to objectives
- Portions of the training standard that the unit of instruction supports
- Instructor requirements, including multiple instructor requirements
- Instructional method, such as lecture, demonstration, performance or self-study
- Support materials, such as student instructional literature or technical orders
- Media utilization
- Equipment utilization
- Instructor guidance
- Lesson plans

Why Have POIs/Syllabus?

The POI/course syllabus is the course control document that serves as the single "blueprint" for providing instruction in a course. It is also used to develop the lesson plans which are used by the instructors to guide teaching-learning activities during units or modules of instruction.

Who Is Responsible?

Instructional developers and instructors normally prepare the POI/course syllabus and revise them as applicable. However, course managers have the overall responsibility for monitoring the preparation, as well as ensuring that they remain current.

Guidelines for POIs

There are no specific guidelines for preparing POIs/course syllabuses since they should be adapted to various course applications to meet the needs of the using organization. However, there are several basic or general guidelines that apply to all POIs. They should:

- Be easy to use.
- Document the plan of instruction.
- Provide adequate information.
- Be easily maintained.
- Meet the organization's need.

Also, the format of the lesson plan is determined by the organization providing the instruction.

Section B
Produce Instructional Materials

Introduction

In the development phase, the instructional materials used to support the system should be developed. Material development is a time-consuming and exacting task regardless of the medium that has been selected. It is essential that quality materials be developed, since they carry the information to be learned to the students. Adequate resources are required to develop quality materials in a timely manner.

What Are They?

Instructional materials refer to printed or other media intended to convey events of instruction or communicate information to the students.

Types of Instructional Materials

Some of the instructional materials/media that can be used to deliver instruction are:

·Print-based material
·Transparencies
·Slide/tape
·Audio/video tapes
·Interactive courseware (ICW), including CBT and CMI
·Interactive video
·Mission scenarios
·Interpretive exercise

Factors in Media Development

Development of instructional media products may be affected by several factors. The relative importance of each of these factors depends on the medium selected. These factors are:

·Development personnel required
·Development time required
·Development cost required

Development Activities

Media product development requires many activities. The type and number of activities depend upon the materials being developed. For example, some common development activities are provided in the following table.

Media	Development Activity
Print	·Draft/write material ·Edit material ·Publish material
Transparencies	·Draft transparency ·Generate reproducible transparency ·Reproduce transparency
Slide/Tape	·Storyboard/script slide or tape ·Shoot and edit slide/tape ·Narrate audio ·Print slide/tape
Videotape	·Storyboard/script ·Shoot and edit video ·Develop audio
CBT	·Storyboard/script ·Develop graphics ·Program/code computer
Interactive Video	·Storyboard/script ·Shoot and edit video ·Develop graphics ·Develop audio ·Program/code computer
Mission Scenarios	· Determine mission requirements ·Establish parameters ·Develop mission ·Program/code mission

All media products go through stages of development which may vary depending on the type of media being developed.

Who Is Responsible?

Developing instructional media products normally requires teamwork and various skills. Instructional developers are responsible for planning, scheduling, and making sure the instructional media get produced. The following table lists team members required for production of the different media.

Media	Development Role
Print	· Subject Matter Expert ·Instructional Developer ·Editor ·Graphic Artist
Transparencies	· Instructional Developer ·Graphic Artist ·Editor
Slide/Tape	· Script Writer ·Subject Matter Expert ·Photographer ·Audio Technician ·Editor
Videotape	· Script Writer ·Subject Matter Expert ·Video Producer, Editor, Photographer ·Audio Technician
CBT	· Script Writer ·Subject Matter Expert ·Graphic Artist ·Computer Programmer
Interactive Video	· Programmer ·Script Writer ·Subject Matter Expert ·Video Producer, Editor, Photographer ·Graphic Artist ·Audio Technician
Mission Scenarios	· Aircrew Member ·Instructional Developer ·Computer Programmer

Guidelines for Product Development

When developing instructional materials, make sure they:

- ·Support the objectives.
- ·Are student-centered.
- ·Build learning on learning.
- ·Meet the design that was specified in the design phase.
- ·Use techniques that are consistent with the principles of effective learning.
- ·Are appealing to the students.
- ·Are interesting and meaningful to maintain student attention.
- ·Require student participation, as with ICW.
- ·Lead students in the direction of the behavior specified in the objective and guide them toward mastery of the task with proper stimuli and reinforcement.
- ·Are developed using experts such as programmers, photographers, graphic artists, script writers, and editors in order to develop quality instructional material.
- ·Are checked prior to publication/production to ensure quality, e.g., for technical accuracy, completeness, programming errors, blurred visuals.
- ·Use appropriate vocabulary at the level of the target population.
- ·Are properly paced.
- ·Are easy to understand.
- ·Include appropriate safety precautions.
- ·Support the human relations concepts to which the Air Force is committed.

Additional Information

For additional information on development of media and materials, see:

- ·AFMAN 36-2236.
- ·Leshin, C. B., Pollock, J. and Reigeluth, C. M. (1992). *Instructional Design Strategies and Tactics*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Section C
Install Instructional Information Management System

Introduction

Another activity that takes place in the ISD development phase is the installation of the instructional information management system. Most individuals involved in the management, design, development, and operation of instructional systems will probably never participate in the design or redesign of an instructional information management system. In case you are ever involved in installing an information management system, there are several things you should know.

Who Is Responsible?

A project manager or officer will normally have the overall responsibility for installing a new instructional information management system, rehosting an existing system, or modifying the software or hardware of an existing system. Individuals from the organizations receiving the system will more than likely be involved in performing acceptance or operational tests of the system. For example, an instructor may be required to record the results of a test, while an instructional developer may be asked to revise a number of objectives and the associated instructional materials.

What Should Be Checked?

During the installation and testing of an instructional information management system, there will likely be documents that guide installation and checklists to test system operation. These documents or checklists are normally sufficient; however, if they are not, there are numerous items that should be checked. Examples of items that can be checked are:

- ·Are the operating instructions adequate?
- ·Is the hardware user-friendly?
- ·Is the software user-friendly?
- ·Are the hardware and software sufficiently documented to support maintenance?
- ·Are there adequate terminals to do the required tasks in a timely manner?
- ·Is the information management in each area accurate?
- ·Is the information management in each area complete?
- ·Is the system reliable?
- ·Is the system adequately interfaced with other users in the organization?

Section D
Update ISD Evaluation Plan

Introduction

QI is a common goal throughout the entire ISD process from the initial project planning to the continuing evaluation of the operational system. Remember that ISD is a quality management process that focuses on both process and products. Therefore, it is necessary to have an ISD evaluation plan that becomes the metric or standard for evaluating the ISD process and the products of each phase. To ensure that the plan remains an effective evaluation tool throughout the life cycle of the project, it needs to be updated periodically, especially after each phase of ISD. At the end of the development, the evaluation plan should be updated to keep it current and accurate.

Assessing Quality

Using ISD to develop instructional systems ensures the quality of the development process as well as the products of that process. The ISD evaluation plan includes procedures for evaluating the process and the products development phase. A good method for assessing the quality of the development phase is to develop a job aid. There are other ways, but they may not be as easy to develop and use. The simplest way to develop a job aid is to use a series of questions such as:

- ·Does the ISD evaluation plan for the development phase assess both process and product quality?
- ·Are the quality standards for the development phase realistic and adequate?
- ·Can the development process be improved? If so, how?
- ·Can the products of the development phase be improved or simplified? If so, how?
- ·Are the various products of the development phase accurate and are they compatible with other products of this or earlier phases? For example: Do the objectives, standard, POI, lesson plan, and student materials all agree?
- ·Are there any products in the development phase that are not needed?
- ·Are there additional products that should be developed?

Why Update the Evaluation Plan?

In order for the ISD evaluation plan to be an effective tool, it should include the most current and accurate information. An updated evaluation plan keeps the evaluation process "on course" and ensures that the evaluation process is effective throughout the remaining phase of the ISD process. An updated plan helps ensure process and product quality.

Who Is Responsible for Updating the Plan?

Course managers are directly responsible for updating the ISD evaluation plan. Other individuals, such as instructional developers, will likely provide information necessary for updating the plan at the end of the development phase.

What Should Be Updated?

The ISD evaluation plan should be updated periodically to include new or revised information such as:

·Changes in the evaluation strategy for the development phase. For example:

··Types of products to be evaluated such as training materials, lesson plans, ICW
··Procedures to be used in evaluating the process and products of the development phase
··Standards or metrics to be used in the evaluation

·Revisions to the evaluation schedules such as:

··Number or quantity of products to be evaluated
··When the development process and products should be evaluated

·Documentation of the results of the development phase evaluation
·Rationale for changes made to the evaluation strategy during the development phase
·Lessons learned during evaluation of the development phase

Tracing the Quality Process

QI is an important part of the ISD process. In the development phase, emphasis is still on quality. An important part of the quality process is to be able to trace what has been done in the development phase to ensure both process and product quality. Therefore, document the quality process used to evaluate the development phase.

Document only what is necessary to trace the quality process.

Section E
Update Management Plan

Introduction

As the development phase is concluded, it is likely that the management plan, which was last updated during the design phase, may again require updating to keep it current and accurate. If the plan is to remain an effective management tool, it should be updated continually so that it provides a roadmap for developing and managing the instructional system. Some of the information in the plan that may require updating as a result of the development phase is project milestones, resource requirements, and resource constraints.

Why Update the Plan?

In order to ensure that the management plan remains an effective tool for managing during the implementation phase, it should be updated with any applicable changes resulting from the development phase of ISD. A management plan with outdated project information is an ineffective tool for managing the ISD process. Therefore, the plan should be the latest roadmap showing where the project is, where it is going, and how it is going to get there.

Who Is Responsible For Updating?

Managers of the instructional system have the responsibility of keeping the management plan updated with the most current information and status. Most of the information necessary for updating the management plan should come from the instructional staff or support organizations.

What Should Be Updated?

As the development phase is being completed, the management plan should be updated if significant changes have occurred. Include new or revised information resulting from the development phase, as applicable. Include information such as:

- Changes to the overall management strategy for the system resulting from the development phase
- Refinements to project definition
- Revisions to resource requirements
- Changes in resource constraints
- New or revised milestones
- Addition or deletion of taskings

Section F
Validate Instruction

Introduction

At this point in the instructional development process, objectives have been developed, tests written, instructional methods and media selected, and instruction is being developed. Yet, there is no assurance the instruction will be effective. Therefore, the instruction should undergo **validation** to prove that the instruction provides graduates with skills, knowledge, and attitudes to meet job performance requirements. If deficiencies are found in the instruction during validation, they are corrected before course implementation. Validation consists of internal reviews, individual try-outs, and small-group tryouts which are conducted as a part of **formative evaluation** and operational (field) tryouts which make up **summative evaluation**.

What Is Validation?

Validation assesses the effectiveness of instruction while it is being developed with the intention of improving it. It is a process of repetitive cycles of development, tryouts, and revisions until evidence shows that the instruction is effective.

When Should Validation Be Done?

When possible, validation should be done as segments, units, or blocks of instruction are developed or revised. Instructional developers and instructors should not wait until all of the instruction has been developed before testing its effectiveness.

Develop Validation Plan

Introduction

For an instructional system to be effective, adequate planning should take place in the initial stages of training development. A part of that planning is the evaluation plan, which often includes a plan of how the instruction is to be validated. Validation planning is essential for successful implementation of an instructional system.

Purpose

A validation plan provides instructional developers and instructors with a road map for validating the instruction. A validation plan provides structure and creditability to the validation process.

Who Is Responsible?

Validation planning is the responsibility of managers within the instructional organization. This responsibility is often delegated to instructional developers since they often provide much of the information that goes into the validation plan such as the validation schedule, number of individual tryouts, and number of tryouts to be conducted.

What's In a Validation Plan?

Validation plans may contain information such as:

·Description of instruction to be validated (objectives, method, medium)
·Who may conduct the validation
·Validation procedures
·Validation schedules
·Program schedule constraints
·Number of tryouts to be conducted in each of the tryout activities
·Number and availability of students to be used in the tryouts
·Sources and how the results should be documented
·How problems should be resolved

Getting Ready To Validate

Prior to starting validation, you should:

·Understand each activity in the validation process.
·Know who is expected to conduct the various activities.
·Know when the activities are to occur.
·Ensure that the instruction is ready.
·Ensure that students have been scheduled.
·Know how to document any deficiencies.
·Know procedures for revising instruction, if applicable.

Conduct Internal Reviews

Introduction

The **internal review**, which is a formative evaluation activity, is the first step of the actual validation process. This review, which is also called a technical accuracy review, identifies inaccuracies and weaknesses in the materials under review. Materials should be thoroughly reviewed, since this may be the last opportunity to revise draft materials before they are tried out on the students. If possible, and when applicable, conduct internal reviews each time instruction is developed, updated or revised.

Purpose

The purpose of the internal review is to verify the accuracy of the instructional materials as they are developed in order to identify inaccuracies and weaknesses in the materials so they can be corrected.

Who Should Review?

Internal reviews should be conducted by:

·SMEs
·Instructional developers
·Instructors

An individual selected to conduct a review should be:

·A subject matter expert
·A concise and constructive critic
·Knowledgeable about instructional design and development

What Should Be Reviewed?

Instructional materials to be reviewed include, but are not limited to:

·Objectives
·Test items
·Storyboards/scripts
·Audiovisual materials such as slides, films, videotapes, transparencies
·Job aids
·Printed materials
·ICW such as CBT and CMI

How To Conduct a Review

There are many ways to review instructional materials for accuracy, completeness, and quality. The bottom line is to cross-check the materials against the data sources such as technical orders, regulations, directives, and checklists. One method of helping conduct the review is to develop a job aid. An example is provided :

Sample Job Aid for Internal Review

1. Is the content of the material accurate?
2. Is the material current?
3. Is the material complete?
4. What are the "good" parts of the material?
5. Are there any "bad" parts in the material?
6. Does the sequence of the material build learning on learning?
7. Are the practice exercises adequate?
8. Are the review exercises adequate?
9. Do the materials/lesson effectively teach the behavior specified in the objective?
10. Is the objective adequately evaluated?
11. Is the content of the material compatible?
12. Can the materials be improved? If so, how?

During a Review

When conducting a review, the reviewers should:

·Take careful notes while conducting the review.
·Make specific comments.
·Identify weaknesses in the materials.
·Recommend ways to improve the materials.

After a Review

After the review, the reviewers should:

·Discuss their review findings.
·Determine what revisions or changes should be made to the materials.
·Decide the best way to make the necessary corrections to the materials.
·Make revisions and changes to the materials, as applicable.

Conduct Individual Tryouts

Introduction

Conducting individual tryouts, which is a formative evaluation activity, is normally the next step in the validation process. During this step, as the instruction and materials are being developed, they are tried out on individual students. The instruction and materials should be tried out on several students, if practical, to add validity and reliability to the data collected during the tryout. It may not always be possible to conduct individual tryouts due to resource constraints.

Purpose

The purpose of individual (one-on-one) tryouts is to determine the effectiveness of small segments or units of instruction and materials as they are developed, updated or revised.

Select Students

A great deal of care should be used when selecting students to participate in the individual tryouts. During the selection process, consider the following factors:

- Students selected for the tryouts should be from the target audience and fall within the predetermined range of:
  - Aptitude
  - Skills
  - Attitude
  - Prior knowledge
  - Background experience

  If students do not fall within the range, tryout results can be skewed. Thus, student performance cannot be generalized to the target audience.

- Students for the first tryouts should be selected from the upper percentage ranges in aptitude and background because:
  - Brighter students are often more likely to point out and analyze weaknesses in the instruction and materials.
  - If better students cannot learn the material, less capable students may not be able to.
  - If lower-level students are used in the individual tryouts and they do well, there is no way to tell if the instruction and materials are at the proper level.
  - It is easier to work down from a known point of difficulty than to work up from an unknown point of difficulty.
  - It is often simpler to add material to make a lesson easier than to delete material to make it more difficult. However, this is not the case in lessons dealing with electronic media presentations.

Media Use During Tryout

The nature of the tryout should depend, to some degree, on the media selected for use in the course. Certain types of media selected for use in the course may be too expensive for use during the individual tryouts or it may not be available. However, there are ways to validate the instruction and materials without having all of the media selected for the course. Following are examples.

If Media Selected Is	How To Conduct Individual Tryout
Paper-based media Available such as job aids, simulators, trainers Capable of being quickly and economically developed such as slides, graphics	Use the actual media that will be used in the course during individual tryouts.

Not available Dangerous to use Expensive to develop	Devise storyboard versions of the instruction. For example: ·Paper script can be used in place of ICW, films. ·Drawings and illustrations can be used in place of ICW, slides. ·Mockups can be used to replace the actual media.

Before a Tryout

Before conducting the individual tryouts, instructional developers should prepare the students for the tryouts. Students need to know:

·The purpose of the tryout.
·Their role in the tryout.
·That they are not being evaluated; the instruction and material are.
·That their active participation is essential if the individual tryout is to be successful.
·That their feedback is necessary in determining adequacy of the instruction and materials.

If instructors are involved with the individual tryouts, they should be aware of their role and the role of the student.

During a Tryout

During the individual tryouts, instructional developers should:

·Closely observe students as they use the material.
·Make careful note of where students seem to have problems or uncertainties.
·Give assistance to students only when it is essential to student progress.
·Administer the relevant test item at the appropriate time.
·Get the students' view about the difficulties encountered during the tryout.

Sources of individual tryouts information are provided below.

Source	Activity/Information
Diagnostic Tests	·Administer pretest to identify entry behavior. ·Administer posttest to assess learning as a result of the tryout.
Student Performance During Learning	·Observe and record students' performance. ·Determine which exercises or tasks result in errors; types of errors; how many students are making the same error(s).
Student Comments	·Get student reaction to the instruction and materials, especially their difficulties. ·Ask students for suggestions on how the instruction and materials can be im proved.

Typical Problems

Often, when conducting individual tryouts, problems are identified that are typically found during the first tryouts. Some of the typical problems are:

- ·Improper sequencing of the instruction
- ·Instruction not clear and concise
- ·Lack of supporting instructional materials
- ·Confusing test items
- ·Test items that do not measure objectives
- ·Insufficient practice time

After a Tryout

When the individual tryouts have been completed, analyze the resulting data to determine if error patterns or problems have occurred on successive tryouts. If so, changes or revisions to the instruction or materials may be appropriate.

Example: Each student participating in the individual tryouts fails to meet the performance standard for a particular objective. Review the objective, training materials, and test, and revise as necessary.

In most cases, several tryouts should be conducted before making any significant revisions or changes to the instruction or materials.

When significant revisions or changes are required in the instruction or materials, it is recommended that additional individual tryouts be conducted in order to determine if the problem was solved.

Conduct Small-Group Tryouts

Introduction

After the individual tryouts have been completed and all necessary revisions have been made to the instruction, it is time to conduct the next stage of validation, which is the **small-group tryouts**. In this stage, which is the last activity in formative evaluation, the instruction and materials are tried out on small groups of students if practical. Again, a lack of resources may prevent or reduce the number of small-group tryouts that can be conducted. Up to this point, the success of the instruction has been based on a limited sampling of students with higher aptitudes. It should be pointed out that the instruction and materials are developed for average students; thus, small-group tryouts are focused on the average group.

Purpose

The purpose of conducting small-group tryouts is to determine if the instruction and materials work under conditions approximating the actual teaching-learning activity.

Select Students

Student selection for the small-group tryout is very important in terms of validating the effectiveness of the instruction and material. Students selected to participate in the tryout should be representative of the target audience. If possible, students selected should:

- Be evenly distributed between low and high aptitudes
- Have varying skill levels
- Come from different backgrounds

Even distribution of students helps determine if the instruction and materials will be effective under operational conditions.

The number of students included in the small groups should be determined based on factors such as:

- Need for teams of students within the small group (for example, some tasks may require students to work in teams of two; if so, the small-group size should be based on multiples of two)
- Planned normal group size of the operational system
- Availability of equipment
- Availability of facilities

Time is a Critical Factor

To this point in the validation process, time required to perform a task has not been of major concern. However, time becomes a critical factor in the small-group tryouts. Learning the material or performing a task is not sufficient; students should be able to learn the information or perform the task within a reasonable time period. Therefore, effort should be made to develop instruction that can be accomplished within a realistic time period based on training requirements and the capability of average students.

Before a Small-Group Tryout

Before trying out instruction on small groups, you should:

- Determine the number of students to be included in the small group.
- Determine the number of groups to be used in the tryouts.
- Select representative students from the target audience.
- Ensure that the instruction and materials have been revised to include the applicable information resulting from individual tryouts.
- Ensure that student materials are available in adequate quantities.
- Ensure that instructional resources such as equipment, personnel, and facilities to be used during the tryout approximate the operational conditions.
- Ensure that the instructional information management system is operating for data collecting, analysis, and reporting.

During a Tryout

When conducting small-group tryouts, you should:

- ·Ensure that the time required for each student to complete the material is accurately recorded. This information is used to determine unit times, course length, and course content.
- ·Record accuracy of student responses. This information should help determine deficiencies in the instruction or materials.
- ·Establish the number of trials a student should be permitted to meet performance requirements.

Don't supplement the instruction. Supplementing the instruction may skew the results of the tryout.

After a Tryout

Conduct a sufficient number of small-group tryouts to ensure that the data collected is both valid and reliable. Once the data has been collected, it should be analyzed to determine:

- ·Median time required to complete each segment or unit of instruction (this information is used to set the approximate times for lessons, segments, units, or modules of instruction).
- ·Need to revise equipment requirements, make changes to facilities, and adjust personnel authorizations.
- ·Instruction and materials requiring revisions or changes.
- ·Priority for accomplishing revisions or changes and plan of accomplishment.

As with the individual tryout, if the instruction or materials require significant revisions or changes, it is recommended that additional small-group tryouts be conducted to determine if the revisions were effective.

Conduct Operational (Field) Tryouts

Introduction

The **operational tryout**, which is the only activity in summative evaluation, is the final step in the validation process. This evaluation activity is conducted under normal operating conditions by an instructor. Field tryouts of instruction may vary from a single block or module of instruction to an entire course. The instruction to be validated will depend largely on whether it is a new course or a block or two of an existing course that has been revised.

Purpose

The purposes of operational tryouts are to:

- ·Determine if the instructional system actually works under operational conditions.
- ·Provide feedback from a large sample of the target audience in which to base final revisions or refinements to the instructional system prior to it becoming operational.
- ·Work out any implementation or operational problems, such as equipment and facilities.
- ·Provide feedback from field units on quality.

Student Selection

For operational tryouts, students are selected to participate from the target population, using the normal student scheduling process.

Before a Tryout

Before conducting the field tryouts, ensure that:

·Resources are available, such as equipment, facilities, and instructors.
·Instruction and materials have been revised based on the results of the small-group tryouts.
·Materials are available in adequate quantities.
·Students have been scheduled to participate in the tryouts and have been informed of their role.
·Size of tryout class is compatible with operational conditions.

During a Tryout

Conducting an operational tryout is like operating a course under normal day-to-day conditions. However, when conducting operational tryouts, you should:

·Ensure that instruction is conducted in the normal operating environment.
·Collect validation data such as time requirements, test results, instructor and student comments, and problem areas.
·Use adequate data samples to ensure valid and reliable data.
·Gather feedback from field on quality of course graduates.

Collect Data

Operational tryout data is collected before, during, and after the instruction is provided.

·Before conducting instruction, the instructional developer or instructor should:

··Determine if students have met course prerequisites and identify their entry skill and knowledge level.
··Collect data using such methods as pretest, oral examination, or directly asking students if they have specific skills or knowledge.

·While conducting instruction, the instructional developer or instructor should:

··Identify breakdowns in instruction and check student progress.
··Record duration of instruction.

·After conducting instruction, the instructional developer or instructor should:

··Administer posttest.
··Interview students.
··Critique instruction.
··Gather supervisors' critiques of graduates.

The field data collection is summarized below.

Stage	Data To Be Collected	Data Collection Methods
Before	·Student entry skill/knowledge level	·Pretest ·Oral examination ·Student interviews
During	·Number of errors students make ·Questions raised by students ·Student work samples ·Duration of instruction	·Observation ·Recording student questions ·Collecting work samples

After	·Student learning gains ·Student views of instruction, materials ·Supervisor's critique	·Posttest ·Student interviews ·Student critiques ·Supervisor critiques

After a Tryout

When adequate numbers of operational tryouts have been conducted, you should:

·Analyze data gathered during the tryouts.
·Revise the instructional system as necessary.

As with other forms of validation, continue to try out, revise, and try out as long as the quality of the instructional system is improved.

Section G
Finalize Instructional Materials

Introduction

Once validation has been completed and revisions have been made, the **instructional materials** should be **finalized**. During finalization, ensure that all of the last-minute changes are made to the instructional materials and they are ready for use. It is important to finalize all of the materials prior to implementing instruction to ensure that they are accurate and complete.

Purpose

Finalization of instructional materials serves several purposes, which are to ensure that the materials are:

·Current and accurate
·Complete
·Ready to use in the teaching-learning activity

Who Is Responsible?

Instructional developers are normally responsible for ensuring that instructional materials are updated and ready to be used when the course is implemented. However, instructional system management should monitor the task, since they have overall system responsibility.

What Needs To Be Updated?

Finalization of the instructional materials includes, but is not limited to:

·Plans that have been developed, such as implementation and management plans
·Course control documents, such as training standards, and POIs
·Materials used in the teaching-learning activity, such as study guides and workbooks

What Should Be Done?

The types and numbers of different materials that are developed for a course should determine what needs to be done during finalization of the instructional materials. An easy way to ensure that all materials are finalized is to develop a job aid consisting of questions on specific areas such as plans or control documents. The following job aid is provided as an example.

Sample Instructional Material Finalization Job Aid	
Plan	
Validation	·Has the validation report been approved? ·Have necessary changes been made?
Implementation	·Is the implementation plan complete? ·Does the plan include current information? ·Has the plan been approved?

Control Documents	
Training Standard	·Has the training standard been revised/changed? ·Has the training standard revision/change been approved? ·Has the training standard been published?
POI/Syllabus	·Has the POI/syllabus been updated? ·Is the POI/syllabus complete? ·Has the POI/syllabus been approved? ·Has the POI/syllabus been published and distributed?
Instructional Materials	
Printed	·Have student workbooks been updated? ·Are student workbooks complete? ·Have student workbooks been published? ·Have the lesson plans been updated? ·Are the lesson plans complete? ·Have the lesson plans been approved and published?
Audiovisual	·Have the transparencies been updated? ·Are the transparencies complete? ·Are the transparencies ready for use? ·Have the slides been updated? ·Are the slides complete? ·Are the slides ready for use?
ICW	·Has the program been updated? ·Is the programming complete? ·Has the ICW been operationally tested?

Chapter 7
IMPLEMENTATION

Overview

Introduction

After the instruction has been validated, you are ready to **implement** the instructional system. Once the instructional system becomes operational, it will require continuous support, maintenance, and evaluation to ensure that it operates effectively and cost-efficiently and produces graduates who meet job performance requirements.

Objectives

The objectives of this chapter are to:

- Discuss implementation of the system functions.
- Describe the activities that occur during system implementation.
- Discuss the operational evaluation process.

Additional Information

For additional information on instructional system implementation , see:

- Knirk, F. G. and Gustafson, K. L. (1986). *Instructional Technology: A Systematic Approach to Education*. New York: Holt, Rinehart and Winston.

Section A
Implement System Functions

Introduction

The system functions of management, support, administration, and delivery should be in place and working if the instructional system is to operate effectively and cost-efficiently. System functions provide the structure that supports, operates, and maintains the system.

Additional Information

For additional information on training system functions, see:

- Bills, C. G. and Butterbrodt, V. L. (1992). *Total Training System Design Function: A Total Quality Management Application*. Wright-Patterson AFB, Ohio.
- Fishburne, R. P., Williams, K. R., Chatt, J. A., and Spears, W. D. (1987). *Design Specification Development for the C-130 Model Aircrew Training System: Phase I Report*. Williams, AFB, Arizona: Air Force Human Resources Laboratory (AFHRL-TR86-44).
- JWK International Corp. (1990). *Final Training System Baseline Analysis Report* (EWOT). Dayton, Ohio: JWK International Corp.
- Williams, K. R., Judd, W. A., Degen, T. E., Haskell, B. C. and Schutt, S. L. (1987). *Advanced Aircrew Training Systems (AATS): Functional Design Description*. Irving, Texas: Seville Training systems (TD-87-12).

Management Function

Introduction

Management is a key system function. The management function should be in place and working throughout the life cycle of the instructional system from the initial planning stage on. Effective management should help produce an effective instructional system.

What It Is

Management is the practice of directing, controlling, and supporting the instructional system.

Who Is Responsible?

Each level within the school or responsible organization has certain management responsibilities. For example:

- Faculty manage the teaching-learning activities.
- Instructor supervisors manage the scheduling of courses.
- Instructional developers manage instructional development.

In addition, other support organizations such as Resource Management and Civil Engineering manage special areas that support the instructional system.

Management Activities

The basic activities of management are:

- **Planning** for the design, development, implementation, support, operation, and maintenance of the instructional system.
- **Organizing** the resources, which involves identifying, arranging, and bringing together resources required for the instructional system.
- **Coordinating** instructional system operation and support.
- **Evaluating** the effectiveness and efficiency of each element in the instructional system.
- **Reporting** status and progress of the development of instruction or operation of the instructional system.

Management Tasks

Following are examples of tasks performed by management in support of the instructional system.

Activity	Examples of Tasks
Planning	· Establish logistic support. ·Identify facility requirements. ·Plan quality improvement programs.
Organizing	· Establish lines of communication between development team and management. ·Schedule people, work, and resources.
Coordinating	· Establish external lines of communication to support organizations to gain logistics, funding, and other support.
Evaluating	· Monitor milestones, budgets, and production. ·Collect and analyze feedback.
Reporting	· Provide status briefings. ·Report inspection findings.

Support Function

Introduction

The importance of the instructional system **support function** cannot be overstressed. Without adequate support, you may be unable to implement the instructional system, or, at best, its operation may be ineffective and inefficient. Support is required from a wide variety of instructional organizational elements in order to implement, operate, and maintain an instructional system.

What It Is

The support function is defined as those long-range, as well as day-to-day, tasks performed in order to implement, operate, and maintain an instructional system. Several examples of support functions are:

·**Maintaining** equipment and facilities
·**Supplying** components for the equipment and materials for the courses
·**Providing** services such as engineering, visuals, publications

Support Activities

Some of the basic support activities include:

·**Supplying** equipment, parts, materials
·**Maintaining** equipment, facilities
·**Producing** instructional materials
·**Constructing** instructional aids, facilities
·**Providing** funding, services

Who Is Responsible?

As with the other instructional system functions, managers have the responsibility for ensuring that the instructional systems are adequately supported for the life cycle of the system. Support for the instructional system should be provided by organizations such as:

·Civil Engineering
·Resource Management
·Visual Services
·Information Management

These are only a few of the many support organizations that may be needed to support the implementation and operation of the instructional system.

Support Tasks

Examples of some of the tasks performed in support of the instructional system are listed below.

Organization	Example of Tasks
Civil Engineering	· Constructs instructional facilities. ·Modifies existing facilities such as by adding new electrical outlets or air conditioning.
Resource Management	· Provides human resources for instructor support, and maintenance personnel. ·Manages funds, equipment, and facilities.
Information Management	· Edits instructional materials such as study guides, handouts, or instructor guides. ·Publishes instructional materials.
Contracting	· Develops contracts for maintenance and other services. ·Processes local purchase forms to procure supplies and equipment.
Maintenance	· Performs quality improvement inspectio ns on instructional, support, and test equipment. ·Performs scheduled and unscheduled maintenance on instructional, support, and test equipment. ·Fabricates trainers.

Visual Information	· Develops and controls visual materials such as slides and film strips. ·Manages visual equipment such as televisions, VCRs, and slide projectors.

Relationship to Implementation

Implementing and operating an instructional system requires a great deal of planning and preparation. Part of that effort is to ensure that the necessary support functions are available.

Administration Function

Introduction

The **administration function** conducts the day-to-day operation of the instructional system. As managers and instructional developers, you should be aware of all the administrative activities that are performed on a daily basis by the various instructional organizations in support of the instructional system.

What It Is

Administration is the part of management that performs day-to-day tasks such as maintaining documentation, typing reports, keeping equipment, supply, and other records, and maintaining student records.

Administrative Activities

The basic administrative activities that support the instructional system are:

·Providing documents, such as instructional standards, plans of instruction, and student workbooks.
·Maintaining records, such as personnel and instructional equipment.
·Administering student support, such as processing students "in" and "out" of the site.
·Administering staff support, such as leave processing and maintenance of personnel programs.
·Scheduling resources, such as personnel, equipment and facilities.
·Monitoring resources, such as equipment and funds.

Who Is Responsible?

Managers have the responsibility of ensuring that the administrative activities are performed in support of the instructional system. However, various instructional organizations have specific responsibilities to support system operations. For example, some of the organizational elements that may be engaged in administration are:

·Registrar
· Typing pool
·Staff support elements
· Student support elements
·Information management
·Contract office (if fees are required)

AdministrativeTasks

Examples of some of the tasks that the various organizational elements perform are listed below.

Organizational Element	Examples of Tasks
Registrar	·Track student entries. ·Maintain student status. ·Print and distribute status reports.

Typing Pool	·Type course control documents. ·Type course materials. ·Type reports.
Student Support	·Process students "in" and "out" of the responsible instructional organization. ·Maintain student health and welfare programs.
Information Management	·Edit instructional materials. ·Publish instructional materials. ·Maintain supply of instructional materials.
Staff Support	·Provide administrative support for instructional staff, such as processing leaves. ·Administer programs such as suggestion, or awards and decorations.

Relationship to Implementation

The instructional system administration functions should be in place and functioning if the instructional system is to be successfully implemented. For the instructional system to work, materials need to be printed and distributed, students scheduled and tracked, and health and welfare concerns addressed. The support, operation, and maintenance of instructional systems depend on these and other administration functions.

Delivery Function

Introduction

In the design and development phases of ISD, appropriate delivery methods were selected and developed to deliver instruction to the students. Prior to implementing the instructional system, management should ensure that the **delivery function** is ready to support the operation of the system.

What It Is

The instructional system delivery function is the means by which instruction is provided to the students. Examples of delivery methods are:

·Instructors
·Computers, which includes ICW, CAI, CMI
·Training devices, including simulators, part-task trainers
·Satellite
·Job aids
·Career development and specialized courses
·Correspondence programs, such as Extension Course Institute (ECI) and Professional Military Education (PME)

Who Is Responsible?

The individuals responsible for the instructional delivery function are:

- **Managers** - Ensure that adequate planning and analysis have been done prior to selecting the delivery method and, once the method is selected, see that it is supported.
- **Instructional developers** - Select the most appropriate delivery method(s).
- **Instructional staff** - use and evaluate the selected delivery method(s) for effectiveness.

Ensuring Readiness

At this point, the delivery function should be fully developed and operational. Validation should have given an indication of the suitability and readiness of the delivery system; however, prior to implementing the instructional system you should "check it out" to be sure that everything is ready. You need answers to questions about the delivery function, such as:

- ·Are there adequate instructors to support the instructional requirements?
- ·Have the instructors been qualified, and are they certified to deliver the instructions?
- ·Are the student workbooks printed in adequate numbers?
- ·Is the necessary equipment available and operational, such as computers, projectors, simulators?
- ·Has the programming of the ICW been completed?
- ·Have slides and/or transparencies been produced?

Section B
Conduct Instruction

Introduction

At this point in the ISD process, the instructional system has been developed, and the instructional system functions are in place and ready to support implementation of the instructional system. It is now time to conduct the instruction.

Additional Information

For additional information on conducting instruction, see AFMAN 36-2236.

Introduction

Before you actually start conducting instruction, "last-minute checks" need to be made to ensure that the instructional system is ready to implement.

Why Make Preparations?

Adequate preparation throughout the instructional development process and these last-minute checks before starting to conduct instruction ensure that each instructional system component is ready. These checks are also a quality assessment of the development process and an evaluation of the ISD application to this point.

Who Is Responsible?

Everyone involved in the support, operation, and maintenance of the instructional system has responsibilities for making final preparations to conduct instruction. This includes:

- ·Managers
- ·Instructional developers
- ·Instructors

What Should Be Checked?

During final preparations to conduct instruction, each component of the instructional system should be checked "one last time" to ensure that everything is ready. Some of the items to be checked are:

·Equipment

··Is instructional, support, and test equipment available?
··Is the equipment available in adequate quantities?
··Is all equipment operational and ready to use?
··Is logistics support, such as spare parts and maintenance, available?

·Facilities

··Are the necessary instructional facilities available?
··Have all necessary facility modifications been completed?

·Human Resources

··Are adequate personnel, including instructors, maintenance personnel, and students, available to conduct the instruction?
··Are the instructors qualified to conduct the instruction?
··Are maintenance and support personnel properly trained?
··Have instructors and students been scheduled for classes?

·Funds

··Have adequate funds been programmed to conduct the instruction, including funds for personnel, facilities, equipment, and fees?

Time

··Did instructional developers have adequate time to design and develop an effective and efficient instructional system?
··Did the instructional staff have adequate time to prepare to conduct the instruction?

· Materials and Supplies

··Are the instructional materials available in adequate quantities?
··Are adequate instructional and office supplies available to conduct instruction?

Guidelines for Conducting Instruction

Introduction

At this point in the ISD process, you have made the final check of each component in the instructional system to ensure that everything is ready for implementation of the instructional system. If everything has checked out, there should be relatively few problems when you start instruction.

Who Is Responsible?

Managers of the instructional system have the overall responsibility for providing the instruction; however, all individuals who play a role in conducting instruction share in the responsibilities. Some of these individuals are:

- **Managers** - have overall responsibility for managing the support, operation, and maintenance of the instructional system.
- **Instructional developers** - have responsibility for ensuring that deficiencies identified during system operation are corrected.
- **Instructional staff** - have responsibility for conducting the instruction and evaluating student performance.
- **Instructional evaluators** - have continuing responsibility for evaluating a graduate's Air Force performance throughout the life cycle of the instructional system.
- **Support organizations** - have responsibility to provide logistic support and services necessary to conduct instruction.

Conducting the Instruction

Once the instructional system is implemented, it should continue to operate until there is no longer a need for the course, or the course is revised to the point that it is given a new identification. Throughout this time there are ongoing activities that ensure system integrity. Some of them are listed below.

- **Resource management** is probably the single most critical issue for managers of the instructional system as well as the instructional staff. Every resource should be managed effectively and efficiently. For example:
  - Students should be scheduled for instruction in a timely manner so time is not wasted.
  - Instructors, when not in the teaching-learning activity, should be utilized to work on course-related items, such as writing test items for the test item pool, or posting changes to instructional materials.
  - Managers should continually check to ensure that the necessary equipment is available in sufficient quantities and is maintained in an operational status. Unneeded equipment should be returned to supply or to the lender, if borrowed.

- **Conduct of instruction** is fundamental to system integrity. No matter what has been done to this point, the system can fail if the instruction is not properly conducted. To ensure that instruction is both effective and efficient, remember:
  - Instruction should always be student-centered. Never allow instruction to be focused on the method or media.
  - Instruction should always be delivered in a professional manner regardless of the media.

- **Evaluation** of the process and products of each phase of ISD ensures that the quality of the system is continually maintained. While the instructional system is operational, periodic operational evaluations ensure the quality of the instructional system.

- **Staff development** is an ongoing activity during the conduct of instruction. Instructional developers and instructors should periodically attend staff development sessions to ensure that they continue to develop professionally and technically. This should help ensure the effectiveness of the instructional system.

Section C
Conduct Operational Evaluation

Introduction

After the instruction is validated, a summative evaluation has been completed, and the system functions are in place, the instructional system is ready for implementation. Once the system is implemented and starts producing graduates, it is time to begin conducting operational evaluations. Operational evaluation is a continuous process that assesses how well course graduates are meeting the established job performance requirements.

Objectives

The objectives of this chapter are to:

- Describe the operational evaluation process.
- Explain internal evaluation.
- Explain external evaluation.

Introduction

Evaluation is a continuous activity that is integrated throughout each stage of ISD, beginning with analysis and continuing throughout the life cycle of the system. Its focus is quality improvement. The last stage of the evaluation process is **operational evaluation**.

What It Is

Operational evaluation is the continuous process of gathering and analyzing internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established requirements. It is a quality improvement activity.

Purpose

The two main purposes of operational evaluation are to:

- Ensure that graduates continue to meet established job performance requirements.
- Continually improve system quality.

What Should You Look For?

When evaluating, look for both strengths and weaknesses in the system. Focus on:

- How well the graduates are meeting job performance requirements.
- Whether instruction is being provided that is not needed.
- Whether any needed instruction is not being provided.
- How well each system component is contributing to overall system quality.
- Ways to improve the graduate's performance as well as the system.

Operational Evaluation Activities

The two operational evaluation activities are:

- **Internal evaluation** - gathers and analyzes internal feedback and management data from within the training environment to assess the effectiveness and quality of the instructional process. Internal evaluation data is normally gathered by the instructional developers and instructors.

- **External evaluation** - gathers and analyzes external feedback data from the field to assess graduates' on-the-job performance in an operational environment. Most external evaluation data is gathered by evaluators from the organization providing the instruction or is provided by the graduates and their supervisors directly from the field. However, in some cases, external evaluation data is gathered and provided to the organization by both Air Force and non-Air Force consultants, advisory bodies, Board of Visitors, accrediting agencies, and professional certification groups.

Additional Information

For additional operational evaluation information, see:

- AFMAN 36-2236.
- Briggs, L. J. and Wager, W. W. (1981). *Handbook of Procedures for the Design of Instruction* (2nd Ed.). Glenview, Illinois: Harper Collins Publishers.

Internal Evaluation

Introduction

Internal evaluation activities begin with implementation of the instructional system and continue throughout the life cycle of the instructional system. Some organizations call this evaluation activity a "course review." Internal evaluations look at the instructional system from within to determine system effectiveness and quality.

What It Is

Internal evaluation is the acquisition and analysis of internal feedback and management data, such as test data, student critiques, instructor comments, and data correlation from within the instructional system.

Purpose

The purpose of internal evaluation is to improve the effectiveness and quality of the instructional system.

Possible Causes for Problems

Although instructional systems are validated prior to implementation, students may still have difficulty with the instruction during day-to-day system operation. Possible causes of student problems are:

- Instructors do not follow the POI or course syllabus.
- The developed course is different from the course that is actually implement ed.
- Resources required to support, operate, and maintain the system are inadequate.
- Instructional materials are not correlated.
- Students do not meet course prerequisites.

Periodic internal evaluations may identify weaknesses (problems) as well as strengths of the instructional system.

Data Collection

Several methods of collecting internal evaluation data are listed:

Data Collection Method	Purpose
Review Course Control Documents	· To determine if there are any discrepancies between the planned course and the course that was actually implemented.

Review Resources	· To ensure that facilities (instructional and support) are available and adequately maintained. ·To ensure that equipment (instructional, support, and test) and supplies are available. ·To ensure that human resources (instructional developers, instructors, students, and mainte nance personnel) are available. ·To ensure that there is adequate time (adequate course length, sufficient time to maintain the course). ·To ensure that funds are adequate to support, operate, and maintain the course.
Visit Instructional Facilities	· To evaluate the quality of implemented instruction (ensure that the visit is long enough to ensure observation of representative instruction). ·To check equipment, instructional media, training aids and devices for condition, operation, and appropriateness. ·To check instructional literature such as study guides and workbooks for quality and availability.
Evaluate Instructor Performance	· To check if instructor follows the plan of instruction, uses instructional media properly, responds to student needs, and is qualified to teach. ·To check instructor evaluation forms to determine if noted weaknesses have been corrected.
Monitor Measurement Program	· To check the measurement program for compromise. If a test has been compromised, it cannot provide useful feedback. ·To monitor the measurement program to ensure quality. ·To evaluate instruction in terms of student performance. Use performance measures to determine students' achievement of objectives.

Conducting an Internal Evaluation

Collect sufficient internal evaluation data for the analysis. Insufficient data may skew the analysis results, possibly leading to incorrect decisions being made. Job aids can be used to gather internal evaluation data. An example of a job aid is provided below.

Check	Data Source
	· Does the POI/course syllabus reflect the operational course?
	· Is the POI/course syllabus current and accurate?
	· Does the POI/course syllabus provide adequate guidance?
	· Do the lesson plan and POI/course syllabus agree?
	· Does the lesson plan reflect what is being taught in the course?

	· Is the lesson plan current and accurate?
	· Do instructional materials support the lesson plan and POI?
	· Do instructional facilities meet system requirements?
	· Do support facilities meet system requirements?
	· Does training equipment meet system requirements?
	· Is the instructional equipment adequately maintained?
	· Does support equipment meet system requirements?
	· Are instructors teaching according to the lesson plan?
	· Are instructors oriented and trained to execute the courses, i.e., have they been given the "big picture"?
	· Are they adequately trained?
	· Do tests adequately measure the objectives?
	· Is the test data thoroughly analyzed?
	· Can improvement be made in the course?

Student Reaction The following is an example of a questionnaire designed to obtain student feedback.

STUDENT REACTION TO INSTRUCTION

PERIOD_____
DATE_____

INSTRUCTOR_____STUDENT_____
____ _____

One way instruction is improved is by sampling student reaction to the instruction. Please answer the following questions.

1. Prior to this instruction, my experience in this area was
   - _____ extensive
   - _____ moderate
   - _____ little or none

2. Did your knowledge of the subject increase as a result of the instruction?
   - _____ yes
   - _____ no

3. If your knowledge increased as a result of the instruction, to what extent did it increase?
   - _____ not applicable (my knowledge didn't increase)
   - _____ slightly
   - _____ moderately
   - _____ extremely

4. Based on my experience, the level of instruction was
   - _____ too advanced
   - _____ about right
   - _____ too elementary

5. The organization of the instruction was
   - _____ very helpful
   - _____ helpful
   - _____ not very helpful

6. The lecture outline (main points of instruction) was
   - _____ very helpful
   - _____ helpful
   - _____ not very helpful

7. Audiovisual aids were
   - _____ of great value
   - _____ valuable
   - _____ of little or no value
   - _____ not used, but could have helped
   - _____ not used and not needed

8. Answers to student questions were
   - _____ meaningful
   - _____ somewhat helpful
   - _____ not helpful
   - _____ not applicable (no questions asked)

9. Should the subject matter covered be changed?
   - _____ yes (please explain below)
   - _____ no

10. Should the method of instruction be changed?
    - _____ yes (please explain below)
    - _____ no

11. Overall, the instruction was
    - _____ outstanding
    - _____ good
    - _____ fair
    - _____ poor

12. Instruments (including tests) to evaluate student performance were
    - _____ outstanding
    - _____ good
    - _____ fair
    - _____ poor

COMMENTS, EXPLANATIONS, OR RECOMMENDATIONS

Data Analysis

Before beginning analysis of the data, ensure that:

- Data have been collected from each component of the instructional system.
- Adequate data samples are collected in order to validate the reliability of the findings.

Following are some methods of analyzing the internal evaluation data.

- Compare the instructional standard with the POI/course syllabus to determine if the requirements of the standard are being met.
- Compare POI/course syllabus with operational course to determine if the planned and operational courses are the same.
- Review POI/course syllabus, lesson plan, and instructional material to determine if they are current, adequate, and in agreement.
- Compare stated resource requirements with actual resources to determine if adequate resources are available to support, operate, and maintain the instructional system.
- Review records to determine if instructors are qualified to teach the course.
- Review test data to ensure that students are meeting course objectives.
- Analyze test data to determine if test items are valid and reliable.

Revising the Instructional System

After internal evaluation data are collected and analyzed, the next stage is to correct deficiencies in the instructional system. If revisions can be made to correct identified problems, they should be made in a timely manner in order to receive the greatest benefit from the changes.

Revisions resulting from the analysis may require reentry into an earlier phase of the ISD process to correct the problem(s). The need to reenter an earlier phase of ISD is determined by the nature and scope of the revision. For example, changing a test item or adding time to a unit of instruction would not require you to reenter an earlier phase of ISD. However, adding a new piece of equipment to the course would more than likely require you to do so.

External Evaluation

Introduction

How well graduates meet job performance requirements is learned through **external evaluation**. This evaluation activity relies on input from the field to determine how well graduates are performing.

What It Is

External (field) evaluation is the process of gathering and analyzing data from outside the instructional environment in order to determine how well recent graduates are meeting job performance requirements.

Purpose

The purpose of external evaluation is to determine if recent graduates of the course:

- Can meet job performance requirements.
- Need all of the instruction they received.
- Need any instruction they did not receive.

Possible Causes for Problems

Some possible problems that may be identified during external evaluations are:

·Criterion test did not measure graduates' ability to meet job performance requirements.
·Objectives do not reflect job performance requirements.
·Job performance requirements were incorrectly identified during task analysis.
·Job performance requirements changed after task analysis.

Collecting Data

Several methods of collecting external evaluation are listed below.

Methods of External Evaluation
Questionnaires
Field Visits
Job Performance Evaluation
Other Sources of Evaluation Input

Questionnaires

Introduction

Questionnaires are effective, cost-efficient evaluation tools. The discussion on questionnaires will focus on:

·Advantages and disadvantages of questionnaires
·Types of questionnaires
·How to prepare and distribute questionnaires
·Analysis of data gathered using questionnaires

Purpose

The purpose of using questionnaires is to:

·Determine the ability of recent graduates to perform specific tasks on which they received instruction.
·Identify the specific nature of any deficiency.
·Determine what tasks are actually being performed by graduates.
·Identify what instruction is not needed for on-the-job performance.

Advantages

Advantages of questionnaires include:

·They are comparatively inexpensive to administer.
·They can be used to collect large samples of graduate and supervisor data.
·They yield data that can be easily tabulated and reported.
·Respondents give their opinions freely.

Disadvantages

Disadvantages of questionnaires include:

- They may not be the most reliable form of evaluation; data validity depends on preparation and distribution.
- Communication is one-way; respondents may not understand some of the questions.
- They may not ask the most relevant questions.
- They collect only opinions, which may not be as reliable as other methods of collecting external data.
- Developing effective and reliable questionnaires may be costly and require extensive experience.
- Low return rates and inappropriate responses affect accuracy.

Types of Questionnaires

Two types of questionnaires can be used to collect external evaluation data:

- One is for the graduates' immediate supervisor. However, responding may be delegated to the graduates' trainer.
- The other questionnaire is for the graduates. This questionnaire is designed to find out what graduates think about the instruction they received.

Preparing Questionnaires

Well-constructed questionnaires that are properly administered are extremely important to the field evaluation process. The following table identifies the five basic stages of questionnaire development.

Stage	Activity
Stage 1	· Define purpose of questionnaire. Focus only on relevant information.
Stage 2	· Determine specific information to be collected. Specify exactly what is needed in a list of objectives.
Stage 3	· Develop questions that ask for specific information such as: ··What conditions/equipment are required to do the job. ··Exact action to accomplish the performance. ··Standards of performance. ··Results of the performance.
Stage 4	· Consider motivational factors when developing questionnaires. You want the respondents to answer fully and conscientiously. Questionnaires should motivate if you: ··Explain the purpose of the questionnaire. ··Tell the respondents how they can benefit from answering the questionnaire. ··Write clear and concise instructions. ··Make questionnaire format uncluttered and easy to answer. For example, using boxes for check marks should make the questionnaire easier to answer. ··Arrange the questionnaire in logical order. ··Ask specific questions.
Stage 5	· Test the questionnaire on sample respondents. Ask them to: ··Evaluate the cover letter. ··Check instructions and questions for clarity. ··Explain how they feel about answering the questions. ·Revise the questionnaire, if necessary, before distribution.

Note: Questions can be taken directly from the task statements in the standard.

Guidelines for Developing Questions

Guidelines for developing effective questions are:

- ·Use *closed-end* questions when you want the respondent to choose answers from a small number of possibilities. This makes tabulation easy but may not give the range of answers desired.
- ·Use *open-end* questions when you don't know all the possible answers. The respondent will probably suggest possibilities.
- ·Word questions to the respondent's level of understanding. Use vocabulary and concepts that are easy for the respondent to understand.
- ·Limit each question to one aspect of a topic.
- ·Decide on the logical order of the questions (task order, general to specific). Each question increases the respondent's frame of reference and further establishes upcoming responses.
- ·Avoid questions that make it easier to answer one way or another.
- ·Avoid questions that show biases or exceptions.
- ·Word questions so they will not threaten the respondents.
- ·Supplemental "information-seeking" questions may be used. Such questions may ask how much time the graduate spends on individual tasks or what equipment or materials the graduate uses.

Guidelines for Constructing Questionnaires

When constructing a questionnaire, several guidelines should be considered.

- ·Provide short, concise, and specific directions for completing the questionnaire. The directions should be printed in heavy, bold type, if possible.
- ·Provide space for the respondent's name, title, organization, and location.
- ·Number the questionnaires to allow for administrative control.
- ·Whenever possible, allow the respondent to use the same type marking for all questions. For example, one of the best methods is to allow use of check marks for responses.
- ·Arrange "yes" and "no" responses vertically rather than horizontally.

Yes___	Yes___ No
No	
Correct	Incorrect

- ·Provide clear verbal descriptions when using rating scales. For example:

How many times have you attended faculty and staff development training in the past year?

___ 0	___ 7-9
___ 1-3	_____ 10-12
___ 4-6	_____ 13 or more

- ·Number each page of the questionnaire.
- ·The questionnaire should be easy to read and mark.
- ·Print on both sides of the pages to conserve materials, if possible.
- ·Send self-addressed return envelope with the questionnaire.
- ·Fold the questionnaire in such a manner that the respondent can refold it the same way to place it in the return envelope after completion.

Guidelines for Preparing Cover Letters

Each questionnaire should have a cover letter. When developing the cover letter, ensure that it:

- ·Explains the purpose of the questionnaire and its importance to improving instruction.
- ·Includes a statement which assures the respondent that the information will be treated confidentially.
- ·Includes a statement that the evaluation is being conducted per AFI 36-2201.
- ·Provides information on how to return the questionnaire.
- ·Indicates the approximate time required to complete the questionnaire.
- ·Shows the date the questionnaire was mailed and the recommended return date.
- ·Uses appropriate letterhead stationery signed by a responsible authority.

Before You Distribute the Questionnaire

Before distributing the questionnaire, it should be administered to a small number of selected individuals to:

- ·Provide valuable feedback on the quality of the questionnaire.
- ·Preclude acquiring misinformation resulting from administration of a faulty questionnaire.
- ·Allow correction of problems in the questionnaire before distribution.

Distribution of Questionnaires

Distribution of the questionnaire is a critical aspect of external evaluation; you just don't pick a few graduates' names and drop a questionnaire in the mail to them. You **plan** the distribution to ensure that the data collected is valid and reliable. When distributing the questionnaire, you should:

- ·Decide to whom you are sending the questionnaire—a recent graduate, his or her supervisor, or both. You may collect important information from both.
- ·Select a representative sample to ensure valid results. Graduates may perform different tasks or their job requirements may vary depending on the major command, geographic location, or organization level. Therefore, questionnaires should be distributed to each area as evenly as possible.
- ·Determine how many questionnaires you need to mail out. That decision is based on:
  - ··Expected response rate.
  - ·· Level of confidence (a statistical consideration whi ch means the size of the sample required for you to be, say, 95 percent sure the sample truly represents the larger population). The graduate sampling chart on the following page shows how to determine the number of questionnaires you need based on this consideration.

Decide when to distribute the questionnaires. Timing is critical. Usually, questionnaires should be sent to the graduates within three to six months after graduation. Beyond six months, it may be impossible to tell whether the graduate learned the skill or knowledge in the course, or on the job. If the questionnaire is sent too early, the graduate may not have had time to perform many of the tasks that were taught in the course.

Note: To ensure that sufficient numbers of the questionnaires are returned for analysis, contact nonrespondents and encourage their response.

GRADUATE SAMPLING CHART

Course Graduates (During Sampling Period)	**Sample Size 95% Confidence***	**Sample Size 90% Confidence**	**Sample Size 80% Confidence**

10	10	10	9
20	19	19	18
40	36	35	32
60	52	49	44
80	67	62	54
100	80	73	62
120	92	83	69
160	114	101	81
200	133	115	90
250	154	130	99
300	171	142	106
350	187	153	112
400	200	161	116
450	212	169	120
500	222	176	123
600	240	186	129
700	255	195	133
800	267	202	136
900	277	208	139
1,000	286	213	141
1,500	316	229	148
2,000	333	238	151
2,500	345	244	154
3,000	353	248	155
3,500	358	251	157
4,000	364	253	157
4,500	367	255	158
5,000	370	257	159
10,000	383	263	161
25,000	394	268	163
100,000	398	270	164

HOW TO USE THIS TABLE:

1. The table can be used as shown in the following example:

   Annual course production is 4,000 - 95% confidence level desired.* Estimated return rate of usable questionnaires is 85%. From the table, 364 usable questionnaires are required. Therefore, this figure should be 85% of the questionnaires to mail out. The number of questionnaires to mail is computed as follows:

   $$\frac{85\%}{100\%} = \frac{364}{X}$$

   $$X = \frac{364 \times 100}{85} = 428 = \text{number of questionnaires to mail}$$

   * It is recommended that the 95% confidence level be chosen. This is the level commonly used in business and education decisions.

Data Analysis

When a sufficient number of completed questionnaires have been returned, you should begin analyzing the data. In this process, the data is:

·Compiled
·Collated
·Analyzed (data from each command should be analyzed together)

Pay special attention to:

·Notes made by respondents on the questionnaires
·Answers to supplemental questions that were included in the question naire

Use with caution any data that contains such obvious errors as:

·Halo effect - indiscriminate rating of all items positively
·Central tendency - indiscriminate rating of items in the center of the scale

Examine the responses to ensure, insofar as possible, that the information accurately reflects the opinion of the graduates and their supervisors.

Reporting the Findings

After completing data analysis, the findings should be reported. The report should include information such as:

·Background information on the course that was evaluated
·Scope of the evaluation
·Tasks evaluated
·Analysis results
·Recommendations
·Milestones for corrective actions, if applicable

Now that the report is complete, your last action is to distribute the report.

Field Visits

Introduction

Field visits are a very effective method of conducting external evaluations. They are normally conducted by an evaluator, often assisted by an instructional developer or instructor. Ideally, field visits should include specialists who are familiar with the graduates' jobs. However, in most cases this is not possible due to limited TDY funds, scheduling constraints, and number and variety of graduates to be interviewed.

Purpose

The purpose of a field visit is to get first-hand information on the graduates' assignment, utilization, and proficiency on the job, and to validate information gained from other evaluation activities.

Advantages

Advantages of field visits are:

·Guidance and information about the evaluation are given directly to graduates and supervisors.
·Information is gathered first-hand by the evaluator. Any questions or assumptions can be clarified.
·Field visits help validate questionnaire data.
·External evaluations build rapport between the instructional activity and the user.
·Additional information can be gained by observing nonverbal messages and asking leading or probing questions.

Disadvantages

Disadvantages of field visits are:

·They are time-consuming. Travel to several different bases requires consider able time. Interviews and observations also require a lot of time if they are done correctly.
·The sample is limited. Since the evaluator only goes to a few bases, the number of interviews and observations conducted is limited.
·The cost is high. Field visits require evaluators to spend limited TDY funds to travel to the various bases.
·Information gathered by the evaluator can be subjective and biased.
·Graduates may feel they are being scrutinized.
·Evaluators are not always skilled at interviewing and observing.

Data Collection

Two methods of collecting data are:

·Interviews
·Observations

Evaluators should interview recent graduates and their supervisors and observe the graduates' on-the-job performance when possible. However, observations are almost useless unless the observer is familiar with the tasks being performed.

Preparing for the Field Visit

Visits to the field to collect evaluation data should be adequately planned. Adequate planning should ensure that useful data is gathered. To prepare for the visit, you should:

·Develop a list of questions to get honest, pertinent answers and to keep the discussion focused.
·Determine the bases to be visited.
·Establish the schedule for the visit.
·Select the individuals to be interviewed and observed.

Conducting the Field Visit

The following are some of the tasks to be performed during the field visit.

- ·Inform graduates and supervisors of the purpose of the visit. Tell them that their answers will furnish valuable information for improving the instruction.
- ·Interview the recent graduates and their supervisors. Supervisors should have the same specialty experience or, in the case of aircrew members, the supervisor should be their flying supervisor.
- ·Determine the graduates' proficiency.
- ·Determine how the skills learned during instruction are being used.
- ·Find out how the graduates are progressing on OJT.
- ·Guide the interviews with your list of questions. (As the interview progresses, you may need to add, delete, or revise questions.)
- ·Take accurate and complete notes, especially on information that is freely given.
- ·Have the supervisor rate the graduates' performance.
- ·Observe graduates perform tasks. (This may not be beneficial if the evaluator does not have job or task knowledge.) Take careful notes on the graduates' performance. After the task has been completed, ask questions to clarify actions taken by the graduates during task performance.

Data Analysis

Data collected from interviews and observations is analyzed in the same manner as questionnaires—that is, compiled, collated, and analyzed by major command.

Reporting the Findings

The results of the field visits and questionnaires should be combined and compared in order to validate the findings. The analysis results of the questionnaires and field visits are compared in order to validate the findings.

Job Performance Evaluation

Introduction

Job performance evaluations are accomplished jointly by the instructional activity and the using command in the operational environment, at representative Air Force bases.

Purpose

The purpose of job performance evaluations is to determine how well recent graduates meet the using command's job performance requirements.

Advantages

Advantages of job performance evaluations are:

- ·Evaluations are conducted on the job by the supervisor.
- ·Evaluations are very thorough.
- ·The supervisor submits reports on a weekly basis, which ensures an accurate assessment of the graduates' performance.
- ·Data can be used to validate other forms of field evaluations.

Disadvantages

Disadvantages of job performance evaluations are:

- ·It usually takes eight to ten weeks to conduct the evaluation.
- ·The supervisor reports progress weekly.
- ·The evaluator makes at least two TDYs to each base.
- ·The sample is limited.
- ·They normally focus on a single command.

Data Collection

Data is collected via field reports submitted by the supervisor to an evaluation element for analysis. These reports "recap" the progress made during the previous week.

Preparing for the Evaluation

As with any evaluation method, you should make adequate plans before starting. Planning tasks include:

- ·Selecting recent graduates and their supervisors to participate in the job performance evaluation.
- ·Meeting with the supervisor and the graduates to explain job performance evaluations and getting the supervisor's commitment to support the evaluation.
- ·Determining tasks to be evaluated based on the training standard. The criteria of performance is the training standard.
- ·Establishing evaluation milestones.

Conducting Job Performance Evaluations

Once the participants have been selected and briefed on the process and its importance, it is time to begin the evaluation. The evaluation consists of the following activities:

- ·The supervisor evaluates and records the graduates' performance on each task performed.
- ·The supervisor reports, on a weekly basis:
  - ··Tasks performed
  - ··Frequency of performance
  - ··Time required to perform the tasks
  - ··Equipment used

Data Analysis and Reporting

When the evaluator receives the job performance reports from the supervisor, they are analyzed to determine how well the graduates are performing the tasks they were taught during the course. Evaluators should watch for reports that indicate the graduate:

- ·Cannot perform a task that he/she learned in the course.
- ·Requires excessive help to perform the task.

In these situations, data analysis should focus on determining why the graduate is not able to meet job performance requirements.

Since the job performance evaluation is normally conducted in conjunction with the other forms of field evaluations, the results of data analysis are included in the Training Quality Report (TQR)

Other Sources of Evaluation Input

Other Data Sources

Other external data sources that can be used to evaluate the graduates' job performance are:

·Inspection team (IG) reports - AF and MAJCOMs periodically inspect instructional activities to determine their effectiveness. Other inspections conducted by these teams may also discover related problems. Use this source of data to determine if graduates are meeting their job performance requirements. Take appropriate action to correct deficiencies. One example of an IG report is the Functional Management Inspection (FMI).

·Standardization/evaluation team findings - Standardiza tion/evaluation teams periodically inspect instructional activities to determine their effectiveness. Analyze findings indicating a problem and take appropriate action to correct the deficiencies.

·AF Form 1284, Training Quality Report (TQR) - The supervi sor of recent graduates reports strengths and weaknesses of the instruction that the graduates of the course received. The instructional activity should respond to any deficiencies identified in the TQR. Note that one or two TQRs by themselves may or may not be justification to change or revise a course. Use problems identified in the report to validate findings of other forms of evalua tion methods.

Chapter 8
EVALUATION

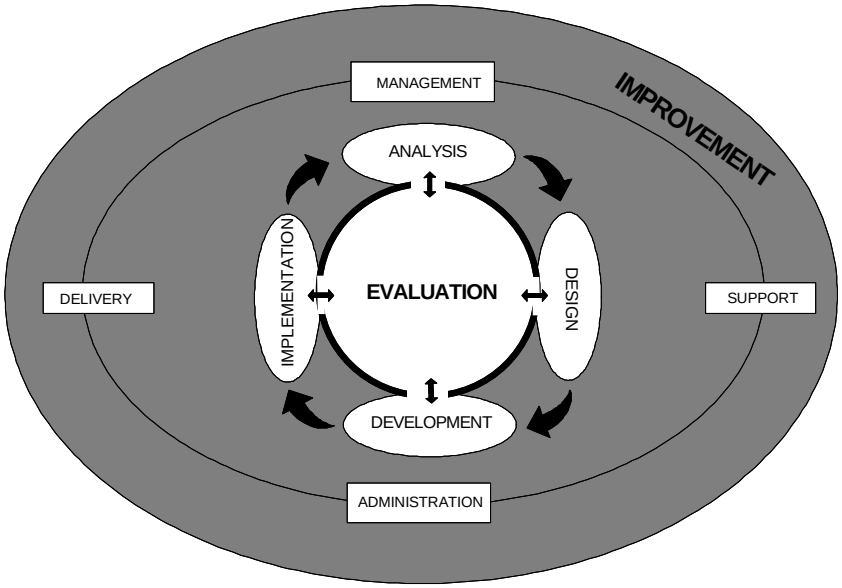
Overview

Introduction

Evaluation is integrated throughout each activity of the instructional development process. It starts in the planning stage with development of an evaluation plan and continues for the life cycle of the training system. The focus of evaluation is continuous improvement in instructional system quality.

Where Are You in the Process?

The ISD model, with evaluation highlighted, is provided in Figure 11. As depicted in the model, each stage in the ISD process involves evaluation activities.



Evaluation

Objective

The objective of this chapter is to summarize:

- Formative evaluation
- Summative evaluation
- Operational evaluation

Continuous Evaluation Process

As previously mentioned, evaluation is an ongoing process. It begins during ISD planning and continues as long as the instructional system is operational. The process includes formative, summative, and operational evaluations. These forms of evaluation are discussed in subsequent sections of this chapter. A brief overview of the evaluation process is provided in the following table in order to acquaint the user of this manual with the continuous evaluation process.

Continuous Evaluation Process		
Form	**Period**	**Purpose**
Formative	From initial ISD planning through small-group tryout	Checks design of individual components of the instructional system for integration (accomplished periodically - is focused on the components -high data collection - make changes when it is least expensive to revise)
Summative	Operational tryout (normally 2 or 3 classes) - real student throughput, full instructional system operation	Checks full system integration and its components (intense -high data collection - short-term - first time everything is working together)
Operational	From completion of the operational tryout continuing for the life cycle of the instructional system	Checks day-to-day system integration and its components (periodic, less data collection, life of system - continuous improvement)

Additional Information

For additional information on evaluation, see:

·Previous chapters in this manual.
·AFMAN 36-2236.
·Briggs, L. J. and Wager, W. W. (1981). *Handbook of Procedures for the Design of Instruction*. (2nd Ed.). Glenview, Illinois: Harper Collins Publishers.
·Dick, W. and Carey, L. (1990). *The Systematic Design of Instruction*. (3rd Ed.). Glenview, Illinois: Harper Collins Publishers.
·O'Neil, H. F. Jr., and Baker, E. L. (1991). Issues in Intelligent Computer-assisted Instruction: Evaluation and Measurement. In T. Gutkin and S. Wise (Eds.), *The Computer and the Decision Making Process*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Section A
Formative Evaluation

Introduction

The **formative evaluation** process begins during analysis and continues through small-group tryout in the development stage of ISD. Within each stage—analysis, design, and development—formative evaluation seeks to improve the quality of the activities and products of ISD. In some organizations, formative evaluation is equated to four stages of validation—technical accuracy reviews, individual tryouts, small-group tryouts, and operational tryouts.

What It Is

Formative evaluation is a form of evaluation designed to collect data and information that is used to improve the activities and products of the ISD process while the system is still being developed. Formative evaluation is also used when the design or development phases are re-entered in order to revise or update the system.

Formative Evaluation Activities

Formative evaluation may include any or all of the following activities, depending upon the community. For example, in the Education, Technical Training and Unit Tranining communities, only the first two activities—process and product evaluations—will likely be performed in the formative evaluation process. However, in the Aircrew Training and Acquisition communities, it may be necessary to perform all of the activities listed below in order to complete the formative evaluation process.

Process Evaluation

Process evaluation ensures quality in the analysis, design, and development activities. It checks each activity against standards, or metrics, established during ISD project planning, to assure process quality, while continually seeking improvements within each activity. Process evaluation enables instructional developers to "form" an effective and efficient instructional system based on quality principles.

Product Evaluation

Product evaluation is an integral part of each stage of the ISD process. Product evaluation focuses on the products of the analysis, design and development activities such as task lists, objectives, tests, plans of instruction and training materials. During product evaluation the focus is again on quality. Products are measured against standards and metrics established in the planning stage of ISD to ensure quality. Product evaluation also helps form a total quality instructional system. Two activities of product evaluation are:

Validation, which takes place during training development and is the final activity in the formative evaluation process. This component, which is discussed in Chapter 6, forms the instructional system by trying out instruction on individuals and small groups. Validation identifies quality improvements that should be made to the instruction prior to implementing the system.

- **Quality control**, which starts in the initial stages of ISD planning with the strategy of controlling quality, and continues throughout training analysis, design and development. This process ensures that each activity such as equipment acquisition, facility construction, etc., is based on quality principles.

Developmental Test and Evaluation (DT&E)

DT&E is an active part of training system development. As a formative evaluation activity, it is conducted to demonstrate that training system equipment design and development are complete, design risks have been minimized, and the system meets performance requirements. It ensures the effectiveness of the manufacturing process, equipment, and procedures.

Operational Test and Evaluation (OT&E)

OT&E completes the formative evaluation process for training system equipment. This formative evaluation activity evaluates the system's operational effectiveness, maintainability, supportability, and suitability. It identifies any operational and logistic support deficiencies, and the need for modification. In addition, OT&E provides information on organizational structure, personnel requirements, support equipment, doctrine, training and tactics. It should also provide data to verify operating instructions, maintenance procedures, training programs, publications, and handbooks.

Site Readiness Reviews (SRR)

The site readiness review is a formative evaluation activity that focuses on evaluating the readiness of the "bed-down" site for the training system. This evaluation ensures that the site, including training facilities and support equipment, is ready for OT&E of the system. Site readiness reviews help ensure the training system effectiveness.

Relationship of the Activities

Each formative evaluation activity contributes to the overall quality of the instructional system. They combine to ensure that:

- Instructional development and revision activities are effective.
- Instruction is cost-efficient.
- The products of each development activity meet quality standards.
- The instruction meets training requirements.
- Equipment satisfies operational, training, and support requirements.
- Facilities meet operational, training, and support requirements.

Period of Formative Evaluation

Planning for formative evaluation begins in the initial planning stage of ISD. However, formative evaluation activities actually begin during analysis and continue through small-group tryout in development.

Section B
Summative Evaluation

Introduction

With the conclusion of small-group tryouts, formative evaluation activities are complete. **Summative evaluation** is the next stage in the continuous evaluation process. This stage of evaluation involves trying out the instruction on the target population in an operational environment. In some organizations, summative evaluations are conducted after the instructional system becomes operational and includes two components—internal and external evaluation.

What It Is

Summative evaluation is a form of evaluation designed to collect data and information during the operational (field) tryouts in order to determine the "summed" effect of the instruction under operational conditions and to make any changes or revisions to the system prior to becoming operational. Summative evaluations are also conducted when significant revisions or updates have been made to the instructional system.

Summative Evaluation Activity

The only summative evaluation activity is the operational tryouts. Operational tryouts are used to:

- Determine if the instructional system works under operational conditions.
- Provide feedback from a large sample of target population in which to base revisions prior to implementation of the instructional system.
- Identify possible implementation or operational problems.
- Determine if instruction is cost-efficient.
- Determine if instruction is adequate and needed.

Evaluating the Integrated System

Summative evaluations are conducted on fully integrated instructional systems. This form of evaluation is essential in determining the effectiveness of the system and correcting any deficiencies prior to implementation.

Period of Summative Evaluation

Summative evaluation is focused on the period of operational tryouts. These tryouts begin after the small-group tryouts have been completed and continue until the instructional system is implemented. Normally, the operational tryout period is limited to two or three classes.

Section C
Operational Evaluation

Introduction

As previously mentioned, the evaluation process is continuous. Once the formative and summative evaluation activities have been completed and the instructional system is implemented, **operational evaluation** begins. Operational evaluation continues as long as the system is operational.

What It Is

Operational evaluation is a form of evaluation designed to gather and analyze internal and external feedback data to ensure that the system continues to effectively and cost-efficiently produce graduates who meet established training requirements.

Operational Evaluation Activities

Operational evaluation includes the following activities.

Internal Evaluation

Internal evaluation focuses on evaluating the instructional system internally. This form of evaluation continuously evaluates feedback data such as instructor comments, student critiques and test results in order to continually improve the system and ensure quality.

External Evaluation

External evaluation focuses on evaluating the instructional system externally. This form of evaluation continually evaluates feedback data from the field such as inspection and evaluation reports to ensure that graduates meet the established job performance requirements.

Relationship of Activities

Each operational evaluation activity contributes to the overall quality of the instructional system by ensuring that:

- Each system component continues to contribute to the overall effectiveness and cost-efficiency of the system.
- Graduates of the course continue to meet the established job performance requirements.
- Instruction is adequate and necessary.

Period of Operational Evaluation

Operational evaluation begins with the implementation of the instructional system and continues for the life cycle of the system.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

MERRILL A. McPEAK, General, USAF
Chief of Staff

EDWARD A. PARDINI, Colonel, USAF
Director of Information Management

SUMMARY OF CHANGES

This revision provides an updated ISD model as well as general aspects of applying the ISD process. It provides for several application handbooks in the specific areas of technical training, aircrew training, acquisition, education and others. Information on learning theory has been added. Quality improvement and evaluation have been emphasized throughout the publication.

Attachment A - Air Force ISD Documents

AFPD 36-22, Military Training

AFI 36-2201, Development, Managing, and Conducting Military Training

AFI 36-2301, Professional Military Education

AFMAN 36-2234, Instructional System Development

AFMAN 36-2236, Handbook for Air Force Instructors

AFH 36-2235, Information for Designers of Instructional Systems (11 volumes)

Vol 1, Executive Summary

Vol 2, ISD Automated Tools/What Works

Vol 3, Application to Acquisition

Vol 4, Guide to Training Technologies

Vol 5, Interactive Courseware (ICW) Design, Development and Management Guide

Vol 6, Guide to Needs Assessment

Vol 7, Design Guide for Device-based Aircrew Training

Vol 8, Application to Aircrew Training

Vol 9, Application to Technical Training

Vol 10, Application to Education

Vol 11, Application to Unit Training

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Attachment C - Abbreviations

AATS	Advanced Aircrew Training System
AETC	Air Education and Training Command
AF	Air Force
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFS	Air Force Specialty
ANG	Air National Guard
ARCS	Attention, Relevance, Confidence and Satisfacti
CAI	Computer-Assisted Instruction
CBI	Computer-Based Instruction
CBT	Computer-Based Training
CDC	Career Development Course
CD-ROM	Compact Disc-Read Only Memory
CMI	Computer-Managed Instruction
CRT	Criterion-Referenced Test
DoD	Department of Defense
DT&E	Developmental Test and Evaluation
ECI	Extension Course Institute
FMI	Functional Management Inspection
ICW	Interactive Courseware
IG	Inspector General
ISD	Instructional System Development
IVD	Interactive Videodisc
JPA	Job Performance Aid
JPR	Job Performance Requirements
LP	Lesson Plan
MAJCOM	Major Command
MTAR	Mission Task Analysis Report
OJT	On-the-Job Training
OMS	Occupational Measurement Squadron
OSR	Occupational Survey Report
OT&E	Operational Test and Evaluation
PME	Professional Military Education

POI	Plan of Instruction
PTT	Part-Task Trainer
QA	Quality Assurance
QAF	Quality Air Force
QI	Quality Improvement
SAT	Systems Approach to Training
SKA	Skills, Knowledge, and Attitudes
SME	Subject Matter Expert
SPO	System Program Office
SRR	Site Readiness Review
STP	System Training Plan
TDY	Temporary Duty
TO	Technical Order
TPR	Trained Personnel Requirement
TPT	Training Planning Team
TQR	Training Quality Report
U&TW	Utilization and Training Workshop
USAF	United States Air Force
VCR	Video Cassette Recorder

Attachment D - Definitions

The following list of definitions includes those terms commonly used to discuss education and training as they relate to instructional system development and as used in this manual. It is not to be considered all-inclusive.

Association. The connection made between an input (stimulus) and an action (response).

Attitude. (a) The emotions or feelings that influence a learner's desire or choice to perform a particular task. (b) A positive alteration in personal and professional beliefs, values, and feelings that will enable the learner to use skills and knowledge to implement positive change in the work environment. Also see **Knowledge** and **Skill.**

Behavior. Any activity, overt or covert, capable of being measured.

Cognition. The mental or intellectual activity or process of knowing, including both awareness and judgment.

Cognitive Strategies. The capability of individuals to govern their own learning, remembering, and thinking behavior.

Computer-Assisted Instruction (CAI). The use of computers to aid in the delivery of instruction. A variety of interactive instructional modes are used including tutorial, drill and practice, gaming, simulation, or combinations. CAI is an integral part of computer-based instruction (CBI) and computer-based training (CBT).

Computer-Based Instruction (CBI) and Computer-Based Training (CBT). The use of computers to aid in the delivery and management of instruction. CBI and CBT are synonymous and are used interchangeably. CAI (the delivery of instruction) and CMI (computer-managed instruction) are both elements of CBI and CBT.

Computer-Managed Instruction (CMI). The use of computers to manage the instructional process in CAI or CBT. Management normally includes functions such as registration, pretesting, diagnostic counseling, progress testing, and posttesting. CMI is also used to schedule and manage training resources such as trainers and equipment.

COMSEC. An abbreviation for Communications Security. The protection resulting from all measures designed to deny unauthorized persons information of value which might be derived from the possession and study of telecommunications and to ensure the authenticity of such communications.

Constraints. Limiting or constraining conditions or factors, such as policy considerations, time limitations, equipment, environmental factors, personnel, budgetary, or other resource limitations.

Course Chart. A qualitative course control document that states the course identity, length, and security classification, lists major items of training equipment, and summarizes the subject matter covered.

Course Control Documents. Specialized publications used to control the quality of the instructional system. Examples are training standards, plans of instruction, syllabi, and course charts.

Courseware. Training materials such as technical data, textual materials, audiovisual instructional materials, and computer-based instructional materials.

Criterion. (a) The standard by which something is measured. (b) In test validation, the standard against which test instruments are correlated to indicate that accuracy with which they predict human performance in some specified

area. (c) In evaluation, the measure used to determine the adequacy of a product, process, behavior, and other conditions.

Criterion-Referenced Test (CRT). A test to determine, as objectively as possible, a student's achievement in relation to a standard based on criterion objectives. During instructional development, the CRT can be used to measure the effectiveness of the instructional system. The test may involve multiple-choice items, fill-in items, essays, or actual performance of a task. If given immediately after the learning sequence, it is an acquisition test; if given considerably later, it is a retention test; if it requires performance not specifically learned during instruction, it is a transfer test.

Discrimination. The process of making different responses to a stimulus. A discrimination requires a person to determine the differences among inputs and to respond differently to each.

Distance Learning. Training that is exported, such as from a resident course to a field location. Also called **Exportable Training.**

Duty. A large segment of the work done by an individual; major divisions of work in a job.

Evaluation. A judgment expressed as a measure or ranking of trainee achievement, instructor performance, process, application, training material, and other factors (see MIL-STD-1379D). It includes **Formative Evaluation**; **Operational Evaluation**; and **Summative Evaluation**.

Exportable Training. See **Distance Learning**.

External Evaluation. The acquisition and analysis of feedback data from outside the formal training environment to evaluate the graduate of the instructional system in an operational environment. Also called **Field Evaluation.** Also see **Operational Evaluation.**

Feedback. Information that results from or is contingent upon an action. The feedback does not necessarily indicate the correctness of an action; rather, it relates the results of the action from which inferences about the correctness can be drawn. Feedback may be immediate, as when a fuse blows because a lamp is incorrectly wired; or delayed, as when an instructor provides a discussion pertaining to an exam taken the previous week, or when completed graduate evaluation questionnaires are reviewed.

Fidelity. The degree to which a task or a training device represents the actual system performance, characteristics, and environment.

Field Evaluation. See **External Evaluation.**

Formative Evaluation. An activity that provides information about the effectiveness of training materials to meet training objectives and the trainee acceptance of training materials as they are being developed. Also called Developmental Testing. Also see **Evaluation.**

Generalization. Learning to respond to a new stimulus that is similar, but not identical, to one that was present during original learning. For example, during learning a child calls a beagle and a spaniel by the term "dog"; a child who has generalized would respond "dog" when presented with a hound.

Instructional Objective. See **Objective.**

Instructional System. An integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques, and procedures performing effectively and efficiently the functions required to achieve specified learning objectives.

Instructional System Developer. A person who is knowledgeable of the instructional system development (ISD) process and is involved in the analysis, design, development, implementation, and evaluation of instructional systems. Also called Instructional Developer, Curriculum developer, Curriculum Development Manager, and other terms.

Instructional System Development (ISD). A deliberate and orderly, but flexible, process for planning, developing, implementing, and managing instructional systems. It ensures that personnel are taught in a cost-efficient way the knowledge, skills, and attitudes essential for successful job performance.

Interactive Courseware (ICW). Computer-controlled training designed to allow the student to interact with the learning environment through input devices such as keyboards and light pens. The student's decisions and inputs to the computer determine the level, order, and pace of instructional delivery, and forms of visual and aural outputs.

Interactive Videodisc (IVD). A form of ICW instruction that specifically makes use of videodisc technology. Video and audio signals are pressed onto the laser videodisc; programming codes may or may not be pressed onto the disc depending on the IVD level. As a result, motion sequence, still-frame shots, computer-generated graphics, and/or audio may be displayed and heard through a monitor under computer and user control.

Internal Evaluation. The acquisition and analysis of feedback and management data from within the formal training environment to assess the effectiveness of the instructional system. Also see **Operational Evaluation.**

Job. The duties, tasks, and task elements performed by an individual. The job is the basic unit used in carrying out the personnel actions of selection, training, classification, and assignment.

Job Aid. A checklist, procedural guide, decision table, worksheet, algorithm, or other device used by a job incumbent to aid in task performance. Job aids reduce the amount of information that personnel must recall or retain.

Job Analysis. The basic method used to obtain salient facts about a job, involving observation of workers, conversations with those who know the job, analysis questionnaires completed by job incumbents, or study of documents involved in performance of the job.

Job Performance Requirements (JPR). The tasks required of the human component of the system, the conditions under which these tasks may be performed, and the quality standards for acceptable performance. JPRs describe what people should do to perform their jobs.

Knowledge. Use of the mental processes which enable a person to recall facts, identify concepts, apply rules or principles, solve problems, and think creatively. Knowledge is not directly observable. A person manifests knowledge through performing associated overt activities. Also see **Attitude** and **Skill.**

Learning. A change in the behavior of the learner as a result of experience. The behavior can be physical and overt, or it can be intellectual or attitudinal.

Lesson Plan. An approved plan for instruction that provides specific definition and direction to the instructor on learning objectives, equipment, instructional media material requirements, and conduct of training. Lesson plans are the principal component of curriculum materials in that they sequence the presentation of learning experiences and program the use of supporting instructional material.

Media. The delivery vehicle for presenting instructional material or basic communication stimuli to a student to induce learning. Examples are instructors, textbooks, slides, and interactive courseware (ICW).

Metrics. Measurement tools used for assessing the qualitative and quantitative progress of instructional development with respect to the development standards specified.

Motor Skill. Physical actions required to perform a specific task. All skills require some type of action.

Norm-Referenced Test. The process of determining a student's achievement in relation to other students. Grading on the curve involves norm-referenced measurement, since an individual's position on the curve (grade) depends on the performance of other students. Generally, norm-referenced measurement is not appropriate in the Air Force ISD process.

Objective. A statement that specifies precisely what behavior is to be exhibited, the conditions under which behavior will be accomplished, and the minimum standard of performance. Objectives describe only the behaviors that directly lead to or specifically satisfy a job performance requirement. An objective is a statement of instructional intent.

Operational Evaluation. The process of internal and external review of system elements, system requirements, instructional methods, courseware, tests and process guide revision as needed to enhance the continued training effectiveness and efficiency of the training system during full-scale operations. It includes **Internal Evaluation** and **External Evaluation.** Also see **Evaluation.**

Perceptual Skill. The process of information extraction; the process by which an individual receives or extracts information from the environment through experiences and assimilates this data as facts (sight, sound, feel, taste, smell).

Performance. Part of a criterion objective that describes the observable student behavior (or the product of that behavior) that is acceptable to the instructor as proof that learning has occurred.

Plan of Instruction (POI). A qualitative course control document designed for use primarily within a school for course planning, organization, and operation. Generally, criterion objectives, duration of instruction, support materials, and guidance factors are listed for every block of instruction within a course. Also called **Syllabus.**

Posttest. A criterion-referenced test designed to measure performance on objectives taught during a unit of instruction; given after the instruction.

Pretest. A criterion-referenced test designed to measure performance on objectives to be taught during a unit of instruction and performance on entry behavior; given before instruction begins.

Reliability. (a) A characteristic of evaluation which requires that testing instruments yield consistent results. (b) The degree to which a test instrument can be expected to yield the same result upon repeated administration to the same population. (c) The capability of a device, equipment, or system to operate effectively for a period of time without a failure or breakdown.

Simulation. A technique whereby job environment phenomena are mimicked, in an often low-fidelity situation, in which costs may be reduced, potential dangers eliminated, and time compressed. The simulation may focus on a small subset of the features of the actual job environment.

Skill. The ability to perform a job-related activity that contributes to the effective performance of a task. Skills involve physical or manipulative activities which often require knowledge for their execution. All skills are actions having specific requirements for speed, accuracy, or coordination. Also see **Attitude** and **Knowledge.**

Subject Matter Expert (SME). (a) An individual who has thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him/her to assist in the training development process (for example, to consult,

review, analyze, advise, or critique). (b) A person who has high-level knowledge and skill in the performance of a job.

Summative Evaluation. The overall assessment of a program at the completion of the developmental process. It is designed and used after the instructional system has become operational. Also see **Evaluation.**

Syllabus. See **Plan of Instruction.**

System Training Plan (STP). The specific document which includes program information and data concerning the system or equipment program, event, or situation that originated the training requirement, and describes the training required and the training programs to satisfy the requirement. The STP is designed to provide for planning and implementation of training and ensure that all resources and supporting actions required for establishment and support are considered.

System Approach to Training (SAT). Procedures used by instructional system developers to develop instruction. Each phase requires input from the prior phase and provides input to the next phase. Evaluation provides feedback which is used to revise instruction. Also see **Instructional System Development.**

Target Audience. The total collection of possible users of a given instructional system; the persons for whom the instructional system is designed.

Task. A unit of work activity or operation which forms a significant part of a duty. A task usually has clear beginning and ending points and directly observable or otherwise measurable processes, frequently but not always resulting in a product that can be evaluated for quantity, quality, accuracy, or fitness in the work environment. A task is performed for its own sake; that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a duty or job array.

Task Analysis. The process of describing job tasks in terms of Job Performance Requirements (JPR) and the process of analyzing these JPRs to determine training requirements. Also see **Job Performance Requirements.**

TEMPEST. A term used to describe compromising emanations. They are unintentional, data-related, intelligence-bearing signals which, if intercepted and analyzed, could disclose the classified information transmitted, received, handled, or otherwise processed by electronic equipment.

Terminal Objective. An objective the learners are expected to accomplish upon completion of the instruction. It is made up of enabling (support or subordinate) objectives.

Training. A set of events or activities presented in a structured or planned manner, through one or more media, for the attainment and retention of skills, knowledge, and attitudes required to meet job performance requirements.

Training Needs Assessment (TNA). The study of performance and the environment that influences it in order to make recommendations and decisions on how to close the gap between the desired performance and the actual performance.

Training Planning Team (TPT). An action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle design, development, acquisition, support, modification, funding, and management of a specific defense training system.

Training Strategy. An overall plan of activities to achieve an instructional goal.

Training System. A systematically developed curriculum including, but not necessarily limited to, courseware, classroom aids, training simulators and devices, operational equipment, embedded training capability, and personnel to operate, maintain, or employ a system. The training system includes all necessary elements of logistic support.

Utilization and Training Workshop (U&TW). A forum to determine Specialty Training Standard requirements and responsibilities for the specialty. Workshop attendees include, but are not limited to, representatives from the training and using organizations.

Validation. The process of developmental testing, field testing, and revision of the instruction to be certain the instructional intent is achieved. The instructional system is developed unit by unit and tested (or validated) on the basis of the objective prepared for each unit.

Validity. The degree to which a criterion test actually measures what it is intended to measure.