

UPDATE OF THE U.S. AIR FORCE INSTRUCTIONAL SYSTEMS DEVELOPMENT (ISD) PROCESS

Katharine C. Golas, Ph.D.
Southwest Research Institute
San Antonio, Texas

Sara Shriver
Consultant
Lorton, Virginia

Conrad G. Bills
Wright-Patterson AFB
Dayton, Ohio

Pat Bowden
Randolph AFB
San Antonio, Texas

ABSTRACT

The U.S. Air Force is revising its Instructional Systems Development (ISD) process. This paper will focus on the background leading up to this revision, the approach that has been followed, and the results to date. In 1992, the Air Training Command and the Air Force Systems Command joined forces to initiate a task order contract that would first establish the current baseline of ISD and then focus on the direction ISD should take. The current process does not adequately support new Air Force application needs, new training technologies, or automated support tools. Also, cognitive/affective aspects of learning are now recognized as having potential for contributing significantly to instructional practices. The authors visited Air Force ISD experts across major commands. Outlines were prepared for the overall description of the Air Force ISD process (AFM 50-2) and the application volumes (AFP 50-68), which give guidelines for implementing the process in different settings including education, acquisition of training, aircrew training, and technical training. Content for the manual and each application volume is closely coordinated with Air Force ISD experts. The manual and pamphlets are presented in a structured writing format with illustrations and examples.

ISD is a total quality process and management is key to its implementation. The distorted view that ISD is procedure-checklist-linear is to be changed to a more accurate view that ISD is process-dynamic-circular, allowing the instructional designer to begin at any phase of the process as required to develop and maintain the total instructional system. Information on affective and cognitive domains is added. Information on monitoring contractor-developed instructional systems includes requirements for measurement tools or "metrics" for assessing progress and traceability of decisions back to initial training needs analysis conclusions. The overall training system architecture or "big picture" is used to define the components that will be required to carry out each training system function. Streamlining of the documentation trail is to be aided by computer-assisted tools. The application of computer technology can assist in total system integration. A method for continuing updates is in place.

ABOUT THE AUTHORS

Dr. Katharine C. Golas is manager of the Instructional Systems Section at Southwest Research Institute. She has over 15 years of experience in high technology instructional systems development for the federal government and private industry. She has a Ph.D. and M.A. in Instructional Systems from Florida State University.

Ms. Sara Shriver is an independent consultant in instructional systems. She has 25 years of experience in Training Systems Research and Development. She has a B.A. in Humanities from the University of Oklahoma.

Major Conrad G. Bills is a senior training system analyst for the Training Systems System Program Office (SPO) at Aeronautical Systems Center, Wright-Patterson AFB, Dayton, Ohio. He has 15 years of experience in instructional systems applications. Major Bills has a B.A. and M.S. in Education and Psychology from Brigham Young University.

Mr. Pat Bowden is Chief of Research and Training Technology Development Division, HQ Air Training Command, Randolph AFB, San Antonio, Texas. He has over 25 years of experience in Air Force Instructional Systems Development. He has an M.A. in Management from Webster University. His duties on this project have been taken over by Major Dick O'Neal.

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INTRODUCTION

Background

The Air Force Instructional Systems Development (ISD) process was designed over three decades ago using concepts from systems engineering, behavioral psychology, and instructional technology to formulate the *procedures for ensuring efficiency, effectiveness, and job relevance* in Air Force training.

Like the other ISD processes adopted throughout the military services, the Air Force ISD model has a generic structure similar to those found in the business and private sector. Some form of *front-end analysis* or needs analysis is used to define tasks, equipment, and personnel requirements for each operational activity. Information from this detailed job description is then used to *plan the instruction, which includes a target audience analysis and a search for proper training media*. Measurable training objectives are prepared and used in the *development* of courseware and training material that leads to executing the actual *instruction*. This generic approach includes periodic and planned feedback mechanisms in the form of internal and external evaluations of the training program. The entire process works within external constraints on the system.

Air Force Regulation 50-8, Policy and Guidance for ISD, prescribes the use of the Air Force ISD process in the design and development of all education and training of personnel. The current Air Force ISD process follows a five-step model which is detailed in AFM 50-2, ISD, with proceduralized steps spelled out in AFP 50-58, Handbook for Designers of Instructional Systems.

The Air Force five-step ISD model shown in Figure 1 requires:

Step 1. Determining precisely what the skilled performer does when doing the job, how well he or she must do it, and under what conditions.

Step 2. Determining if instruction is needed and, if so, determining what instruction to give the untrained personnel so that they can do the job well.

Step 3. Expressing these instructional needs as specific objectives and devising tests for every objective to measure whether the students achieve the objectives.

Step 4. Designing and developing instruction to teach the objectives and having students try out the instruction to be sure it is effective.

Step 5. Conducting and evaluating the instruction; and later, evaluating how well the graduates do the job.

The feedback and interaction function supports entering the model at any point, which is often appropriate in a course revision. The constraints primarily represent fixed items such as money, people, facilities, time, security, and technology availability.

Since the definition of the five-step ISD model, advances have been made in cognitive psychology, instructional design, learning theory, and human factors studies. Such areas as cognitive task analysis and computer-assisted training system design have been under investigation. These concepts are already being applied in major training system acquisition programs.¹ Expert system

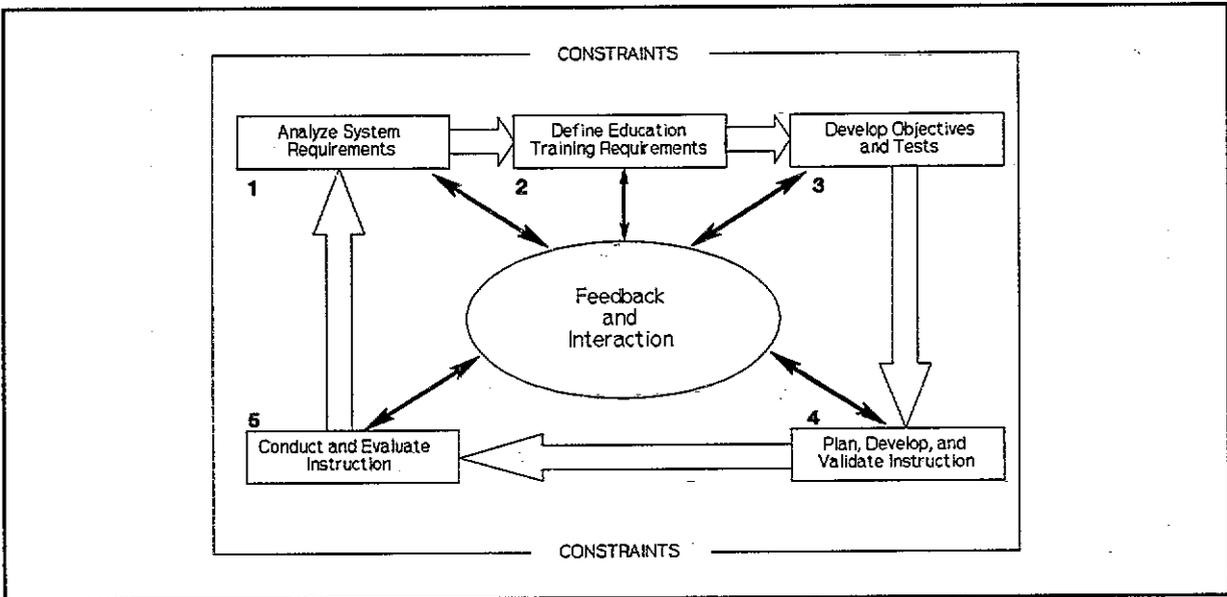


Figure 1. ISD Model

technology is enhancing applications such as decision analysis. Computer technology evolution now opens the door for streamlining the "paper trail" and enhancing the capabilities of the instructional designer. Print media approaches have been enhanced through desktop publishing to take full advantage of graphics, white space and humor. Tools and techniques to enhance the ease and effectiveness of ISD are becoming available. However, the implementation of ISD in the Air Force has become a source of increasing frustration to users. Of primary concern is the audit trail created in AFP 50-58 for documentation of the ISD process. This audit trail was good for traceability for systematic decisions, but the documentation became an inspection item. The resulting paperwork exercise is outdated and unsupportable.

Today we recognize the problems presented from implementing a linear instructional system development process through regulated external controls. These problems are caused by:

1. Requirements that developers follow the letter (boxes and arrows) rather than the intent of the procedures.

2. Requirements for excessive record keeping, paperwork, forms and reports documenting every step, to the detriment of the course development effort.

3. Suspense dates for course development that are too close for application of the procedures.

Since the Air Force adopted the ISD process, there have been drastic changes in the training environment and training requirements.² More and more instruction is being developed by private industry under contract to the Air Force. Restructuring of the education and training career fields, particularly merging of the enlisted ISD and on-the-job (OJT) specialties, has resulted in decreasing familiarity with ISD processes. In addition, the rapid technological changes in both weaponry and training technologies, and the reduction in force, have resulted in a continuing drain of work force skills. As a result, there is concern about how we will meet the training needs of tomorrow. The automation of many routine tasks has removed important learning opportunities for novices. Increased system complexity combined with improved system reliability has simultaneously increased possible sources of malfunction while decreasing

opportunities for personnel to practice troubleshooting and repair.

The Air Force ISD process as implemented appears to make it more difficult to meet the increasing demands for curriculum development to modernize Air Force capabilities. The currently published curriculum design and development procedures appropriate for producing print, audio-visual, or simple computer-assisted instruction provide little guidance for the course developer who is required to adapt the ISD process for interactive videodisc, Digital Video Interactive®, external or embedded interactive computer-based instruction, intelligent tutoring systems, or performance support systems.

Finally, the language and style of the Air Force procedural guidance is too difficult to follow. The examples do not meet the needs of the broad range of users. The guidance assumes that personnel using the process are trained in instructional system design; but this is only true of a diminishing cadre of ISD expertise.

Specific applications such as aircrew training have stretched the current process. For example, it is difficult to design training for cognitive tasks such as crew coordination, as well as to plan courses for educating Air Force professionals. These applications need an updated ISD process.

Goals

The goals of this update of the Air Force ISD process are to:

1. Provide up-to-date, flexible, user-friendly guidance in the principles and procedures for applying a systems approach to training in the Air Force. The process should be flexible enough to apply across a broad range of acquisition and operational conditions from a single course development to a full system as part of *integrated product development for new weapon system acquisition*.
2. Improve the current Air Force ISD guidance to provide support for the full range of instructional development activities covering the cognitive, affective, and procedural aspects of Air Force education and training.

3. Provide a vehicle for monitoring, updating, and disseminating information about usable new technologies and tools for Air Force instructional development and delivery.

Methodology

The update of the U.S. Air Force ISD process was initiated in May 1991 with a baseline analysis using a three-pronged investigation³:

1. Needs assessment techniques were applied to determine Air Force users' problems with the current ISD process and guidance.
2. Experts were interviewed and literature was reviewed to identify trends in instructional design (ID) theory, relevant current thinking in learning theory, motivation, cognitive psychology, and instructional design.
3. A matrix analysis was used to assess new technologies.

The update of the Air Force ISD process includes simplification of AFM 50-2 and publication of a series of information guides for users in the acquisition, education, aircrew, and technical training communities. The approach was to converge working groups from each of these communities. These working groups assisted in drafting detailed outlines for both the revised AFM 50-2 and their own application guide and reviewing and validating drafts of these documents.

REVISION OF AIR FORCE ISD

Needs Assessment Description

The needs assessment employed the following techniques in determining opportunities for updating the Air Force ISD process.

1. Survey Through Questionnaire. A survey was developed and disseminated within Air Force major commands and educational institutions to collect information on (1) the current use of ISD regulations (AFM 50-2, AFR 50-8, AFP 50-58, etc.); (2) problems associated with using these documents; (3) how well the documents support new weapon systems acquisition; and (4) the effect on ISD training development of early manpower,

personnel, and training integration in acquisition. Open-ended items asked: (1) where the ISD process should begin; (2) the kinds of guidelines needed for estimating costs, validating and evaluating materials, revising courses, and managing contractors; and (3) how future technologies will impact the ISD process. Forced-choice questions asked the respondents to react to previous suggestions from a 1986 ATC Training Needs Assessment Study⁴ regarding: (1) procedures for using shortcuts; (2) inclusion of more examples; (3) providing step-by-step procedures, checklists and quick summaries; (4) developing separate procedures for different users; (5) separating ISD philosophy from how-to procedures; (6) providing separate publications to support different training methods and media; and (7) providing a more lively illustrated format.

2. Internal Air Force Interviews. One-on-one and small group interviews were conducted at all of the major commands and the Air University to gather information from and share ideas with key personnel regarding the Air Force ISD process.

3. External Interviews with Subject Matter Experts. In addition to Air Force personnel, six renowned ISD subject matter experts (SME) were interviewed for the purpose of reviewing their positions on current ISD theory applicable to Air Force needs. The SMEs were Dr. Robert Gagné, Dr. William Spears, Dr. Harry O'Neil, Dr. Robert Tennyson, Dr. David Merrill and Dr. Walter Wager.

4. Observation. During the site visits, the project team directly observed Air Force training professionals, instructors, and students in their work environments and collected information on current work practices and ISD products. Visits were made to classrooms, simulator facilities, flightlines, maintenance facilities, interactive courseware development labs, and various learning centers.

5. Literature Review. Many organizations within the Air Force have developed their own supplements to the current regulations. Some organizations have developed automated tools to assist them with the ISD process. Samples of ISD guideline supplements and tools were collected and analyzed during the training

needs assessment study. Relevant publications were reviewed.

Needs Assessment Results and Implications

The information presented here on the strengths and limitations of the current ISD process in the Air Force is based on the data received from the training needs assessment study, which included internal interviews with Air Force personnel and external interviews with subject matter experts.

1. Strengths of Current Air Force Process.

a. The process itself. A majority of the respondents reported that the ISD process is not a problem. They saw ISD as both flexible and systematic. The cyclical process with feedback and feedforward will withstand the test of time. The generic quality of the model makes it adaptable to various applications. An overwhelming majority of respondents reported that they try very hard to implement the intent of ISD or adapt the spirit of ISD for their particular application.

b. General architecture. Respondents agree that the basic five-phased approach of 1) analyze, 2) design, 3) develop, 4) implement, and 5) evaluate is still an excellent model to follow to develop instructional materials. However, the recommended top-level ISD model needs to be general, without "boxes and arrows," so that the process remains dynamic and flexible. AFM 50-2 should state the common grounds on which instructional design and development should be based. These grounds should be general, not overly detailed, and expressed in simple language, free of jargon.

c. Evaluation. Evaluation is emphasized in the current Air Force model as being critical to the success of the systems approach. As part of the dynamic ISD process, more provision needs to be made for evaluation to take place iteratively throughout the life cycle of the program. Developers want guides and standards to support conducting evaluation from the beginning of training development through implementation and operation which will ensure the effectiveness of the training product as well as the ISD process itself.

2. Limitations of Current Process.

a. It is difficult to adapt the current ISD model to specific training applications. Many respondents reported that the uniqueness of their programs makes it difficult to apply ISD as it is now written. The ISD process currently in place in the Air Force is more applicable to *technical training than to aircrew, education, and acquisition training.*

b. Emphasis is on following the letter rather than the intent of the procedures. The requirements in the regulations are too rigid. Experienced ISD developers get around this fairly easily by adapting the information to their specific needs. Novice developers, on the other hand, can quickly get lost in the detail.

c. Excessive paperwork, forms, print reports are required. A requirement to produce paperwork to support training decisions and serve as a data trail for the development process was reported by many as being a detriment to the course development effort. Keeping documentation current is burdensome, and the paperwork exercises are outdated and insupportable. Respondents reported that there is no systematic process for knowing what paperwork to generate or how long to keep it. Because of this, there is a tendency to keep too much detail to support training decisions and products.

d. Information as presented in regulations is too complex. The language and style of the regulations are difficult to follow. Comments included: too "bulky," tables and figures too complex, language not simple, vague, too cumbersome, too formal, not enough examples and samples, hard to decipher. Again, many respondents reported that the regulations are totally unsuitable for an inexperienced or novice ISD developer.

e. Information in regulations is outdated. The current ISD model and regulations were developed before computer-based training technologies emerged as an instructional delivery system. The current ISD procedures provide no help to the designer of state-of-the-art instructional delivery systems or automated tools.

f. Information on affective domain is lacking. The current Air Force ISD guidance lacks information on the affective domain as it pertains to training, particularly how emotions or feelings influence a learner's desire or choice to perform a particular task or job.

g. Detail on cognitive domain is lacking. The Air Force ISD procedures need information on advances made in cognitive psychology and adult learning to support inclusion of the cognitive components of tasks in training curricula.

3. Suggestions for Improvements. The revised ISD model and guidelines should:

a. Reduce the requirement for paperwork. The revised guidelines should offer information on how to streamline the documentation trail using computer-assisted tools.

b. Provide information in a more comprehensible manner. Simplifying the description of the process will facilitate user acceptance and commander support. The revised guidelines should include summaries and checklists, and provide more illustrations and examples.

c. Provide information on affective domain. The revised guidelines should provide information on how to incorporate elements of the affective domain into instructional designs. Air Force training developers need guidance in how to develop instruction which will improve student motivation, morale, and attitudes.

d. Provide information on cognitive domain. The new ISD guidelines should provide specific information on how to develop training for tasks which require extensive use of a learner's cognitive abilities and which also provide the organic knowledge underlying procedural and motor tasks.

e. Provide information on resource analysis and associated cost-benefit analysis. Include guides for assessment of resource requirements and cost trade-offs in the decision-making process. Emphasis should be on training efficiency without compromising training effectiveness.

f. Provide information on ISD management. AFM 50-2 should provide for decentralized control and management of instructional development. Along with decentralization, standards should be specified which are expected to be met by those employing the process—standards which are to be met regardless of adaptation to a particular community or project.

g. Emphasize that the ISD process is a tool. The ISD process is a tool to get the right training for the operational assets deployed so the mission can be accomplished.

h. Change perceptions of the ISD process. Users' perception of the ISD process is distorted by the procedure-checklist-linear mentality ingrained by current operator/maintainer training. There is a need to shift this perception to ISD as a dynamic process which addresses a series of relevant, interrelated questions, and emphasize that it is a circular process with opportunity for insertion at any time as required to develop or maintain instruction.

i. Include references to good ISD texts. There are a number of good texts already published which could be acquired for the ISD offices as expert references. These references, supplemented with "how to's" and "what works," could enhance the "workbench" understanding. However, the importance of simple, straightforward guidelines should not be overlooked.

j. Provide metrics. Managers of the ISD process or monitors of contract instructional developments need measurement tools or "metrics" for assessing the qualitative and quantitative progress with respect to the development standards specified. Each product should be supported by a traceable decision record back to the initial questions addressed in the training needs analysis. Formative and summative evaluation should provide these data and the training management information system should be the means for collecting, reducing, and presenting these data in a usable form to the managers.

k. Address integration issues. Integration of the instructional development products into the

total training system must be addressed from the very beginning, considering all the primary training system functions (delivery, management/administration, support, evaluation, and quality improvement)⁶. These functions are not to be confused with the phases of the ISD process, since these functions must be in operation in order to achieve a successfully integrated training system. The allocation of these functions to the various components or people that make up the total training system ensures that the "big picture" perspective is accounted for throughout the phases of development and implementation.

The revised Air Force ISD model shown in Figure 2 includes the basic phased approach of the ISD process, which is analysis, design, development and implementation. The process is in context of the training or instructional system functions, including management, administration, support, evaluation and quality improvement. Quality improvement encircles the model, permeating the entire process with a constant quality mindset. Evaluation is internal, providing feedback to the instructional system throughout each phase of the process. Training system personnel, having evaluation feedback, can then ensure continual quality improvement throughout the entire life cycle of a program.

Trends in ID Theory

The review of trends in ID theory covers current and forecasted instructional system design processes in such fields of study as cognitive psychology, instructional design, learning theory, human factors psychology, and systems engineering.

The new technologies provide instant unlimited random access. This allows the interweaving of verbal, graphic, and pictorial representations; instant switching from context to focus; navigating through large complex equipment; and depicting results of actions. Simulation makes possible, through these representational capabilities, the capability of engaging the learner through electronic gaming techniques, and intensifying learner involvement in problem solving and decision making. This results in the learner gaining not only knowledge and

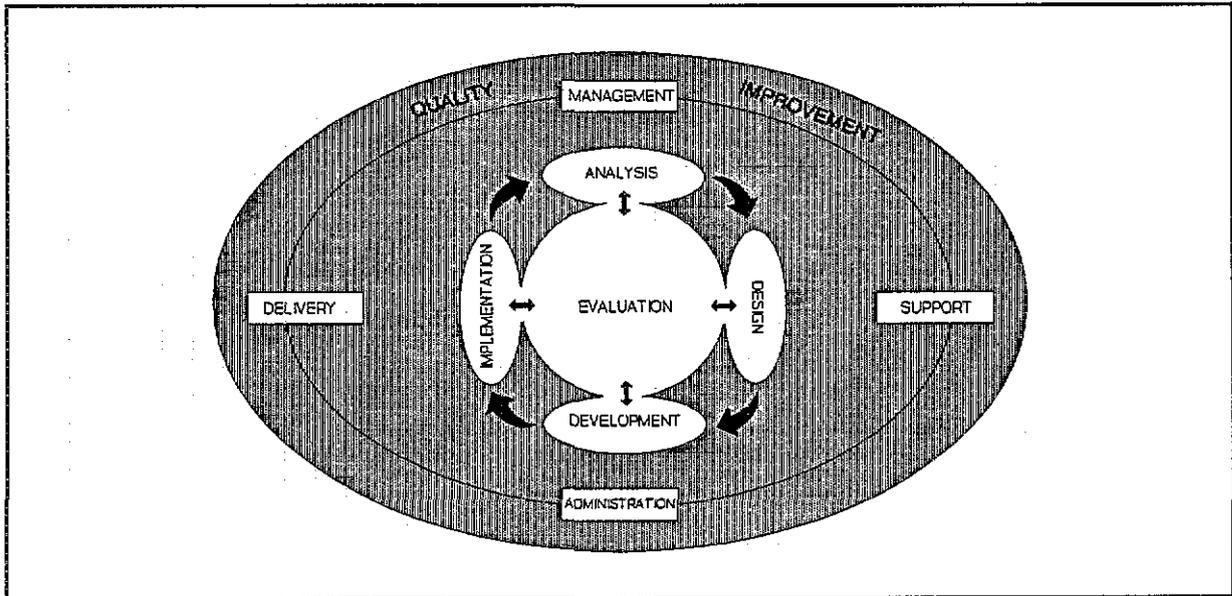


Figure 2. Revised ISD Model

understanding, but the confidence that comes through experience, in this case synthetic but highly effective. In addition, digitization techniques now permit rapid low-cost changes in the finished materials. Research now is exploring, documenting, and transmitting the means of exploiting these capabilities to the maximum benefit of the training environment.

The following paragraphs summarize some general ID trends anticipated for the 1990s.

1. Interactive network of theories. Tennyson⁶ predicts that the ID field will abandon the pursuit of a single, all-encompassing instructional design theory and concentrate on establishing an interactive network of theories. Tennyson writes that the trend toward a synthesis of elements of various ID theories started in the 1980s. An early example of an integrated instructional design theory is Charles Reigeluth's Elaboration Theory.⁷ This theory calls for the designer to analyze and sequence concepts on the basis of their importance and their relative complexity and specificity. Instruction starts with the large, general view of the subject and gradually focuses on the details and complexity of the components. Integration and review take place with a return to the larger view. As the application is repeated, an increasingly elaborate understanding of the subject is acquired by the learner.

2. Emphasis on human relations, motivation, and attitudes. Tennyson⁶ reports that human relations will likely be a center of much ID progress in the coming years. Learner variables, for example, have already begun to play an important role in ID theory, and the area of motivation promises to be of particular significance in the near future. Very recent literature⁸ on formulation of Total Quality Management through the development of training emphasizes that many employers in the 1990s realize that it is not sufficient to train employees to perform effectively through technology or improved management skills, or professional development. Training improves an employee's motivation, morale, values and attitudes. Workers need to know how to learn, solve problems, develop creative solutions, and stretch themselves to operate and think outside of existing paradigms. They need strategies for creating change within their organizations. Comprehensive training must place equal emphasis on the affective as well as the cognitive or behavioral domains of learning.

Keller⁹ 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 must be met to have a motivated learner:

- A for attention
- R for relevance
- C for confidence
- S for satisfaction

Attention involves grabbing the learner's interest at the beginning of instruction and maintaining that interest throughout the lesson and course. Relevance is the personal significance and value to the learner of mastering the learning objectives. Confidence relates to the learner's expectancy of success. Satisfaction comes from achieving performance goals.

3. Metaskills. The metaskill concept¹⁰ 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.

4. Enterprise. Gagné and Merrill¹¹ 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 an *enterprise*. An enterprise is a purposive 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 designer is to identify the goal of a targeted enterprise along with its component skills and knowledge, and then to design instruction that enables the student to acquire the capability of achieving this integrated outcome.

5. Emphasis on learner control and interactive technologies. Clearly limited in traditional instructor-led classroom training, the idea of learning control is now being exploited to allow adults to manage their own learning with interactive training technologies. The learner can control what objectives to work on, how to sequence the lesson, what the pace of instruction should be, how many and what kind of examples to see, how much practice to get,

what terms to define, and what concepts to illustrate. The intent in learner-controlled instruction is to improve the instruction by accommodating individual differences and allowing the learners to play a more active role in their learning¹².

6. Changing role of the instructional designer. The 1970s saw the emergence of instructional design professionals who were systematically trained in graduate schools around the country. Organization analysis, customer analysis, planning, change management, and other systems-oriented skills will be important competencies for the ISD professional in the 1990s.¹³⁻¹⁶ In 1980, Briggs assessed training programs for instructional designers. His observation holds true today: "There is a danger, however, that we may train them too narrowly. For their own good and the good of the field, we must seek a reasonable balance of theory, research, history, practice, respect for other disciplines, and human relations."¹⁶

7. Tennyson's fourth generation ID model. Tennyson's fourth generation ID model resembles a schematic structure and has a cognitive learning paradigm foundation for the various procedures of instructional development. By employing technological developments from the field of artificial intelligence, the fourth generation model handles the complexity of ID with a diagnostic/prescriptive system.

Tennyson reports that the goal of the 1990s is to extend the fourth generation model by focusing on the situational evaluation component of producing instruction. Emphasis is on specific needs within the constraints of the system. Reports of the divergence of ID models suggest that successful implementation of the fourth generation ID model requires closer attention to the realities of organizational systems.

Table 1 summarizes the four generations of ID (from Tennyson¹⁷).

Table 1.

Four Generations of ISD

<ul style="list-style-type: none">• First generation. The main focus of the first generation model was the implementation of the behavioral paradigm of learning. The system had four components: objectives, pretest, instruction, and posttest. The system was completed with an evaluation loop for purposes of revision.
<ul style="list-style-type: none">• Second generation. 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 paradigm remained, but was of secondary importance to the focus of the system: developing instruction.
<ul style="list-style-type: none">• Third generation. In practice, the ISD process was too linear and did not account for situational differences among applications. To account for 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 iterative process that could be entered at any point depending on the current state of the author's situation. Although learning theory was still considered behavioral, cognitive theory was beginning to have some impact such as in the use of simulations for acquisition of cognitive skills in decision making.
<ul style="list-style-type: none">• Fourth generation. Advancements in cognitive psychology 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 diagnostic/prescriptive system.

Recommendations

The following recommendations were suggested to the Air Force based on the results of the Baseline Analysis.

1. Continue to use the Air Force ISD systems approach to training and improve the present five-step model.

2. Acknowledge that ISD is a total quality process.

3. Develop separate guidelines for the major Air Force instructional applications that address the unique training and education requirements of each, and that are designed and written in a style suitable to the users' needs. Unique performance requirements include:

- Acquisition - Interrelate engineering and training information
- Education - Academic orientation

- Technical Training - Diagnostic problem solving

- Aircrew Training - Integrate psychomotor, procedural, and cognitive skills in real time

4. Establish a clearinghouse to follow research trends, results of training technology transition, and the use of ISD support tools. This clearinghouse would service Air Force training developers with information on promising developments. The clearinghouse should include a publication of short descriptions of methods under the title "what works."

5. Establish a consulting operation with a DSN number and ISD experts to answer questions and provide referrals to Air Force training developers who need assistance.

Summary

The revised AFM 50-2 will describe the application of Instructional System Development (ISD) principles and processes for

the development and delivery of education and training programs in the Air Force. It will present the instructional design model for developing and implementing instructional systems, and the theory that supports the model. It will describe current training technologies and their uses, and automated tools for streamlining the ISD process. It will tie learning theory and philosophy to the process of developing instruction. It will include methodologies for continual management of the ISD process. The revised regulation will include many examples, graphics, and illustrations. Content will be structured to facilitate ease of use. AFM 50-2 will be used by all personnel who plan, develop, approve, administer, conduct, evaluate, or manage Air Force instruction.

Applications of the revised process will be described in ten volumes of AFP 50-68. Four of the volumes will include how-to's for developing training for aircrew, acquisition, technical training and education. The other six volumes will include information on what works—automated tools, instructional systems development applied to work center on-the-job training, computer-based training selection, and interactive courseware development and management. An executive summary of AFP 50-68 will be developed for the commander or manager of ISD. The executive summary will briefly summarize the overall process and acquaint the reader with the essence of the ISD process, and will explain what the commander or manager can do to aid the process.

The revised AFP 50-68 volumes will be structured to meet the needs of the application environments with illustrations, examples and samples, checklists, and summaries.

CONCLUSIONS

The results from the project leading to the update of the Air Force ISD process indicate that the top-level functional requirements for a systematic instructional development process for Air Force education and training have not changed with the advances in technology and instructional theory. In order to meet Air Force needs for skilled, educated personnel, the instruction provided still needs to be based on analyses of the performance requirements of

Air Force missions/duties/jobs/tasks and a determination of the necessary qualifications of the performers. The instruction must be designed for effective and efficient transmission of skills, knowledge, and attitudes to the student. Development guidelines must cover the actual preparation of the instruction. Implementation must ensure that students receive the instruction. Evaluation must monitor the efficiency and effectiveness of the output over the entire ISD process and throughout the life cycle of the program. ISD must be recognized as a total quality process.

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ACRONYMS

AFM	-	Air Force Manual
AFP	-	Air Force Pamphlet
AFR	-	Air Force Regulation
ATC	-	Air Training Command
CGI	-	Computer Generated Imagery
DVI	-	Digital Video Interactive
ID	-	Instructional Development
ISD	-	Instructional Systems Development
ITS	-	Intelligent Tutoring System
IVD	-	Interactive Video Disc
PSS	-	Performance Support System
SME	-	Subject Matter Expert
TNA	-	Training Needs Analysis