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A SURVEY AND ANNOTATED BIBLIOGRAPHY OF AUTHORING AIDS FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT

ROBERT S. LOGAN

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20. ABSTRACT (*Continue on reverse side if necessary and identify by block number*)

The objectives of this study were: (1) to examine the literature to identify authoring aids for developing instructional materials and to identify information clearing houses for existing instructional materials; and (2) to develop a generalized, computer-based model of a self-paced instructional system that can be used to determine expected timesavings and costs of self-pacing as compared to conventional instruction. The purpose of Part 1, reported in Volume 1, was to examine the ISD concept as it relates to the authoring process and to identify

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20. ABSTRACT (continued)

and analyze tools and procedures which facilitate the ISD process. Findings of the study are: (a) more applied but unevaluated documents are associated with the civilian environments; (b) relatively equal numbers of applied and evaluated documents exist in both the civilian and military environments; (c) a greater number of authoring aids (tools, procedures, and methodologies) tend to be produced by the civilian environment; and (d) more procedures are available than either tools or methodologies. Approximately sixty authoring tools and procedures are arranged by ISD phase and step in an extensive, annotated bibliography. The ISD model used in this study was the Interservice Procedures for Instructional Systems Development (IPISD) Model. The results of Part 2, a computer-based model of self-paced instruction, are reported in Volume ~~II~~ 2.

PREFACE

This study was conducted under Contract MDA-903-76-C-0086 with the Department of Defense, Advanced Research Projects Agency, Cybernetics Technology Office. The program manager was Dr. Harold F. O'Neil, Jr. The principal investigator was Dr. Robert A. Vecchiotti, McDonnell Douglas Astronautics Company - East.

The author wishes to express his appreciation to the many individuals who contributed to this program. He is indebted to the following personnel of the McDonnell Douglas Corporation: Mr. William H. Stobie, and Dr. Wilson A. Judd, for their contributions.

SUMMARY

PROBLEM

The authoring process and authoring aids which facilitate development of instructional materials has recently emerged as an area of concern in the field of Instructional Systems Development (ISD). This is due to a growing realization that instructional materials development is a major cost factor in developing instructional systems. The purpose of this study was to examine the ISD concept as it relates to the authoring process, and to survey, identify, and analyze authoring tools and procedures which aid the ISD process.

APPROACH

Both American and Canadian sources from 1965 to the present were searched in the following areas: (a) developmental studies of on- and off-line instructional systems; (b) evaluation and comparison of developmental methodologies for instructional materials; (c) design and installation of instructional materials; (d) "user studies" involving effectiveness of a medium and comparative effectiveness of alternative media; (e) information processing behavior of students; (f) analyses of training tasks and job requirements; and (g) revision procedures for instructional materials and systems, both on- and off-line.

Computerized searches were made of data banks in the Educational Resources Information Center (ERIC), the National Technical Information Service (NTIS), and the libraries of McDonnell Douglas Corporation. Manual searches were made of indexes, abstracting services, and bibliographies at several local universities. A Selective Dissemination of Information (SDI) service was used along with personal communication with over seventy individuals and associations prominent in the field of instructional technology.

In total, over five thousand reports were read in full-text or abstract form, and approximately fourteen hundred practical, development-oriented documents were selected for inclusion in a computer-based information storage and retrieval system developed for the study. The documents were categorized by: (a) author; (b) institution; (c) title; (d) publication date; (e) applicable ISD step; (f) type of media; (g) type of application; (h) type of evaluation; and (i) type of environment.

RESULTS

Findings of the study include: (a) more applied but unevaluated documents are associated with the civilian environment; (b) relatively equal numbers of applied and evaluated documents exist in both civilian and military environments; (c) a greater total number of authoring aids (tools, procedures, and methodologies) tends to be produced by the civilian environment; and (d) more procedures are available than either tools or methodologies. Six significant aspects of the authoring process were also identified.

In addition, an extensive annotated bibliography of approximately sixty authoring tools and procedures was produced. Based on the Inter-service Procedures for Instructional Systems Development (IPISD) Model, the annotated bibliography groups documents by ISD phase and step, and provides citations, abstracts, and analytic information.

CONCLUSIONS

Recommendations are made for creating tools for ISD steps which have none, for refining procedures into tools for ISD steps where tools are more useful, and for developing methodologies for ISD steps where the state-of-the-art is in advance of current tools and procedures.

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1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 Instructional System Development (ISD) - Instructional Systems Development is an adaptation of the systems approach, a sequence of steps by which complex systems are broken down into smaller, more manageable problem areas that can then be analyzed for use in analysis, design, development, implementation, and control of an instructional system. The systems approach has been adapted to instruction in order to define such things as job activities, testing, sequencing instruction, and evaluating instructional systems in terms of both learners and organizational as well as physical components.

The Interservice Procedures for Instructional Systems Development (IPISD) provided the ISD model used in this study (TRADOC, 1975). The IPISD model consists of five phases and nineteen steps. Each step has both an input and output. The phases and steps in the IPISD model are not necessarily done on a once-and-once-only basis but rather provide for a continuing, iterative process of system development.

1.1.2 Authoring Tools and Procedures - Authoring tools and procedures were identified primarily to supply information for decision-making purposes, not to assess their merit. Since the authoring process is an ISD activity, the terms "authoring tools" and "authoring procedures" must be defined in relation to an ISD methodology. An ISD methodology is a general systems approach with multiple components which, given a certain set of constraints, is used to produce an instructional system. An authoring procedure is a step or series of steps which operationally defines one component of the methodology. An authoring tool is an evaluated, self-contained product in a suitable format which is applied to the analysis, design, development, implementation, or control of one or more steps of a procedure.

The authoring process is conceived as a series of separate, though related, activities:

- Information Gathering - the acquisition of supportive information from task analysis, existing training materials, instructors, and incoming students

- Information Conversion - the development of that information into properly sequenced packages with format and structure that enable learning to occur effectively and efficiently

- Information Revision - the revision, as necessary, of the information packages during formative and summative evaluation based on feedback from students, instructors, and administrators

- Information Publication - the publication of those packages in a construction which meets the requirements of the learner and the training environment, e.g., a lesson intended for homework may require a different construction than one intended for in-class presentation.

1.2 PURPOSE AND SCOPE

The purpose of this literature search was to identify and analyze authoring tools and procedures for developing instructional materials and to identify information clearing houses and data banks for existing instructional materials. Both American and Canadian sources from 1965 to the present concerning ISD were searched in the following areas:

- Developmental studies of on- and off-line instructional systems
- Evaluation and comparison of development methodologies for instructional materials
- Design and installation of instructional materials
- "User studies" involving effectiveness of a medium and comparative effectiveness of alternative media
- Information processing behavior of students
- Analyses of training tasks and job requirements
- Revision procedures for instructional materials and systems, both on- and off-line.

1.3 APPROACH

Computerized searches were made of data banks in the Educational Resources Information Center (ERIC), the National Technical Information Service (NTIS), the Defense Documentation Center (DDC), and the libraries of the McDonnell Douglas Corporation. Manual searches were made of indexes, abstracting services, and bibliographies at several area universities. A Selective Dissemination of Information (SDI) service was used along with personal communication with over seventy individuals and associations prominent in the field of instructional technology. In total, over five thousand reports were read in full-text or abstract form, and approximately fourteen hundred practical, development-oriented items were selected for inclusion in the computer-based information storage and retrieval system developed for the present study. Appendix A contains the codes whereby reports and other documents were described and entered in the data base.

1.4 RESULTS

Six significant aspects of the authoring process were identified: (1) size and configuration of authoring teams; (2) knowledge and proficiency of course authors; (3) existing course structures, lesson materials, and course control documents; (4) type of media and type of instruction; (5) type and extent of evaluation and revision; and (6) text-handling and materials reproduction systems. Since the only subjective aspect of the authoring process is knowledge and proficiency of course authors, identification and distribution of authoring tools and procedures would allow course authors to develop materials from a baseline of equal knowledge. Thus, the other objective aspects of the authoring process could be categorized and manipulated in a "laboratory" (i.e., controlled) setting, and it should be possible to model the authoring process variables and to formulate decision rules for managing the materials development cycle with an optimum mix of personnel and organization.

It was found that at least one authoring aid (tool, procedure, or methodology) was available for every ISD activity. The types of authoring aids, however, are unevenly distributed among ISD activities. Relatively equal numbers of authoring aids are produced by civilian and military environments. Finally, it was found that more procedures than either tools or methodologies are available to analyze, design, develop, implement, and control the ISD process.

An annotated bibliography of authoring aids for developing course materials using the ISD approach was prepared as Appendix B. It includes an analysis of documentation related to ISD and the identification of information clearinghouses for existing instructional materials. The bibliography is in a format ready for use.

2.0 APPROACH

2.1 PROBLEMS

Although the national investment in computer-based educational training to date is some $2 billion, the extensive use of computer-related instructional technology is yet to be realized. Anastasio and Morgan (1972), the Carnegie Commission (1972), Demerath and Daniels (1973), Levien (1972), and Wilcox (cited in Hunter, Kastner, Rubin and Seidel, 1975) attempted to determine why computer-related technology has not been widely adopted for instruction. Hunter et al. (1975) summarized their findings as follows:

a. Materials - High-quality materials and materials using different instructional techniques or strategies or addressing alternative subjects are not readily available.

b. Overlooked Materials - When new instructional materials are developed, earlier versions of the work are automatically considered obsolete. Additionally, instructional materials in actual use are often overlooked.

c. Relationship of Materials to Curricula - Lack of standardized curricula prevents a building-block approach to and comparative evaluation of different sets of instructional materials.

d. Documentation - Clear, extensive documentation of innovative projects is seldom available.

e. Attitudes - Faculty members fear role reduction and dehumanization through use of instructional technology. Administrators feel that computers, media carrels, and other instructional hardware are luxuries which should be treated separately from the normal cost of school operations and therefore, if necessary, can be dropped from the budget with little harm to instruction or learning.

f. Skilled Personnel - Technically competent specialists who can provide training in the uses and techniques of instructional technology are in short supply. A corollary is that broad formal training in instructional technology is not generally available.

g. Proof of Effectiveness - There are few examples of proven, cost-effective computer-based instructional systems. Coupled with the scarcity of evaluative measures applicable to computer-based instruction, there is no definitive evidence that computers improve the quality of learning.

h. Cost - The high capital investment required to purchase or develop sophisticated instructional technology is a deterrent to use, especially in public schools.

Of these eight problems, four are concerned with instructional materials, the developmental use of which remains typical of the "cottage industry" approach criticized by Molnar:

> The large amount of uncoordinated research activities and the lack of preplanned linkages between research and practice has led to the existence of an expensive cottage industry in educational technology which tends to retool every academic year. Researchers and educators frequently demonstrate a strong resistance to the use of someone else's innovation. It has been said that if there was a Nobel prize for educational research, we would have to nominate an entire generation of researchers for their co-discovery of the wheel. (Molnar, 1971, p.7)

At least three factors have forced educational researchers to develop and apply their own unique methods to such things as job analysis, test generation, construction of behavioral objectives, and implementation, evaluation, and revision of instruction. First, many educators feel very strongly that instruction should have a local, indigenous quality (Demerath & Daniels, 1973). Second, instructional development efforts are usually driven by a "raw empiricism" so that

> Instructional materials are prepared on the basis of intuition, folklore, or experience and administered to members of the target population. If the students pass the test, the product is considered appropriate; if not,

> the materials are revised and tried again. This tryout-revision cycle is repeated until the product works or the developers run out of resources or time. (Merrill and Boutwell, 1973, p.96)

Third, there is a lack of information on available authoring tools, procedures, and clearinghouses for existing course materials (Logan, 1976).

This study attempted to identify and evaluate authoring aids and information clearinghouses that facilitate analyzing, designing, developing, implementing, and controlling the ISD process. In addition, four research hypotheses were tested:

- The civilian environment has a greater number of applied, unevaluated documents than the military environment
- The civilian environment has a greater number of applied, evaluated documents than the military environment
- There are unequal numbers of documents within the three authoring and categories (tools, procedures, and methodologies)
- The civilian environment has a greater number of authoring aids than the military environment.

Authoring tools and procedures were identified primarily to supply information for decision-making purposes, not to assess their merit. The first reason for taking this approach was that selection criteria did not include evaluation of the relative worth of a particular tool or procedure. Second, data resulting from evaluation of a particular tool or procedure were either unavailable or not clearly identified. And third, the study emphasized breadth, not depth, and, therefore, many tools and procedures in as many ISD activities as possible were identified -- regardless of their relative worth.

The terms "authoring tools" and "authoring procedures" are defined in relation to an ISD methodology. Accordingly, three definitions are given. An ISD methodology is a general systems approach with multiple components which, given a certain set of constraints, is used to produce an instructional system. An authoring procedure is a step or series of steps which operationally defines one component of the methodology. An authoring tool is an evaluated, self-contained product in a suitable format which is applied to the analysis, design, development, implementation, or control of one or more steps of a procedure. Authoring tools and procedures, of course, are used in a materials development cycle called the "authoring process."

The Interservice Procedures for Instructional Systems Development (IPISD) provided the model for ISD used in this study (TRADOC, 1975). The complete IPISD model is presented in Figure 1.

2.2 METHOD

2.2.1 Search Strategy - Both American and Canadian literature from 1965 to the present were searched for references pertaining to instructional systems in the following areas:

- Developmental studies of on- and off-line instructional systems
- Evaluation and comparison of instructional materials development methodologies
- Design and installation of instructional materials
- "User studies" involving effectiveness of a medium and comparative effectiveness of alternative media
- Information processing behavior of students
- Analysis of training tasks and job requirements
- Procedures for revising instructional materials and systems, both on-line and off-line.

Key words used in the literature search were:

- Adaptive Models
- Adjunct Questions
- Advanced Organizers
- Audio-visual Materials
- Auto-Instructional Aids
- Embedded Questions
- Formative Evaluation
- Instructional Technology
- Job Analysis
- Performance Checks

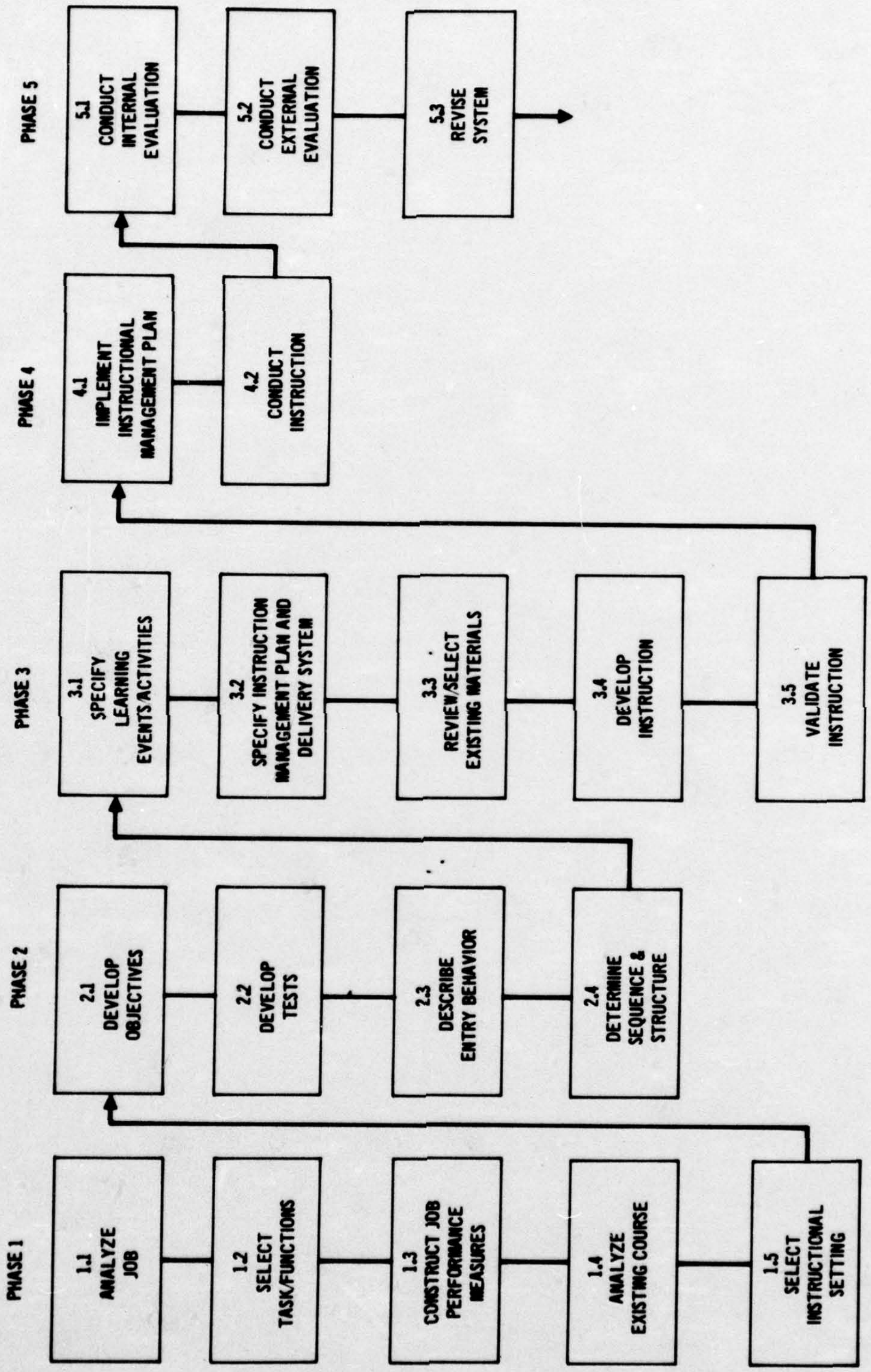

FIGURE 1 INTERSERVICE PROCEDURES FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT MODEL

- Behavioral Objectives
- Branching
- Computer-Assisted Instruction
- Computer-Managed Instruction
- Criterion-Referenced Testing
- Delayed Reviews
- Educational Technology
- Programmed Instruction
- Programmed Texts
- Remediation
- Reviews
- Scopes
- Summative Evaluation
- Task Analysis
- Testing

Computerized searches were made of data banks in the Educational Resources Information Center (ERIC), the National Technical Information Service (NTIS), the Defense Documentation Center (DDC), and the libraries of the McDonnell Douglas Corporation. Manual searches were made of indexes, abstracting services, and bibliographies at several local universities. In addition, a Selective Dissemination of Information (SDI) service was used along with personal communication with over seventy individuals and associations prominent in the field of instructional technology. Over 5,000 reports were read in full text or abstract form, and approximately 1,400 practical, development-oriented items were selected for inclusion in the computerized data base developed for the study. Approximately sixty documents were selected from the data base for inclusion in the annotated bibliography, Appendix B.

2.2.2 Information Storage and Retrieval System - A computer-based information storage and retrieval system was established for the study. Hardware consisted of a teletype terminal connected via a communications link to a Xerox Sigma 9 computer. Printouts and formal reports were processed at a commercial computer-service office. Software consisted of two, high-level English language "packaged" programs: EDIT and CONFIRM. EDIT permitted easy data entry and allowed document titles to be accessed by keyword. CONFIRM was used for complex retrieval operations, statistical counts, and report generation.

2.2.3 Selection Criteria - Authoring aids and information clearinghouses were classified as either tools, procedures, or methodologies used to analyze, design, develop, implement, and control ISD activities. Research reports and brochures from clearinghouses were selected for inclusion in the data base according to three criteria. First, selected documents had to fit the definition of a tool, procedure, or methodology. Second, since the end result of the study was to be the identification and analysis of authoring aids usable in a military training environment, selected documents had to report work developed in a military setting, or in the civilian sector and be suitable for adaptation to operational military training. Third, work discussed in a report had to be applied and evaluated or, if a procedure or methodology, at least applied though unevaluated. Authoring methodologies were included in the study only for comparison with tools and procedures. Only one methodology was included in the annotated bibliography

2.2.4 Procedure for Bibliographic Compilation - The procedure adopted for compiling the annotated bibliography consisted of the following four steps:

2.2.4.1 Definition of Item Record - An item record was defined to include the characteristics by which research items could be compared. Data elements of the item record included: (a) personal or corporate author(s); (b) institutional affiliation; (c) publication title; (d) publication date; (e) media; (f) type of application; (g) type of evaluation; (h) type of environment (military or civilian); and (i) type of ISD activity, according to the IPISD model. These data were entered by codes which allowed quicker, more accurate data entry and reduced item record length. For example, the institution, "University of Texas at Austin," was coded "B2480."

2.2.4.2 Creation of Data Base - For documents read initially in full-text form, a complete set of data was input in one operation. Data entry for documents in abstract form required two steps. The symbol "ORD" (which indicated that an item had been ordered) in the institution field and author and title were input to establish the document's item record. After the document had been received, it was analyzed to obtain the remaining data required, and the "ORD" code was replaced by the institutional affiliation code. Using "ORD" in the institution field automatically built an on-line order file which allowed the determination of the number of documents on order versus those on hand, and allowed the identification of excessive lags between orders and receipts as a basis for follow-up action. A special-purpose program, called OLD TABLE, produced a daily total of item records in each ISD activity and phase, and in the whole data base. Systematic use of this capability made it possible to "map" the data base and identify those ISD activities or phases requiring additional research.

2.2.4.3 <u>Analysis</u> - The data base was analyzed in terms of authoring aids (tools, procedures, and methodologies) for developing instructional materials. Printout listings were obtained of research reports describing authoring aids that had been applied and evaluated in military or civilian environments. In some cases, an additional printout identifying unevaluated applications was also produced. Appropriate authoring aids were then selected from these listings based on three guidelines: large pools of applied and evaluated reports allowed some early or obsolete work to be rejected; relative cost and availability made some authoring aids more suitable than others; and approaches and concepts that had been widely used but not evaluated were occasionally chosen over narrower, more parochial work that had been evaluated.

2.2.4.4 <u>Cataloguing</u> - The selected reports were categorized by the following considerations:

a. Coded as a tool, procedure, or methodology,

b. Coded by type of medium, application, evaluation, environment, and ISD activity.

3.0 RESULTS

Three constraints limit the interpretation of the results. First, due to limited resources, classification and categorization of the reports surveyed were not subject to inter-judge reliability tests. Second, the population of reports in the data base was created by applying operational definitions of authoring tools, procedures, and methodologies, and the classification scheme to characterize the reports was derived by the author of this study. Third, though it may be suggested that documentation patterns for the total ISD R&D effort and this study may be similar (particularly for that portion of the effort applying to authoring tools and procedures), no specific evidence was systematically obtained to support this.

3.1 RESEARCH HYPOTHESES

To test the four hypotheses posed in Section 2.1, a total of 1424 documents were analyzed. Two pools of documents relative to ISD authoring aids were collected: (a) applied and evaluated; and (b) applied but not evaluated. These documents were further classified by environment, either military or civilian, and by type of authoring aid. The numbers of documents in each classification are presented in Tables 1, 2, and 3. Chi square was used to test each research hypothesis.

3.1.1 First Hypothesis - "The civilian environment has a greater number of applied, unevaluated documents than the military environment." The test of this hypothesis was statistically significant ($X^2 = 172.13$, df = 1, $p < .01$), indicating that more applied, unevaluated documents were associated with the civilian environment. (See Table 1)

3.1.2 Second Hypothesis - "The civilian environment has a greater number of applied, evaluated documents than the military environment." The test of this hypothesis was not statistically significant ($X^2 = 1.73$, df = 1, $p > .01$). This suggests that relatively equal numbers of applied, evaluated documents exist in each environment. (See Table 1)

3.1.3 Third Hypothesis - "There are unequal numbers of documents within the three authoring aid categories." The test of this hypothesis was statistically significant ($X^2 = 145.72$, df = 2, $p < .01$). Based on the raw data, it is apparent that more procedures were available than either tools or methodologies. (See Table 2)

3.1.4 Fourth Hypothesis - "The civilian environment has a greater number of authoring aids than the military environment." The test of this hypothesis only approached statistical significance ($X^2 = 6.26$, df = 1, $.05 > p > .01$. Inspection of the raw data, however, suggests a tendency for the civilian environment to produce a greater number of authoring aids. (See Table 3)

3.2 AVAILABILITY OF AUTHORING AIDS

3.2.1 ISD Activities Lacking An Authoring Aid - The raw data were analyzed to determine the ISD activities for which there were no tools. Tools are considered to be the most desirable authoring aid because they are readily transportable and require the least adaptation or restructuring by potential users. No tools were found for the following ISD activities:

- o Select Tasks/Functions
- o Construct Job Performance Measures
- o Select Instructional Settings
- o Specify Learning Events/Activities
- o Implement Instructional Management Plan
- o Conduct External Evaluation.

No authoring procedures were found for the ISD activities:

- o Select Instructional Setting
- o Specify Learning Events/Activities.

3.2.2 Availability of Authoring Aids by ISD Activity - The steps of the IPISD model are specified in the fold-out in Appendix B. Each step has an input and an output. For example, one phase in the IPISD model is "Analyze." One step in that phase is "Analyze Job." One input to that step is a needs analysis imposed by installation of a new system, weapon, or equipment to a job or training situation. An output of that step is a validated list of job tasks concerning that new component. Although the output of one step may provide an input to the following step, the steps of the IPISD model are not necessarily linear or performed

STATUS	ENVIRONMENT	
	Military	Civilian
Unevaluated	57	308
Evaluated	297	331
Total	354	639

TABLE 1: NUMBER OF APPLIED DOCUMENTS SURVEYED

CATEGORY	NUMBER
Tools	67
Procedures	260
Methodologies	104

TABLE 2: NUMBER OF AUTHORING AIDS BY CATEGORY

ENVIRONMENT	NUMBER
Military	189
Civilian	242

TABLE 3: NUMBERS OF AUTHORING AIDS BY ENVIRONMENT

on a once-and-once-only basis. The static model only provides a useful method for working on or talking about the dynamic process called ISD. Since the authoring process is composed of four activities (information gathering, conversion, revision, and publication), authoring tools and procedures were drawn from ISD activities which analyzed, designed, developed, implemented, and controlled those activities. Available authoring tools and procedures that follow have been grouped according to ISD activities. Numbering of ISD activities is in accord with the fold-out cited above.

I.1 Analyze Job. An extensive Air Force occupational analysis program was begun in the 1960s that culminated in development of a very effective tool for computer-based job analysis. The CODAP system (for Comprehensive Occupational Data Analysis Programs) provides individual or group descriptions that specify the percent time spent on each task in a job, describes an actual job at different task levels such as apprentice or officer, derives individual and group job differences, and identifies specific types of jobs as they exist or should exist within a general specialty. Detailed descriptions of procedures, programming notes, and applications are provided by Archer (1966), Morsch and Archer (1967), Christal (1972), Weismuller, Barton, and Rogers (1974a, 1974b), Stacey, Weismuller, Barton and Rogers (1974), Mayo, Nance, and Shiegekawa (1974), Stacey and Hazel (1974), and Christal and Weismuller (1975).

Foley (1975) describes the use of several standardized worksheets for manual job analysis. The Task Inventory Exchange (TIE, 1975) collects occupational and task inventories and, to date, has published three task inventory directories.

I.2 Select Tasks/Functions. McKnight and Adams (1970) report that a panel of experts selected critical behaviors for driver education training from a possible pool of 1000 relevant behaviors. Powers (1971) added a phrase to the standard task statement which aided the selection of tasks for teaching physician's assistants. The phrase, "in order to," was used to indicate an intended outcome of a task, and, thereby, group students according to the required levels of competence. Cline (1973) used a multivariate statistical model to predetermine preferable aircraft assignments for Air Force pilots.

I.3 Construct Job Performance Measures. Gael (1974) describes the selection and design of instruments used to measure job aptitudes and job proficiencies for five Bell System jobs. The instruments employed both knowledge and performance measures as well as simulation.

I.4 Analyze Existing Course. Lewis, Willow, Brock, Lonigro, Eschenbrenner, and Hanson (1974) analyzed an Air Force course in Precision Measuring Equipment (PME) in order to convert it from conventional instruction to self-paced, individualized instruction. The analysis was done in four phases: (a) select course segments for individualization; (b) analyze course and job documentation; (c) choose the target population; and (d) examine the training environment. Formal analysis of an existing Air Force course appears in the Specialty Training Standard (STS), Plan of Instruction (POI), and the Course Chart for Inventory Management Specialist (645X0) and Materiel Facilities Specialist (647X0). The documents, which provide codes for various levels of performance required at end of training and divide instruction into sequential segments, can be used to distinguish between required levels of performance (both cognitive and psychomotor) and to sequence instruction accordingly.

II.1 Develop Objectives. A programmed workbook intended as an introduction to behavioral objectives and to a Navy handbook which teaches the writing of behavioral objectives is divided into three modules (Bureau of Naval Personnel, 1968). Module 1 discusses the general concept of behavioral objectives, Module 2 introduces the Navy's Handbook for Writing Learning Objectives, and Module 3 contains an exercise kit for using the handbook and includes testing instruments. The Behavioral Objectives Training Package (ESCOE, 1971) serves as a user's guide to writing and implementing behavioral objectives and provides an overview of the operation of the Educational Service Center for Occupational Education which contains a clearinghouse for behavioral objectives information. Dillman (1971) provides an excellent discussion of writing effective behavioral objectives. The discussion is presented in programmed-text format with self-reviews at the end of each section. Another programmed text by Rose, Balasek, Kelleher, Lutz and Nelken (1972a, 1972b) is designed to help teachers learn how to write performance objectives. An instructor's manual accompanying the programmed text provides management procedures for inservice training. Barton (1973) presents a booklet that teaches how to recognize and write technically correct performance objectives. Validated over a two-year period, the booklet is in programmed-text format and contains numerous self-checks. A compact, reuseable, multi-color Reference Wall Chart (INSGROUP, 1975) identifies the structure of measurable objectives, discusses three applications of measurable objectives, presents several taxonomies of learning which are used to analyze objectives, and contains a brief section of annotations for the taxonomies. Also on the chart are three addresses where collections of objectives may be obtained.

II.2 Develop Tests. Brown, Brooks, Cocks, and Kersch (1972) report a teacher workshop for defining, developing, and evaluating test items. The Center for the Study of Evaluation, in conjunction with Research for Better Schools Inc., analyzed and evaluated approximately 2600 tests for measuring higher-order cognitive, affective, and interpersonal skills (Center for the Study of Evaluation, 1972). A practical guide for preparing and using criterion-referenced tests in classroom instruction was developed by Gronlund (1973). Checklists for evaluating criterion-referenced tests and procedures for item analysis are also given. Swezey and Pearlstein (1974) developed a manual that thoroughly covers the design, use and evaluation of criterion-referenced tests. Four steps are discussed: (a) develop adequate behavioral objectives; (b) develop a test plan and examine practical constraints; (c) build an item pool; and (d) select the final test items for instruction. Stevens and O'Neil (1976a) discuss procedures for generating test items by item transformation, i.e., by varying sentences according to their syntactic structure. The test items can be used in multiple-choice or constructed response tests. Stevens and O'Neil (1976b, 1976c) suggest procedures for developing and evaluating tests items for generalized multiple-choice tests and for comprehension-, application-, and analysis-level tests.

II.3 Describe Entry Behavior. Bierbaum and Planisek (1969) developed an index and procedure for determining the probable academic success of students seeking readmission after academic dismissal. An interest inventory designed to measure the vocational interests of enlisted men entering the Air Force was developed by Ecternacht, Reilly, and McCaffrey (1973). Called VOICE (for Vocational and Occupational Interest Choice Examination), the instrument was to be used in the development of an interest inventory for the Guaranteed Enlistment Program. Mockovak (1974) assessed the literacy requirements of Air Force career ladders in order to determine the reading demands placed upon trainees and job incumbents by instructional materials. Vitola, Mullins, and Brokaw (1973) found that removal of the draft as a motivator for enlistment affected the Air Force in three ways: (a) decreased accessions completing education beyond the high school level; (b) the discharge rate for first-term airmen after four years was 79 percent; and (c) the average difference on mean scores for AQE aptitude composites between Blacks and Non-blacks decreased.

II.4 Determine Sequence and Structure. Dansereau, Evans, Wright, Long, and Actkinson (1974) and Dansereau, Evans, Actkinson, and Long (1974) developed and evaluated the use of multidimensional scaling (called INSCAL) as a procedure for describing the information structure of Air Force instructional materials and generating effective instructional sequences. A checklist for determining students' positions along a curriculum scale was developed (Bucks County Public Schools, 1970) which may be useful as a manual backup to computer-based learning systems for assessing student performance and determining proper learning sequences.

III.3 Review/Select Existing Materials. The State University College at Buffalo (1972) has published a user's manual which describes computer-based resource units in various subject areas and gives directions for obtaining them. Up to five units may be requested, and individual difference variables may be indicated on the request form. An annotated listing of curriculum materials which can be obtained from state education agencies is available from the U.S. Government Printing Office (1973). Various guides cover agriculture, distributive education, health occupations, home economics, technical education, and trade and industrial occupations. The National Network for Curriculum Coordination in Vocational-Technical Education develops, publishes, and distributes curriculum guides and various curriculum support services from six regional curriculum management centers. Curriculum guides are published in the form of brochures, booklets, and microfiche. The Special Reserve Components Educational Video Tape Catalog contains a listing of educational video tape programs selected for Army unit training. Though the materials are intended for Reserve component use, they may be used by other Services, Army schools, and training centers. The video tapes may be borrowed from various Training Aids Support Offices (TASOs) or can be copied on user-supplied cassette tapes. The Directorate for Audio-Visual Activities (DAVA, 1975) presents a detailed user's guide that provides the required information for participating in the Defense Audio-Visual Information Network and for utilizing the network's Audio-Visual Products Data Base. Appendices give input data guidelines for data coding and other computer-related activities. The Department of the Army (1974, 1975) provides two catalogs of Army motion picture films and audio-visual aids. The first catalog gives annotated listings of motion picture films, slides, audio-visual kits, recordings, and tape recordings intended for use by instructors, information officers, and defense contractors. The second catalog provides annotations of motion picture films for non-profit use by Government agencies, civic, religious, fraternal and educational organizations, schools, colleges, and universities. Materials from the first catalog are oriented to Army career fields, while those in the second catalog are on more general subjects such as education, sports, and health.

III.4 Develop Instruction. Best (1971) discusses various procedures and materials which minimize expense and time in the preparation and production of computer-controlled films. For local production shops, this report provides much of the information required for processing filmstrips into slides for either computer-controlled, rear-screen projectors or for transparencies. Thiagarajan (1971) offers a programmed text for teaching the craft of programming. Five stages of the programming process are discussed, and a confirmation section at the conclusion of the book contains correct answers to the questions embedded in the text. How to Design and Produce Individualized Instruction Programs (Minnesota Mining and Manufacturing Co., 1972) is a pragmatic workbook intended to be used for developing audio-visual programs for the 3M Sound-On-Slide System. In another user's manual, guidelines for writing computer-based resource units are presented and organized into two operations (State University of New York, 1972). The first operation involves formulating behavioral objectives, instructional content, activities, materials, and measuring devices. The second operation involves coding these five component items for future computer retrieval. Deterline and Lenn (1972) developed a self-study course that teaches a set of skills called CISTRAIN (for Coordinated Instructional System for Training) for designing, developing, and implementing instruction. The two-volume set of instruction includes a Lesson Book and a Study Resource Materials Book. Siegel, Lambert, and Burkett (1974) present a concise, entertaining synthesis of readability research and illustrate findings from that field that are useful to course writers. Nesbit and O'Neil (1976) provide guidelines for editing programmed texts. The report contains a glossary of terms, explanations of three models for programmed texts, and guidelines for checking the lesson content and author's style.

III.5 Validate Instruction. The use of computer-based test analyses and course evaluation questionnaires is reported by Aleamoni (1970). The system provides for: (a) test scores; (b) analysis of scores for groups or individuals; (c) test item analysis printouts; (d) item analysis data; and (e) analysis of course evaluation questionnaires, attitude scales, and other measures which have no known correct response. A manual and system documentation are provided. Abedor

(1972) presents a formative evaluation model which functions in a real-world, operational environment. Noting that multiple, iterative revisions of materials can be a monumental and costly effort, Abedor designed a formative evaluation model to generate large amounts of data on instructional problems in a one-shot trial of the prototype lesson. Ward (1972) investigated an author's use of formative evaluation during the preparation of a CAI course. Rayner (1972) developed a formative evaluation model that provides data not only for content but also for procedural changes to instructional materials. Hummel-Rossi (1972) devised a multiple-choice test for evaluating knowledge of Bloom's taxonomy. The test includes an instruction sheet, a specially-treated answer sheet which, when rubbed, displays the answer, and the testing instrument.

V.1 Conduct Internal Evaluation. Bailey (1972) discusses the testing of manual procedures in the Bell System personnel subsystem. The procedures consist of six steps and provide data concerning the numbers and kinds of errors and the probable causes of errors for various job activities. Miller and Sellman (1973) developed a new student critique form for the Air Training Command which indicated that (a) attitudes of trainees toward technical training were "slightly positive;" (b) the most positive attitudes toward technical training were held by Non-Commissioned Officers, followed by Officers, and then Airmen; and (c) airmen were uncertain that technical training was adequately preparing them for on-the-job performance.

V.2 Conduct External Evaluation. Anastasio (1972) proposed a field-test evaluation of the PLATO and TICCIT systems that included cost and educational analyses. Of interest to course writers are the discussions of achievement and attitude measures and the Survey of Instructor Activities and Attitudes contained in Appendix A of the Anastasio report.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The preceding findings suggest four areas for further consideration. First, an ISD activity such as Select Instructional Setting that has no tool or procedure associated with it should be investigated to determine whether a tool or procedure is critical to the role of that ISD activity in education or training. If a tool or procedure is critical to the execution of that activity, further investigation should be conducted in order to create the tool or procedure.

Second, if a tool is generally considered the most useful authoring aid for an ISD activity, then the proportion of procedures identified in the present study should be modified into tools.

Third, in an ISD activity where several tools and procedures but few methodologies are available, priority should be given to further research and development. In test development, for example, nineteen tools and procedures were identified for constructing criterion-referenced tests which are currently the most widely-used form of testing instrument. However, test development is identified with only six methodologies. When new situations arise where criterion-referenced testing is not appropriate and few test development methodologies exist, an unacceptable lag between formulation of new testing systems may occur.

Fourth, during the course of the study, six significant aspects of the authoring process were identified: (a) size and configuration of authoring teams; (b) knowledge and proficiency of course authors; (c) existing course structures including lesson materials and course control documents; (d) type of media and types of instruction; (e) extent and type of evaluation and revision; and (f) text-handling and reproduction systems. The only subjective aspects of the authoring process are knowledge and proficiency of course authors. Since identification and distribution of authoring tools and procedures would allow course authors to develop materials from a baseline of equal knowledge, the objective aspects of the author process can be categorized and manipulated in a "laboratory" (i.e., controlled) setting. Thus, it should be possible to model authoring process variables in order to formulate decision rules for managing the materials development cycle with an optimum mix of personnel and organization.

In summary, ISD has been discussed as an adaptation of the systems approach. The product of an ISD effort was seen as an instructional system, one component of which was the authoring process. Four activities of the authoring process were identified: information gathering, conversion, revision, and publication. Authoring tools and procedures were identified for each of the four activities. It was recommended that an authoring process model be developed for formulating decision rules for properly managing development of instructional materials.

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APPENDIX A

DATA ITEM NAMES AND CODES FOR DOCUMENT ENTRIES

APPENDIX A

Data Item Names and Codes for Document Entries

DATA ITEM NAME	DATA ITEM CODE
Author	Self-explanatory
Institution	B = College or University[a]
	Y = Non-profit Organization
	Z = Profit-making Organization
Title	Self-Explanatory
Date of Publication	Self-Explanatory
ISD Activity Number	2.2[b]
Type of Media	0 = ETV
	1 = Radio
	2 = Programmed Text
	3 = CAI
	4 = CMI
	5 = CAI/CMI
	6 = Audio-visual
	7 = Lecture
	8 = Other
Type of Application	0 = Theory
	1 = Applied
	2 = Applied in Lockstep
	3 = Applied in Self-paced
Type of Evaluation	0 = Evaluated
	1 = Not evaluated
Type of Environment	0 = Civilian
	1 = Joint Military Service
	2 = Army
	3 = Navy
	4 = Air Force
	5 = Marines
	6 = None

APPENDIX A

(Continued)

[a]College and university codes were followed by a four-digit numeric code obtained from the Skills Inventory System Code Book (St. Louis: McDonnell Douglas Corp., 1974). Profit and non-profit-making organization codes were followed by that organization's accepted abbreviation. For example, ZIBM indicated the International Business Machines Corporation and YYMCA indicated the Young Men's Christian Association. Where no standard abbreviation could be obtained, only the one-letter code was used.

[b]ISD activity numbers follow those of the Interservice Procedures for Instructional Systems Development Model shown in Figure 1. For example, 2.2 indicates "Develop Tests."

APPENDIX B

AUTHORING AID ANNOTATED BIBLIOGRAPHY

APPENDIX B

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APPENDIX B

AUTHORING AID ANNOTATED BIBLIOGRAPHY

The abstracts in the bibliography are grouped in accordance with the steps of the IPISD model. The IPISD model consists of five phases and nineteen steps; the phases are Analysis, Design, Development, Implementation, and Control. The steps within each phase are summarized below.

Phase I. Analyze. A certain training or educational program is determined to be both desirable and feasible. The job or preferred outcome to be taught is analyzed as a series of task statements. Numerical, analytic techniques and the judgment of subject matter experts are used to select a subset of the task statements for training and instruction. The instructional setting, i.e., whether the training and instruction should be conducted in formal schools, on job situations, in correspondence courses, or wherever, is determined.

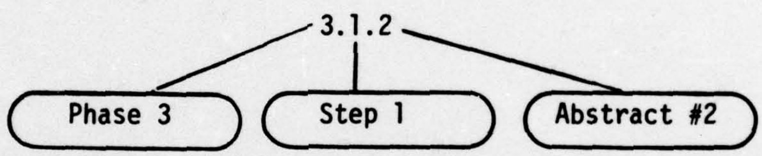
Phase II. Design. The tasks selected for training and instruction in Phase I are converted into behavioral objectives which specify the outcomes to be obtained at the end of training. Criterion measures are devised for measuring learner performance (both cognitive and psychomotor, if desired) against the objectives. Incoming student characteristics are identified in terms of general ability, reading level, and prior experience.

Phase III. Development. Carefully selected and prepared media and materials are developed. Decisions are made concerning (a) management of students, instructors, and course; (b) desired learning experiences and activities; and (c) the form and content of the instructional delivery system. Instructional materials are developed and validated during small- and large-group tryouts. Instructional materials and procedures are revised in order to assure that learners meet lesson and course objectives.

Phase IV. Implementation. Instructional and management staff are trained to meet the requirements of the instructional management plan and delivery system selected as the instructional vehicle. Media and materials are implemented in approved, large-scale courses of instruction, and feedback is obtained on both system performance and effectiveness of materials.

Phase V. Control. Data obtained during instruction are used to answer two questions. First, are students learning what they were intended to learn; and second, did what the students learn benefit them after training, i.e., during later employment or further study? Negative answers to either question, which are identified during internal and external (or field) evaluations, indicate that the contents and procedures of the new system should be revised.

Each abstract in the bibliography is prefaced by a three-part number and a step title. The reference number on the left side of the page indicates the ISD phase, the step in that phase, and the particular abstract in that step. The step title on the right side of the page provides an easy reference point for the reader. For example, an abstract prefaced with the number "3.1.2" indicates that the abstract is concerned with Phase 3 (Development), Step 1 (Developing Objectives) and that it is the second abstract in that step:



The step title translates the code "3.1" into "Specify Learning Events/Activities." To retrieve information concerning a particular ISD activity or step, merely consult the Table of Contents of the bibliography and turn to the section of abstracts beginning with the appropriate Phase/Step number. The abstracts that follow begin with Phase 1, Step 1, Abstract 1 (1.1.1) and continue through with Phase 5, Step 3, Abstract 2 (5.3.2). Refer to the fold-out on the following page as necessary for identification and sequence of ISD activities and steps.

THE FIVE PHASES ARE:

PHASE 1 ANALYZE

Inputs, processes, and outputs in Phase 1 are all based on job information. An inventory of job tasks is compiled and divided into two groups: tasks not selected for instruction and tasks selected for instruction. Performance standards for tasks selected for instruction are determined by interview or observation at job sites and verified by subject matter experts. The analysis of existing course documentation is done to determine if all or portions of the analysis phase and other phases have already been done by someone else following the ISD guidelines. As a final analysis phase step, the list of tasks selected for instruction is analyzed for the most suitable instructional setting for each task.

PHASE 2 DESIGN

Beginning with Phase 2, the ISD model is concerned with designing instruction using the job analysis information from Phase 1. The first step is the conversion of each task selected for training into a terminal learning objective. Each terminal learning objective is then analyzed to determine learning objectives and learning steps necessary for mastery of the terminal learning objective. Tests are designed to match the learning objectives. A sample of students is tested to insure that their entry behaviors match the level of learning analysis. Finally, a sequence of instruction is designed for the learning objectives.

PHASE 3 DEVELOP

The instructional development phase begins with the classification of learning objectives by learning category so as to identify learning guidelines necessary for optimum learning to take place. Determining how instruction is to be packaged and presented to the student is accomplished through a media selection process which takes into account such factors as learning category and guideline, media characteristics, training setting criteria, and costs. Instructional management plans are developed to allocate and manage all resources for conducting instruction. Instructional materials are selected or developed and tried out. When materials have been validated on the basis of empirical data obtained from groups of typical students, the course is ready for implementation.

PHASE 4 IMPLEMENT

Staff training is required for the implementation of the instructional management plan and the instruction. Some key personnel must be trained to be managers in the specified management plan. The instructional staff must be trained to conduct the instruction and collect evaluative data on all of the instructional components. At the completion of each instructional cycle, management staff should be able to use the collected information to improve the instructional system.

PHASE 5 CONTROL

Evaluation and revision of instruction are carried out by personnel who preferably are neither the instructional designers nor the managers of the course under study. The first activity (internal evaluation) is the analysis of learner performance in the course to determine instances of deficient or irrelevant instruction. The evaluation team then suggests solutions for the problems. In the external evaluation, personnel assess job task performance on the job to determine the actual performance of course graduates and other job incumbents. All collected data, internal and external, can be used as quality control on instruction and as input to any phase of the system for revision.

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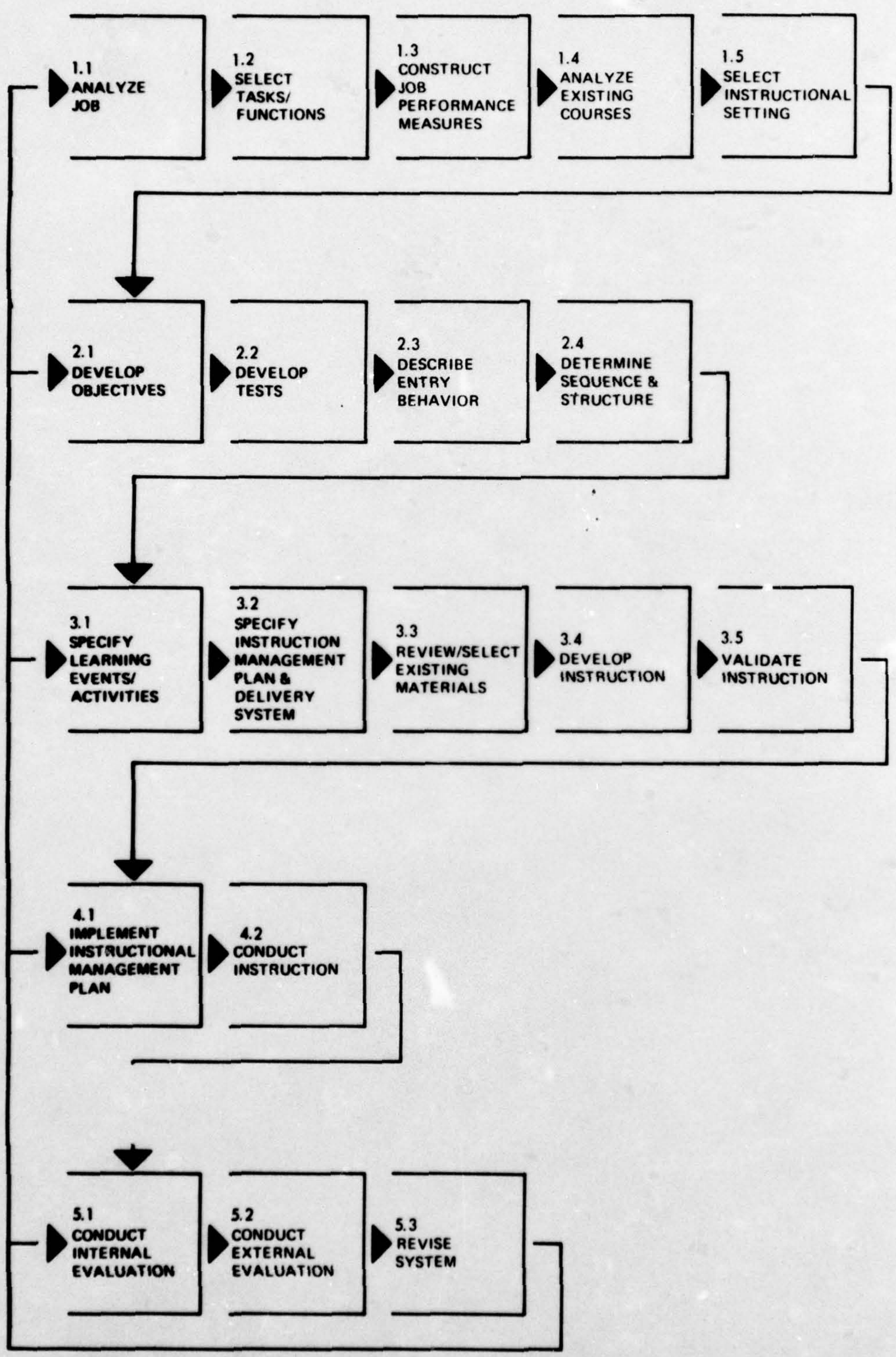

THE OUTCO

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THE OUTCOMES OF THE BLOCKS ARE:

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.1 . . . a list of tasks performed in a particular job.

.2 . . . a list of tasks selected for training.

.3 . . . a job performance measure for each task selected for instruction.

.4 . . . an analysis of the job analysis, task selection, and performance measure construction for any existing instruction to determine if these courses are usable in whole or in part.

.5 . . . selection of the instructional setting for task selected for instruction.

2

.1 . . . a learning objective for and a learning analysis of each task selected for instruction.

.2 . . . test items to measure each learning objective.

.3 . . . a test of entry behaviors to see if the original assumptions were correct.

.4 . . . the sequencing of all dependent tasks.

3

.1 . . . the classification of learning objectives by learning category and the identification of appropriate learning guidelines.

.2 . . . the media selections for instructional development and the instructional management plan for conducting the instruction.

.3 . . . the analysis of packages of any existing instruction that meets the given learning objectives.

.4 . . . the development of instruction for all learning objectives where existing materials are not available.

.5 . . . field tested and revised instructional materials.

4

.1 . . . documents containing information on time, space, student and instructional resources, and staff trained to conduct the instruction.

.2 . . . a completed cycle of instruction with information needed to improve it for the succeeding cycle.

5

.1 . . . data on instructional effectiveness.

.2 . . . data on job performance in the field.

.3 . . . instructional system revised on basis of empirical data.

REFERENCE NUMBER: 1.1.1 ANALYZE JOB

CITATIONS:

Archer, W. B. Computation of group job descriptions from occupational survey data (Report No. PRL-TR-66-12). Lackland Air Force Base, Texas: Air Force Systems Command, Aerospace Medical Division, Personnel Research Laboratory, December 1966.

Morsch, J. E., & Archer, W. B. Procedural guide for conducting occupational surveys in the United States Air Force (Report No. PRL-67-11). Lackland Air Force Base, Texas: Air Force Systems Command, Aerospace Medical Division, Personnel Research Laboratory, September 1967.

Christal, R. E. CODAP: Input standard (INPSTD) and variable generation (VARGEN) programs (Report No. AFHRL-TR-72-51). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Personnel Research Division, May 1972.

Stacey, W. D., Weissmuller, J. J., Barton, B. B., & Rogers, C. R. CODAP: Control card specifications for the UNIVAC 1108 (Report No. AFHRL-TR-74-84). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Computational Sciences Division, October 1974.

Weissmuller, J. J., Barton, B. B., & Rogers, C. R. CODAP: Source program listings for the UNIVAC 1108 (Report No. AFHRL-TR-74-83). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Computational Sciences Division, October 1974a.

Weissmuller, J. J., Barton, B. B., & Rogers, C. R. CODAP: Programmer notes for the subroutine library on the UNIVAC 1108 (Report No. AFHRL-TR-74-85). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Computational Sciences Division, October 1974b.

Mayo, C. C., Nance, D. M., & Shigekawa, L. Evaluation of the job inventory approach in analyzing USAF officer utilization fields (Report No. AFHRL-TR-75-22). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Occupational and Manpower Research Division, June 1975.

Stacy, W. J., & Hazel, J. T. A method of determining desirable task experiences for first-line supervisors (Report No. AFHRL-TR-75-23). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Occupational and Manpower Research Division, August 1975.

Christal, E. E., & Weissmuller, J.J. New CODAP programs for analyzing task factor information. Paper presented at the meeting of the Military Testing Association, Indianapolis, September 1975.

ABSTRACT:

An extensive Air Force occupational analysis program was begun in the 1960s that culminated in development of an on-going computer-based occupational analysis system. Providing valid job analysis information, the Comprehensive Occupational Data Analysis Programs (CODAP) allow job analysts to describe and evaluate existing jobs within Air Force Career Specialties, and to establish training priorities for new courses. The CODAP system can: (a) provide individual or group descriptions that specify the percent time spent on each task in a job; (b) describe an actual job at different task levels (such as apprentice, officer, and so forth); (c) derive individual and group job differences; and (d) identify specific types of jobs as they exist or should exist within a general specialty. These features, as well as an introduction and program notes, are described in the series of citations discussed below.

Archer (1966) provides a detailed analysis of occupational survey data by using a miniature sample. Based on responses of ten incumbents to a job inventory consisting of ten task statements, composite job descriptions are derived for (a) special groups of incumbents, selected on the basis of background information data; and (b) job type members, identified by an automated job clustering program. Illustrations of computer outputs from both types of analysis are explained. The 10 incumbents are Medical Service personnel with duty level ratings of three, five, and seven. The ten task statements are concerned with supervising subordinates, performing ward procedures, and performing outpatient procedures. Each incumbent filled out a job inventory survey by checking the tasks he performed as part of his job and rating the tasks on a nine-point relative time-spent scale. In a very detailed discussion with 38 tables and four figures, the author illustrates how task-and-

duty-level descriptions are derived, and how membership and homogeneity of job types are clustered.

Morsch and Archer (1967) describe the procedures for collecting, organizing, analyzing, and reporting job task information of Air Force officers and airmen. Discrete steps in the application of the Air Force job analysis method are given in the following chronological order: (a) location and procurement of source materials; (b) construction of preliminary job inventory; (c) internal review of preliminary job inventory; (d) revision of preliminary job inventory; (e) field test/review of revised job inventory; (f) construction of final job inventory; (g) selection and location of occupational survey samples; (h) reproduction of job inventory materials; (i) packaging and mailing job inventories; (j) administration of job inventories; (k) receiving, scanning, and coding job inventory booklets; (l) integrating added job inventory information; (m) keypunching and verifying job inventory data; (n) computer analysis of job inventory data; and (o) the Occupational Survey Report. With clear, concise discussion of each step plus fifteen appendices which contain everything from instructions for self- or group-administration of the job inventory to a sample letter of appreciation, this report is an evaluated, self-contained tool for job or task analyzers.

The next four reports present information to be used by computer specialists aiding the job analysis effort. Christal (1972) describes and gives application examples of CODAP's Input Standard Program (INPSTD) and Variable Generation Program (VARGEN). Stacey, Weissmuller, Barton, and Rogers (1974) present control card write-ups for 34 main programs in the UNIVAC 1108 version of CODAP. Arranged alphabetically by program name and preceded by a short summary of the program functions, each write-up contains: (a) detailed control card specifications necessary for using the CODAP system; (b) general input-output specifications; (c) general program logic; and (d) diagnostic aids. Weissmuller, Barton, and Rogers (1974a) cover source programs for the UNIVAC 1108 version of CODAP. Included are 34 FORTRAN main programs and 78 FORTRAN and 20 Assembly Language subroutines. Weissmuller, Barton, and Rogers (1974b) discuss programmer notes on 100 library subroutines used by the UNIVAC 1108 version of CODAP. Arranged in alphabetical order by subroutine name, each note includes: (a) comments on peculiar requirements for conversion and use of subroutines; (b) summaries of subroutine functions and a list of entry points; and (c) for each entry point, a calling sequence with descriptions of input and output arguments.

Typical uses of the CODAP system for course developers are given in the next two reports. First, the job inventory method of job analysis for officer positions was studied by Mayo, Nance, and Shigekawa (1974). The authors concluded that the inventory method was operationally adequate but, due to the officers' broader, concept-oriented responsibilities, more specific approaches to task construction are required than are usually needed for airmen positions. To resolve the issues of task specificity and breadth of coverage for officers' fields, "heavy front-end work" (i.e., research requisite information) is recommended.

Second, skill-level career ladders in Accounting and Disbursement were studied by Stacey and Hazel (1974). More than 1200 Accounting and Finance Supervisors examined 254 journeyman-level tasks and rated the importance of each task relative to satisfactory supervisory performance. Job analyses of career work experiences indicated: (a) many supervisors had limited career experience in the desirable journeyman-level tasks; (b) many supervisors had spent most of their career time in very few of eight accounting and finance work areas; and (c) lack of supervisory work experience was related to on-the-job performance. The authors concluded that the present accounting and finance work management unit was too broad for required work activities, and recommended the separation of the Accounting (671x1) and Disbursement (671x3) career ladder through the seven-skill level.

In a recent paper, Christal and Weissmuller (1975) describe five new programs added to the UNIVAC 1108 version of CODAP which are designed to analyze and manipulate information describing work tasks rather than jobs or persons. One use of the new program is to rank-order training priorities for curriculum designers. Although the technical discussion is beyond the intent of this bibliography, the authors report that control card specifications are now available which can be reprogrammed for execution on IBM 360-370 series computers.

DATA SUMMARY:

Media:	Computer-based
Application:	Computer-based job analysis
Evaluation:	Extensive field-tests
Environment:	Military (Air Force)
Key Number:	1.1 Analyze Job
Authoring aid type:	Tool

REFERENCE NUMBER: 1.1.2

ANALYZE JOB

CITATION:

Foley, J. P., Jr. Task analyses for job performance aids and related training. In T. C. Rowan (Ed.), Proceedings of the Invitational Conference On Improved Information Aids for Technicians. Sumner, Maryland: Logistics Management Institute, May 1975.

ABSTRACT:

A major problem in educating instructional personnel in the use of task analysis has been a lack of agreement as to its purpose and method of execution. Emphasizing maintenance, Foley argues that perhaps the more important purpose of task analysis is to determine the content of training, and offers a standardized execution methodology.

The first step in task analysis is, of course, identification of tasks actually done on the job. If job requirements are being done only partially, then what people should do should also be identified. Work sheets for a Task Identification Matrix (TIM) are given which list each system hardware component and its parts on a numbered line. Column headings on the TIM consist of 14 maintenance actions such as adjust, align, calibrate, checkout, handle, clean, lubricate, and inspect. Then, for each cell in the matrix, a code is entered which indicates the level of maintenance required. After every task has been identified and scoped, a Task Inventory is produced which is simply a listing and numbering of each task identified in the matrix. The computer storage and handling of task information would permit automatic generation of task inventories. (See references for the CODAP System, 1.1.1)

The second step in task analysis is functional analysis of the identified tasks. Under the umbrella of a Task Description Index and Management Matrix (TDIMM), the functional analysis information is formatted on three worksheets. The preliminary Information Worksheet lists the hardware item with which the task is associated as well as required supplies, forms, replacement parts and technical orders, and necessary notes, cautions, and warnings. The Task Description and Information Index merges this information with summary information about the task such as criticality, frequency of occurrence, number of steps, and task type. The Detailed Step Description Worksheet provides for a detailed, step-by-step analysis of the task. It includes maintenance support information and special instructions. When a task

involves use of test equipment and special tools, a Test Equipment and Tool Use Form is completed. Graphics of each form are given in the text.

Using these documents does not ensure that effective directions are finally written for the maintenance technician. A third step is required which involves "a software middle man" who is able to add the proper behavioral cues to the technical directions and analysis. For example, in one application where exploded views of an aircraft did not supply the required pictorial cues for disassembly, Foley says that it was necessary to add the phrase "when lens is closed it looks shiny."

A variant of conventional task analysis is special analysis for troubleshooting tasks. Special guidance must be given both to task analyzers and technicians. Foley recommends the use of Maintenance Dependency Charts, Logic Trees, and Fully Proceduralized Job Performance Aids, details of which are beyond the scope of his report.

Although the author used maintenance examples to illustrate the utility of standardized worksheets, it should not be difficult to adapt the forms for use in other task analysis situations.

DATA SUMMARY:

Media:	Print
Application:	Manual task analysis
Evaluation:	None
Environment:	Military (Army)
Key Number:	1.1 Analyze Job
Authoring aid type:	Tool
Number of pages:	21
Number of references:	31

REFERENCE NUMBER: 1.1.3

ANALYZE JOB

CITATION:

Task Inventory Exchange. Brochure. Columbus: The Ohio State University, Center for Vocational Education, 1975.

ABSTRACT

Task analysis is a time- and money-consuming activity which generates task inventories for specific jobs in organizations or occupational areas with a limited intent of use on the part of their developers. However, if their existence and character are known these same job inventories may have much wider application. To bridge the gap between those who need but are unaware of existing task inventories and those who have previously developed them, the Task Inventory Exchange (TIE) was created. The TIE has four functions: (a) identify existing occupational/task inventories; (b) collect, catalog, and store existing task inventories; (c) publish directories of available task inventories; and (d) supply microfiche or hard copies of available task inventories.

The TIE obtains task inventories through distribution of a brochure and placement of advertisements in eight professional journals. Contributions of task inventories and related literature for the TIE should be made in two copies. It also actively conducts comprehensive literature searches in the data bases of Educational Resources Information Centers (ERIC), National Technical Information Service (NTIS), Abstracts of Instructional/Research Materials in Vocational and Technical Education (AIM/ARM), and University Microfilms. Results of these activities are collected and stored on magnetic tape and in hard-copy volumes.

The TIE periodically publishes directories of task inventories. Volume 1, Directory of Task Inventories, was published in 1974 and contained citations for 77 publications listing task inventories for 280 job titles or occupational areas. Volume 2, same title, was published in 1975 and contained citations for 177 publications listing inventories for 379 occupations or jobs. Volume 3 is currently in press. The cost for Volumes 1 and 2 is $4 and $7, respectively.

The TIE supplies partial or whole task inventories on a cost-recovery basis. The first five microfiche of any one document are 65 cents and each additional

fiche is 15 cents. Paper copies of task inventories are five cents a page.

Further information concerning the TIE may be obtained from:

Paul E. Schroeder, Project Director
Task Inventory Exchange
Center for Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, Ohio 43210
(614) 486-3655.

DATA SUMMARY:

Media:	Microfiche, Print
Application:	Job Analysis
Evaluation:	None
Environment:	Civilian
Key Number:	1.1 Analyze Job
Authoring Aid Type:	Tool
Number of Pages:	Approximately 20
Number of References:	4

REFERENCE NUMBER: 1.2.1 SELECT TASKS/FUNCTIONS

CITATION:

Cline, J. A. A multivariate statistical model to predetermine preferable aircraft assignments: A feasibility study (Doctoral Dissertation, Arizona State University, 1973). University Microfilms No. 73-20, 494.

ABSTRACT:

If job assignments can be made before students begin or complete training, it is possible to identify appropriate training tasks or functions that are needed for job assignment and tailor individual learning programs for individual students. Cline developed a model for selecting pilots for end aircraft assignment (advanced pilot training) early in Undergraduate Pilot Training. His technique may be extended to other fields.

Peer-ranking data were obtained from an earlier study and used as the primary operational measure of a pilot's success flying an operational aircraft. Secondary measures included advanced pilot training grades, and on-the-job Officer Effectiveness Ratings by supervisors. Two techniques used in the study are of interest to course developers: (a) conversion of peer-rankings into ordinal data; and (b) selection of subgroups for classes of training.

One disadvantage of peer ranking is that while it is possible to determine who is first, second, or third, it is not possible to measure the amount of difference between the first and the second, and between the second and the third. Therefore, Cline converts the peer rankings into ordinal data by using a technique similar to Thorndike's T-Score procedure. The ordinal data become the criteria for the further selection of subgroups for classes of training. The validity of the criteria are, Cline admits, subjective and "cannot be statistically measured", but their reliability was measured by the coefficient of concordance (W), which is a measure of the commonality of judgements. In this particular study, it indicated the degree to which pilots kept the same relative standing in the group when peers ranked all members of the group.

Selection of subgroups for classes of training was based upon selected variables such as military grade and flying hours in jet-powered aircraft, and upon a

statistical technique called Automatic Interaction Detector (AID). Developed and refined by Air Force personnel, the AID technique essentially divides the total sample into mutually exclusive subgroups of increased homogeneity with respect to the dependent variable. For example, using AID, Cline found that the most important variable for explaining the variance in pilot Armed Forces Qualifying Test (AFQT) was education. The first split separated college graduates from high and non-high school graduates and accounted for 68 percent of the variance. The second split separated high and non-high school graduates and accounted for an additional nine percent of the variance.

Finally, the author combined regression analysis and discriminant analysis to form a classification model which establishes group membership and indicates the probable degree of individual success in such a group. Decision functions match individuals to groups. When training requirements for groups such as "fighter pilot" or "bomber pilot" or "navigator" are identified (which Cline does not do), then tailored learning programs for individuals within those groups can be developed.

DATA SUMMARY:

Media:	Computer-based
Application:	Individualized Instruction
Evaluation:	None
Environment:	Military (Air Force)
Key Number:	1.2 Select Tasks/Functions
Authoring Aid Type:	Procedure
Number of Pages:	211
Number of References:	

REFERENCE NUMBER: 1.2.2 SELECT TASKS/FUNCTIONS

CITATION:

McKnight, A. J., & Adams, B. B. Driver education task analysis, Volume II: Task analysis methods. Final report (HumRRO Tech. Rep. 72-13). Alexandria, Va.: Human Resources Research Organization, November 1970. (ERIC Document Reproduction Service No. ED 075 624)

ABSTRACT:

During the development of performance-oriented driver education objectives and a set of measuring devices for evaluating attainment of the objectives, over one thousand behaviorally-relevant system characteristics were identified. The behaviors identified during the analysis of driving tasks varied considerably in their criticality to the safety and efficiency with which the highway traffic system operates. Since an efficient program of driver education must account for this variation, an evaluation of behavior criticality became a part of the analysis. The approach to criticality evaluation was, of necessity, a judgemental one; there were insufficient data to support any empirical determination of criticality. A group of authorities in the area of traffic safety -- driver educators, enforcement officers, license officials, and fleet safety personnel -- performed the evaluation. The plan called for each evaluator to rank, in terms of criticality, three groups of 25 behaviors from a total list of 1500 behaviors. This allowed each behavior to be ranked five times. However, since seven of the evaluators did not return completed evaluations, the number of rankings in some cases was four instead of five. The rankings were then transformed to standard scores with a mean of zero and a standard deviation of 10. The scores for each behavior were averaged to obtain a criticality index for each behavior. An analysis of variance showed a high degree of agreement among the evaluators.

There were four steps in the criticality evaluation: (a) obtaining criticality data; (b) selecting an evaluation method; (c) administering the evaluation; and (d) generating criticality indices.

Data were obtained from a literature review and from analysis of 1100 actual automobile accidents. An evaluation method was chosen after a pilot study of three approaches -- rating, task group ranking, and random group ranking -- found that

random group ranking provided the only straightforward means of comparing behaviors across tasks. Once the data had been obtained and the evaluation method had been chosen, the actual administration of the evaluation materials began. One hundred evaluators chosen with the aid of the National Highway Safety Bureau were mailed a sample of 25 behaviors, the task descriptions, and a set of directions. Upon completing a ranking, the evaluator was asked to place a colored card in the stack of ranked behaviors beneath the last behavior he felt was critical enough to be required of qualified drivers. The rankings were then returned to the authors.

The data from 94 evaluators were used to generate criticality indices. In analyzing the results of the rankings, individual ranks were converted to their normalized equivalents. The normalized scores ranged from +2.0 for a rank of "1" to -2.0 for a rank of "25," and the mean of zero corresponded to a rank of 13. The means of these normalized values and their associated standard deviation were then calculated for each of the 1500 behaviors.

Since the behaviors were not a representative sample of the population, their relative standing to one another would not approximate their standing within the population, and so simply ranking the behaviors against one another was not appropriate. Thus, an additional procedure, described below, was needed to create valid criticality indices.

First, a group of the previously ranked behaviors was selected to provide a behavior whose mean rank corresponded to each of the 25 ranks. Next, an additional group of five evaluators took each of the unranked behaviors and assigned it the rank of the behavior in the list of the ranked 25 behaviors to which it most closely approximated in criticality. The behavior was then given the same rank value as the corresponding ranked behavior. The evaluator was also asked to decide whether the behavior was sufficiently critical to be considered a minimum requirement for a qualified driver. The results were then processed in the same manner as described for the previously ranked behaviors.

Although the criticality indices remain ultimately subjective and one's confidence in their validity rests with his confidence in the evaluators, a high level of agreement supports confidence while non-agreement destroys it. An analysis of variance indicated a high level of agreement among evaluators concerning the critical behaviors. Further, an analysis of variance of inter-task differences indicated much similarity in the criticality of behaviors within a particular task. The results of each analysis of variance are given in the text of the report.

Although the procedure suggested by McKnight and Adams is rather involved, especially where large numbers of behaviors are considered, it provides a solution to the course developer's question of, "What tasks are sufficiently critical that they must be taught?", and thereby aids the selection of appropriate tasks and functions.

Four appendices are given: A. Behaviorally Relevant System Characteristics; B. Directions to Evaluators of Task Criticality; C. Task Criticality Means and Standard Deviations; and, D. List of Evaluators.

DATA SUMMARY:

Media:	None
Application:	Individualized Instruction
Evaluation:	None
Environment:	Civilian
Key Number:	1.2 Select Tasks/Functions
Authoring Aid Type:	Procedure
Number of Pages:	45
Number of References:	None

REFERENCE NUMBER: 1.2.3 SELECT TASKS/FUNCTIONS

CITATION:

Powers, L. The systems approach to functional job analysis: Task analysis of the physician's assistant. Volume 1: Task analysis methodology and techniques. Winston-Salem, North Carolina: Wake Forest University, Bowman Gray School of Medicine, 1971. (ERIC Document Reproduction Service No. ED 059 378)

ABSTRACT:

The basic structure of a task statement has two parts: the end result; and the worker activity required to bring about the end result. The end results are those steps which must be carried out to accomplish the organization's objectives. For physician's assistant, typical end results might be "progress notes on hospital, home, and office patients" and "hospital discharge summaries for physician's review and signature." Typical work activities for the same profession include "perform and/or schedule" and "assist the physician with...." These are basic structures which every competent task statement should contain.

Powers, however, has added a phrase to the task statements collected in this volume by which task statements may aid in selection of tasks and functions for training. The phrase is: in order to. The phrase may be used to indicate an intended outcome of a task, and thereby group students according to required levels of competence. Those students with nearly adequate competence to do the intended task should receive less training than those who lack a basic competence. Consider, for example, two tasks in electronics training which have different outcomes but a same worker activity. The tasks are "troubleshooting an oscilloscope" and "using an oscilloscope,' and the worker activity is "turn on an oscilloscope." If a student turns on an oscilloscope in order to troubleshoot it rather than in order to operate it, a very different level of training -- both in content and extent -- is required for the end result. Also, students may be expected to bring different prior abilities to each task.

The collection of task statements for physician's assistant was developed during a systematic sampling of the professional activities of pediatricians, family practitioners, surgeons, obstetricians, and internists. Course outlines, training objectives, and goals for training physician's assistants were also developed.

DATA SUMMARY:

Media:	None
Application:	Individualized Instruction
Evaluation:	None
Environment:	Civilian
Key Number:	1.2 Select Tasks/Functions
Authoring Aid Type:	Procedure
Number of Pages:	130
Number of References:	None

REFERENCE NUMBER: 1.3.1 CONSTRUCT JOB PERFORMANCE MEASURES

CITATION:

Gael, S. Employment test validation studies. JSAS Catalog of Selected Documents in Psychology, 1974, 4, 95 (Ms. No. 711)

ABSTRACT:

Gael reports a study of five Bell System jobs in order to identify job activities and dimensions, job products and factors for product quality, relative importance of various products and job activities, and the skills required to perform the work. The activity analysis results -- "activity analysis" being a Bell System word substituted for "task analysis" -- were translated into employment tests and job performance measures. Gael's discussion is confined to the selection and design of the instruments used to gauge aptitudes and proficiencies. It does not deal with results.

Five Bell System jobs were studied: (1) Service Representative; (2) Toll Operator; (3) Directory Assistance Operator; (4) Traffic Service Position; and (5) Clerical. As an example of the thoroughness and adaptability of the Bell System studies, the Service Representative (SR) and the Clerical Tests will be discussed. SR work positions consist of a special desk in which 2500 to 4000 customer records are filed; a position identification board that identifies, by telephone number, all the records filed in the desk; a telephone; several reference books; an elaborate in-out basket for work status documentation; and other incoming and outgoing paper work. SR activities consist of customer contact, clerical, computational, and filing efforts which are performed under a steady influx of customer and intra-company calls. A call frequency analysis, however, shows that the four most frequent contacts require: (a) taking orders for new telephone service or changes to existing service; (b) explaining and adjusting telephone bills; (c) recording equipment malfunctions or service problems and reporting them to maintenance; and (d) notifying customers of overdue accounts and arranging payment schedules.

Two SR job performance measures were developed to measure acquisition and application of job knowledge and skills, and to measure job proficiency in a standardized situation. The primary purpose of the written Job Knowledge Review (JKR) was to determine the comprehension level of company policies, and job

procedures and practices. Using multiple-choice and constructed-response questions, the JKR covered topics such as SR reference materials, types of equipment available to customers, charges for individual pieces or combinations of equipment and services, customer complaints, and intercompany and intracompany communications. The JKR was administered to a class of SRs at the end of formal training and required about one hour to complete. On the other hand, the Job Performance Review (JPR) was a job proficiency measure involving simulation. One administrator initiated calls to the SR in a time- and-setting-controlled situation while another specially-trained administrator listened to each "customer" contact and evaluated the SR's oral performance. The JPR consisted of contact-generated and other clerical work and required 75 to 90 minutes to complete. Three JPR scores were given for each simulation: (a) Record Preparation (RP), the sum of the points accorded each part of a record prepared or completed as determined by comparison with a model set of records with points already assigned; (b) Verbal Contact (VC), the sum of points assigned each part of the verbal interaction with the "customer;" and (c) Filing (F), the number of records not in the designated location when the JPR was terminated.

The JKR and the three JPR scores were combined in a composite score that represented the acquisition of knowledge and the ability to apply that knowledge on the job. In response to management emphasis on customer satisfaction, the Verbal Contact (VC) score was weighted twice that of the other components.

The paradigm described for the SR test was followed for the three Operator test studies with only minor modifications.

Nearly 120,000 telephone company employees work at 400 jobs classified as clerical. The main problem in developing a job performance measure for clerical workers, then, was to reduce systematically clerical jobs to activities common to most clerical jobs. Descriptions of 400 jobs were reduced to eight dimensions and work samples in each dimension were obtained which, after refinement and printing, resulted in a Clerical Performance Measurement (CPM) package and an administrative manual used to train CPM administrators in giving and scoring the CPM.

The administration, media, and format of the CPM could perhaps be readily adapted to a clerically-oriented Defense Occupational Specialty (DOS) such as the

Air Force's Inventory Management career field, below the seven-skill level. Administration of the CPM requires about two days and can be given to groups of 10 people by one administrator. In addition to the CPM materials and administrative manuals, other requirements include tape cassettes, playback units, office supplies, a timer, and an enclosed, quiet room that can hold up to 10 study participants at separate tables. Completed CPM packages are scored by the administrator and independently by an assistant.

The eight CPM packages consist of five timed clerical activities, three self-paced programmed texts, and an audio tape. Each unit is contained in a separate folder placed inside an expansion folder. The timed clerical activities, completed in accordance with specific instructions, are Filing, Classifying, Posting, Checking and Coding. The self-paced units contain programmed texts and examinations that are parts of the telephone company training course for clerks. The examinations are intended to measure the ability to learn the specific content and detail of clerical jobs. They are entitled Toll Fundamentals, Punched Card Fundamentals, and Plant Repair Service. Job proficiency measures are obtained by combining the eight CPM scores for each study participant.

The five employment test validation studies discussed above covered jobs in which about 300,000 Bell System employees work, and, according to Gael, many more than that are screened yearly for those jobs.

DATA SUMMARY:

Media:	Simulation, programmed text, and audio tape
Application:	Self-paced job performance measurement
Evaluation:	None
Environment:	Civilian
Key Number:	1.3 Construct Job Performance Measures
Authoring Aid Type:	Procedure
Number of Pages	8
Number of References:	5

REFERENCE NUMBER: 1.4.1 ANALYZE EXISTING COURSE

CITATIONS:

Inventory management specialist and inventory management supervisor. Specialty training standard 645X0. Washington, D.C.: Department of the Air Force, Headquarters, 11 August 1975.

Materiel facilities specialist. Plan of instruction 3ABR64730-1. Lowry Air Force Base, Colorado: Lowry Technical Training Center, School of Applied Aerospace Sciences, Department of Logistics Training, 2 January 1974.

Materiel facilities specialist. Course chart 3ABR64730-1. Lowry Air Force Base, Colorado: Lowry Technical Training Center, School of Applied Aerospace Sciences, Department of Logistics Training, 12 September 1973.

ABSTRACT:

Analysis of an existing Air Force course appears in the Specialty Training Standard (STS), Plan of Instruction (POI), and the Course Chart. These are official, Air Force-prepared documents intended to provide guidance to course administrators, instructors, and developers.

The STS describes in terms of a number-letter code the knowledges and skills an airman in a particular career field (such as Inventory Management) must have by end of training. The number codes indicate required task performance levels, and range from 1 (least) to 4 (complete task proficiency). The letter codes are both lower and upper case, and indicate task or subject knowledge levels, respectively. Lower-case letter codes range from "a" (knowledge of nomenclature) to "d" (knowledge of theory). Upper-case letter codes range from "A" (knowledge of facts) to "D" (knowledge of evaluation). The requirements for task knowledges and skills are given by skill level. For example, one task in the Inventory Management career field is "conducting inventories", which three-level airmen are required to know to the "A" STS level and five-level airmen are required to know to the "B" STS level. That means a three-level airmen "can identify basic facts and terms about the subject" while five-level airmen "can explain relationship of basic facts and state general principles about the subject." The STS is useful in determining a number of task-related issues such as selection of training tasks or writing behavioral objectives

because it is an officially accurate analysis of required knowledges and skills in a particular field.

The Plan of Instruction (POI) is a publication that identifies units of instruction for a particular course and indicates the following for each unit of instruction: (a) duration of instruction and the day on which it is presented; (b) the criterion levels to be reached; (c) support materials; and, (d) the STS reference for the course content being presented.

The Course Chart divides the course into blocks of instruction and specifies the sequence in which the lessons are presented. Major equipment items used in a course are identified and the number of hours of technical and related training is specified. Related training includes commander's calls and briefings, traffic safety, and human relations.

DATA SUMMARY:

Media:	Print
Application:	Conventional and self-paced instruction
Evaluation:	Quality control by experienced personnel in the career field
Environment:	Military (Air Force)
Key Number:	1.4 Analyze Existing Course
Authoring Aid Type:	Tool
Number of Pages:	Variable by career field
Number of References:	Variable by career field

REFERENCE NUMBER: 1.4.2

CITATION:

Lewis, W. E., Willow, J. D., Brock, G. R., Lonigro, J. K., Jr., Eschenbrenner, A. J., & Hanson, A. L. Precision measuring equipment (PME) individualized instruction (Report No. AFHRL-TR-74-46). Lowry Air Force Base, Colorado; Air Force Human Resources Laboratory, Technical Training Division, August 1974.

ABSTRACT:

A portion of an Air Force course in Precision Measuring Equipment (PME) (3ABR32430-2) was converted from conventional instruction to self-paced individualized instruction in order to determine the feasibility of individualizing the entire course as part of the Advanced Instructional System (AIS). Self-paced programmed texts and audio-visual materials were developed, administered, and evaluated for a 90-hour block of instruction. Training time was reduced by 31% with all trainees achieving criterion objectives.

One phase of the study concerned analysis of the existing course, which was done in five tasks. The first task was to select course segments for individualization according to five selection criteria. Chosen course segments should: (a) sample the full range of skills and knowledges required in the PME course; (b) sample the full range of media requirements in the PME course; (c) contain skills and knowledges which are prerequisites for accomplishing frequently occurring job tasks; (d) contain skills and knowledges essential to both current and projected frequently occurring job tasks; and, (e) be able to be implemented without disrupting normal trainee flow through non-selected segments.

The second task was to analyze course and job documentation. The following doucments were analyzed: (2) Course Chart; (b) Specialty Training Standard (STS); (c) Plan of Instruction (POI); (d) student study guides, workbooks, programmed texts, and handouts; and, (e) the Occupational Survey Report (OSR). The Course Chart, POI, and STS proved useful in providing an overview of the course (see annotations for these documents in this section, 1.4.1) while the OSR was used to obtain data on task, frequency of performance, and total time spent doing the task on the job.

The third task was to choose the target population. Several factors were considered: (a) size and rate of increase or decrease of target population; (b) location and size of instructional "units"; (c) Airman Qualification Examination (AQE) scores relevant to the general and specific knowledges and skills required by the PME course; (d) scores on standardized national achievement tests and/or on validated local achievement tests; (e) entry skills and learning rates; and, (f) appropriate instructional strategies.

The fourth task was to examine the training environment. The PME laboratory contained 12 classrooms. Those classrooms devoted to academic topics (such as basic electronic theory) contained tables and chairs while classrooms given to "hands-on" practical performance contained not only tables and chairs but also workbenches and electronic equipment. The primary pieces of equipment in the PME course were calibration standards and applied measurement trainers. Since the standards and trainers were available in limited quantities, trainees in some segments of instructions worked in pairs.

The fifth task was to select representative segments of the PME course for individualization. Air Training Command specified that Block X, Waveform Analysis, be individualized, which satisfied selection criteria two through five. An additional 24 hours of instruction were selected from other blocks in order to satisfy selection criterion 1.

Eight appendices are included in the report: A. Sample Task Analysis; B. Sample Learning Objective; C. Lesson Flowchart; D. Trainee Progress Flowchart; E. Instructional Method Questionnaire; F. Block X, Small-Group Tryout Results; G. Block X, Large-Group Validation Results; and, H. Trainee Background Data.

DATA SUMMARY:

Media:	Programmed texts and audio-visual
Application:	Self-paced, individualized instruction
Evaluation:	Formative and summative evaluation
Environment:	Military (Air Force)
Key Number:	1.4 Analyze Existing Course
Authoring Aid Type:	Procedure

Number of Pages: 62

Number of References: None

REFERENCE NUMBER: 1.5.1 SELECT INSTRUCTIONAL SETTING

CITATION:

Ely, D. P. Instructional hardware/A guide to architectural requirements. New York: Educational Facilities Laboratories, 1970. (ERIC Document Reproduction Service No. ED 043 959)

ABSTRACT:

A dated but comprehensive discussion of audio and visual display equipment, television-based teaching systems, computer assisted instruction (CAI), and student response systems useful in a variety of instructional settings is presented. No evaluation of specific systems is given. No arguments are made for which systems should be installed, how large the installations should be, or how they might be used. The report is intended to "familiarize the educational community with the general nature of various electronic teaching systems." Chapter sections begin with a general discussion, and then specific equipment types are considered Approximate costs and component flowcharts are frequently presented for system layouts.

The audio equipment chapter considers: (a) tape recorders and phonographs; (b) wireless teaching systems emphasizing radio; (c) language laboratories; (d) telephone-based teaching systems; (e) dial access systems; and (f) cable distribution systems.

Sections in the visual display equipment chapter include: (a) slide and filmstrip projection; (b) overhead projection; (c) opaque projection; (d) motion picture projection; (e) film loops including single concept, repeating, and cartridge films; (f) microfilm, (g) room darkening and ambient light standards; (h) projection screens; (i) lectern control panels; (j) individual student carrels; and (j) teaching machines.

In the chapter on television-based teaching systems, instructional television (ITV) is distinguished from educational television (ETV). ITV is defined as television programs planned for particular school systems and broadcast via closed circuit transmission to specific areas or classrooms. ETV is defined as general

educational and informational television programs usually broadcast over public television channels. The chapter includes sections on: (a) television transmission and distribution systems; (b) production equipment; (c) production space requirements; (d) service requirements for TV production, including air conditioning, power, and lighting requirements; (e) display methods for TV programs; (f) approximate equipment costs for open and closed circuit systems; and (g) investment cost (equipment plus maintenance) for 150-classroom and 300-classroom systems.

The CAI chapter discusses: (a) implications of educational computer systems; (b) processing requirements; (c) terminal requirements; (d) system options; (e) space requirements; (f) environmental requirements; (g) service requirements, including methods of cabling and wiring for computer systems; (h) fire protection; and (i) approximate costs of a large municipal CAI system. Due to constant development of computer-based education equipment, costs cited by the author are, perhaps, now unrealistic. But the general information in each section, the learning center diagrams of typical CAI learning centers, and the wiring/cabling illustrations remain informative.

Student response systems use some type of responder unit at a student station and an instructor console that registers responses. The chapter contains two sections: (a) a brief description of responder units and instructor consoles; and (b) a discussion of three commercial systems.

Instructional technology terms are defined in Appendix 1, a glossary of 196 definitions. Other appendices provide the names and addresses of major manufacturers of electronic teaching equipment, a bibliography of suggested readings, and data sheets for recording equipment characteristics.

DATA SUMMARY:

Media:	Audio-visual, television, computer-assisted instruction
Application:	None
Environment:	None
Key number:	1.5 Select Instructional Setting

Authoring aid type: Methodology
Number of pages: 124+
Number of references: 15

REFERENCE NUMBER: 2.1.1 DEVELOP OBJECTIVES

CITATION:

Barton, G. E. Performance objectives: A self-instructional booklet. Provo, Utah: Brigham Young University Press, 1973.

ABSTRACT:

This booklet teaches how to recognize and write technically correct performance objectives. Validated over a two-year period by hundreds of students and several instructional psychologists, the booklet is arranged in programmed-text format and consists of two parts.

Part One covers the three aspects of a technically-correct performance objective: behavior; criteria; and conditions. With clear examples, Barton notes that: (a) specified behavior should be observable and indicate proficiency at a task; (b) specified criteria should be measurable and appropriate, i.e., should match or be important qualifications of the desired behavior; and (c) specified conditions should describe the exact task characteristics to be mastered and list the resource materials available for use.

A self-check is given at the end of each section. The last self-check serves as a post-test for the program and can be taken at any time.

Part Two of the booklet consists of pages for writing technically correct performance objectives, and a key for critiquing the written performance objectives.

The author admits that writing instructional objectives is not always appropriate and includes an article discussing situations where more general learning statements -- called "worthwhile activities" -- should be used.

DATA SUMMARY:

Media:	Programmed text
Application:	Self-paced instruction
Evaluation:	"Hundreds of students and several instructional psychologists over a two-year period"

Environment:	Civilian
Key number:	2.1 Develop Objectives
Authoring and type:	Tool
Number of pages:	36
Number of reference:	None

REFERENCE NUMBER: 2.1.2 DEVELOP OBJECTIVES

CITATION:

Behavioral objectives training package. Amherst, Mass.: Evaluation Service Center for Occupational Education, 1971. (ERIC Document Reproduction Service No. ED 060 218)

ABSTRACT:

The purposes of this training package are: (a) to serve as a user's guide to writing and implementing effective behavioral objectives; (b) to provide an overview of the services provided by the Evaluation Service Center for Occupational Education (ESCOE); and (c) to suggest an alternative technique to aid the writing of behavioral objectives.

Part I defines behavioral objectives in terms of measurable performance, conditions under which the performance occurs, and extent to which the performance can be measured. These terms are analogous to the commonly-accepted terms of the basic structure of a behavioral objective: behavior; condition; and standard.

Part II discusses the operation of ESCOE. Essentially, the service is an information feedback/evaluation system for a decentralized, voluntary network of occupational schools called Local Education Agencies (LEAS). The LEAS submit raw behavioral objectives to ESCOE, which are then coded and placed in a computerized data bank. When a sufficient quantity of raw (original) objectives are available within a given subject area, they are retrieved from a data bank and synthesized by a panel of instructors active in that particular subject. The objective synthesis process combines raw objectives having the same or similar performance into one larger objective so that all variations of conditions and extent indicated by different LEAs are included. Criterion tests are constructed from these synthesized objectives which are then made available to the LEAs. Participating LEAs can access the total data bank, but information identifying the source of a given objective is blanked out when a printout is sent to an LEA other than the one submitting the original data.

A description of each section and instructions on how to fill in the required information are given for the objective input coding form (Behavioral Objective Reporting Form #12).

Part III of the report presents an article entitled "The Operationalizing of Fuzzy Concepts," which offers an alternative way of systematically breaking down a generalization into its measurable parts, i.e., into the structure suitable for an objective.

Sample transparencies are available from ESCOE for participating LEAs. A glossary of terms and phrases is given.

DATA SUMMARY:

Media:	Computer-based, print, visual
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.1 Develop Objectives
Authoring aid type:	Tool
Number of pages:	128
Number of references:	31

REFERENCE NUMBER: 2.1.3 DEVELOP OBJECTIVES

CITATION:

Dillman, F. E., Jr. Instructional objectives: Specificity and behavior. Menlo Park, California: Dillman Associates, 1971. (ERIC Document Reproduction Source No. ED 061 704)

ABSTRACT:

The basic structure of a behavioral/performance objective contains a required behavior, a specified standard, and a given condition. However, there are good objectives and there are not-so-good objectives. To write good, effective objectives, Dillman suggests that several conceptual factors be considered. His discussion is presented in programmed-text format with a self-review and answers and explanations at the end of each section.

The first factor is to ensure that an instructional objective rather than an educational goal is written. "An educational goal is a long-range and broader accomplishment to be achieved in a semester, in a school year, or even during a longer school experience, such as upon completion of high school. An instructional objective is, by contrast, a short-range accomplishment to be achieved in a day, a week - a relatively shorter time."

The second factor is to prevent an objective from being written so narrowly and restrictively that it becomes merely a learning activity or teaching step. But "if you are writing objectives that are too narrow, it doesn't necessarily mean that you should 'throw them out' -- when you get your objectives properly composed, the 'too narrow' objectives may still be used as teaching points or learning activities for the objectives you develop." In other words, objectives by nature have a requisite specificity.

The third factor is to write both the content and the language of the objective to the level of the target population, for significant behavior at one level may be insignificant at another. "Count to ten in one minute without external aids" may be a proper objective for first-graders but not for calculus students -- and yet the objective contains the basic parts: a behavior, a standard, and a condition.

The fourth factor is to not bury the intent of the objective in the preciseness of its words. "The problem in this area arises when a objective states that the student be able to cut out the pets in the picture." Does this require skill in cutting, or in discriminating? Does it call for indicator behavior or principal performance? If you want the learner to identify the pets, then demand identification. It is unfair to demand cutting (and the connotation to the pupil that this is the required skill) when identification is what the objective really requires.

Awareness of these factors plus skill in writing the basic parts of a behavioral objective should result in construction of good, effective objectives.

DATA SUMMARY:

Media:	Programmed text
Application:	Conventional and self-paced instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.1 Develop Objectives
Authoring and type:	Tool
Number of pages:	39
Number of references:	None

REFERENCE NUMBER: 2.1.4 DEVELOP OBJECTIVES

CITATION:

Objectives for instructional programs. Reference wall chart. Huntington Beach, California: INSGROUP Inc., 1975.

ABSTRACT:

Objectives for instructional programs is a reusable, multimedia instructional package providing up to 25 hours of group or self-paced instruction in writing and using measurable objectives. The Reference Wall Chart abstracted here is a four-color wall chart containing the major points of the instructional package in a concise but easily read format.

The chart has four divisions. The first division identifies the structure of measurable objectives as: (a) an outcome, which is also known as "behavior;" (b) an achievement level, also known as a "criterion;" and (c) the evaluation conditions, also known as simple "conditions." An extensive, categorized "shopping list" of outcome verbs that can be used to specify achievement levels and evaluation conditions is given.

The second division discusses three applications of measurable objectives: (a) learning objectives; (b) organizational objectives; and (c) program objectives. Definitions and examples for each application are given.

The third division presents several taxonomies of learning used to analyze sets of objectives in terms of logical sequence and complexity levels. Eight taxonomies in the cognitive, affective, and psychomotor domains are given. A simplified, INSGROUP-derived, seven-level classification scheme for sequencing sets of objectives on the basis of complexity is illustrated.

The fourth division contains brief annotated citations for taxonomies presented on the chart, and gives three addresses where collections of objectives may be obtained.

DATA SUMMARY:

Media:	Multicolor visual
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.1 Develop Objectives
Authoring aid type:	Tool
Number of pages:	1
Number of references:	15

REFERENCE NUMBER: 2.1.5

CITATION:

Preparation of learning objectives. Washington, D.C.: Department of the Navy, Bureau of Naval Personnel, 1968. (ERIC Document Reproduction Service No. ED 058 721)

ABSTRACT:

Prepared by the Bureau of Naval Personnel, this programmed workbook is intended to: (a) introduce the subject of learning objectives and explain their use and importance; (b) describe a Navy handbook on writing learning objectives and teaching students how to use the handbook as a working reference guide; and (c) provide practice in preparing relevant, practical learning objectives. Intended for military personnel, the workbook is useful for civilian practitioners too. The workbook contains three modules.

In Module I, Chapter 1 defines a learning objective as "an instructional goal expressed in terms of measurable student performance." Chapter 2 defines terminal objectives as representing what the student will be doing on the job while enabling objectives should close the gap between what the student knows now and what he is to learn. It is noted that an objective is classified as either terminal or enabling according to its purpose within the curriculum, and that what represents terminal performance for one course may represent enabling performance for a later, more advanced course or skill. Chapter 3 states that learning objectives are important because they support "the overall system of Consistent Course Design, Practical Instructor Guidance, and Job-Effective Student Instruction."

Module II introduces the Handbook for Writing Learning Objectives (NAVPERS 93510-2), the guidebook of the Bureau of Naval Personnel for developing learning objectives. Module II is written in a SCRIPT format (Selt-Confirming Recitation in Programmed Teaching) and presents a series of questions about the text. The format permits a student to pass quickly over known material, but directs him to sections of the Handbook needed for study. Upon completion of Module II, a review quiz is given that requires a student to: (a) select the scope of course, topic, and lesson objectives; (b) identify each of the three functional elements of a learning objective, without error, when presented with a model objective;

(c) select examples of knowledge, skill, and attitude categories of learning; (d) identify two purposes of a Topic Analysis Worksheet, when presented alternative answers in a multiple-choice format; and (e) identify three steps in learning objective analysis, when presented with alternative answers in a multiple-choice format.

Module III contains an exercise kit for using the Navy handbook as well as the handbook itself. Containing matching sets, constructed-response items, and similar learning-by-doing exercises, Module III covers the following topics: (a) concept-matching; (b) evaluating learning objectives; (c) constructing learning objectives; and (d) a carefully-structured final test in which the student writes a knowledge, attitude, and a skill objective. The test is graded upon completion. The scoring system consists of stars. For each question answered "Yes," 2 stars are awarded; for each question answered "No," no star is awarded. A rating scale ranges from 6 stars or less to 10 stars. Ten stars represents "outstanding" while 6 stars or less is "unsatisfactory." The scoring system could be upgraded.

DATA SUMMARY:

Media:	Programmed text
Application:	Self-paced instruction
Evaluation:	None
Environment:	Military (Navy)
Key number:	2.1 Develop Objectives
Authoring aid type:	Tool
Number of pages:	172
Number of references:	None

REFERENCE NUMBER: 2.1.6

DEVELOP OBJECTIVES

CITATIONS:

Rose, B. K., Balasek, J., Kelleher, J., Lutz, J. L., & Nelken, I. A programmed course for the writing of performance objectives. A constructed response linear program. Bloomington, Indiana: Phi Delta Kappa, Commission on Educational Planning, 1972. (ERIC Document Reproduction Service No. ED 073 528)

Rose, B. K., Balasek, J., Kelleher, J., Lutz, J. L., & Nelken, I. Writing performance objectives. Instructor's manual for teachers and administrators. To be used with a programmed course for writing of performance objectives. Bloomington, Indiana: Phi Delta Kappa, Commission on Educational Planning 1972. (ERIC Document Reproduction Service No. ED 073 529)

ABSTRACT:

Designed to help teachers learn how to write performance objectives, this well-written programmed text covers: (a) identifying goal statements; (b) identifying basic parts of a performance objective; (c) writing performance objectives; (d) writing cognitive objectives at the levels of knowledge, comprehension, application, analysis, synthesis, and evaluation; (e) recognizing psychomotor objectives at the levels of imitation, manipulation, precision, articulation, and naturalization (that is, achieving automatic and spontaneous responses); (f) recognizing and writing performance objectives in the affective domain; and (g) recognizing and writing performance objectives at the program level and the instructional level.

Each part of the text begins with objectives for the part and continues with logically-arranged frames containing frequent embedded questions and feed back. Part II teaches how to classify performance objectives into the cognitive, psychomotor, and affective domains, and how to specify which level in a domain the objective is intended to measure. Part III teaches how to write program level objectives relating to institutional goals and reflecting desired exit levels of student performance. Part III teaches how to write instructional level objectives for specific courses, disciplines, or units of work by grade level or curriculum area.

A series of assignments intended to review the previous information concludes the book. Topics covered include recognizing complete and incomplete performance objectives, completing performance objectives in two of six suggested curriculum areas, and identifying simple and complex performance objectives.

The instructor's manual accompanying the programmed text is designed to enable school districts to utilize effective management procedures for inservice training of teachers in writing performance objectives. The first four sections of the instructor's manual provide management guidelines and instructional aids for <u>defining</u> and <u>reviewing</u> the use of programmed materials. Management guidelines for <u>developing</u> programmed materials are given in Section 5. The presentation includes a description of sequential learning paths as an organizational technique for instructional system design.

DATA SUMMARY:

Media:	Programmed text (Course), Print (Handbook)
Application:	Self-paced instruction (Course and Handbook)
Evaluation:	None (Course and Handbook)
Key number:	2.1 Develop Objectives (Course and Handbook)
Authoring aid type:	Tool (Course and Handbook)
Number of pages:	49 (Course), 38 (Handbook)
Number of references:	17 (Course), None (Handbook)

REFERENCE NUMBER: 2.2.1 DEVELOP TESTS

CITATION:

Brown, L., Brooks, G., Cocks, P. J., and Kersch, M. E. Evaluation for individualized instruction. An operational guide for teacher workshops. Downers Grove, Ill.: Institute for Educational Research, 1972. (ERIC Document Reproduction Service No. ED 066 492)

ABSTRACT:

Presented in this operational guide for teacher workshops are 11 instructional sessions concerned with: (a) educational objectives; (b) global objectives; (c) behavioral objectives; (d) hierarchy of learning objectives; (e) purposes of achievement testing; (f) techniques of measurement; (g) multiple-choice items; (h) basic statistical measures; (i) test analysis interpretation of computer output; (j) validity and reliability, and (k) the liaison role of the workshop participant. The discussion relating to testing is given below.

Multiple-choice test items consist of two parts, a stem or lead and alternatives. Faults can be written unintentionally into either part. A list of 10 common faults of multiple-choice test construction is followed by a fault exercise sheet. The faults are: (a) behavior elicited by test items does not match the behavior stated by the applicable objective; (b) the item stem does not present a single, definite, important problem; (c) the item alternatives do not include a single, correct, best answer or completion; (d) an incomplete item stem does not include as much of the problem as possible, which may lead to several possible correct alternatives; (e) the item alternatives are not stated as briefly as possible; (f) the item is not stated in positive terms and, when a negative is used, it is seldom underlined or capitalized; (g) the item alternatives are not grammatically consistent with the stem; (h) alternatives are not approximately similar in grammatical construction, degree of precision, or length; (i) alternatives are implausible and, therefore, do not tempt students with incomplete or superficial knowledge of the subject; and (j) alternatives contain a "trick" word in an otherwise correct response just for the purpose of catching the reader offguard.

In the test analysis instructional session, brief discussions of item difficulty, item discriminating power, and correct scores are presented. A series of computer printouts of various test analyses follow the discussion, and then a list of 52 study questions in four categories is given: (a) format and general data; (b) test items; (c) students as individuals and as groups; and (d) uses of data for decision-making.

Creation of a test-item data bank was one purpose of the workshops. It is unknown at this time whether a data bank was in fact created.

DATA SUMMARY:

Media:	Computer-based
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.2 Develop Tests
Authoring aid type:	Tool
Number of pages:	90
Number of references:	9

REFERENCE NUMBER: 2.2.2

DEVELOP TESTS

CITATION:

CSE-RBS test evaluations: Tests of higher-order cognitive, affective, and interpersonal skills. Los Angeles: University of California, Graduate School of Education, Center for the Study of Evaluation, 1972.

ABSTRACT:

The Center for the Study of Evaluation (CSE) and Research for Better Schools (RBS), Inc. conducted a study to: (a) determine the number and quality of testing instruments available for measuring higher-order cognitive, affective, and interpersonal skills; and (b) to reveal areas where such instruments were not available. Approximately 2600 tests and scales were collected and evaluated. Of 429 categories in the three areas, 183 (43%) had no available test, and 179 (42%) contained 10 or fewer tests. The quality of the instruments was rated predominately poor to fair.

An evaluation instrument was developed which rated all instruments according to seven criteria: (1) Validity; (2) Examine appropriateness, i.e., its suitability for an examiner or examinee in terms of comprehension level, physical format and response mode; (3) Normed excellence concerning reliability, replicability, and refinement of test results; (4) Teaching feedback; (5) Usability; (6) Retest potential, meaning the number of alternate testing forms available; and (7) Ethical propriety, which considered questionable administrative procedures or test content, and treatments which were inappropriate, insulting, or offensive to the examinee. As the underlined letters indicate, the evaluation instrument was called VENTURE.

The section for tests of higher-order cognitive skills included measures of disposition, cognitive styles, strategies, and skills. A two-dimensional classification scheme was developed for the evaluation of cognitive tests. Rows were labeled with category descriptors such as "classifying" and "inventing - ideating." Columns were headed by content identifiers such as "verbal-semantic," and "symbolic." Cells indicated the code assigned to the interaction between the two dimensions, and included the number of tests collected and analyzed in each category.

The section for tests of affective skills generally included measures of traits or dispositions that hold constant for an individual in different situations. As in the previous section, a two-dimensional matrix for test evaluation was developed. Rows were identified by six affective skills categories which in some cases were subcategorized. Six major affective skills were listed: (1) personal temperament; (2) social temperament; (3) attitudes, opinions, beliefs; (4) needs; (5) interests; and (6) values. Columns were labeled with classification descriptors such as "Reports About Self: Description" and "Behavioral Measures: Actual Measures." Cells contained assigned codes and the number of tests collected and evaluated for each category or subcategory.

In the third section, tests of interpersonal skills focusing on specific, concrete, social situations and measuring the behaviors exhibited by an individual in those situations were evaluated. This aspect generally distinguishes tests of interpersonal skills from tests of affective skills. For example, a test which measured aspects of a student's relationship with his actual teachers was assigned to the interpersonal skills section; but a test which measured the valence of a student's attitude toward teachers in general was listed in the section on affective skills. A three-dimensional morphological model evaluated test type by role by situation. Test types were: (a) reports about self; (b) reports about others; and (c) behavioral measures. Roles included relations with: (1) peers; (2) authorities; (3) subordinates; and (4) people-in-general. Situations for the first roles included: (a) at school; (b) at home; (c) other; and (d) general. For the last role, the situation "at work" replaced "other" and "general." Cells contained assigned codes for each test category and the number of tests collected and evaluated in that category.

Two indexes included in the volume provide: (a) the tests and scales arranged in alphabetical order with section/cateogry number; and (b) publication, distribution, and reference sources for the tests and scales.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None

Environment:	Civilian
Key number:	2.2 Develop Tests
Authoring and type:	Tool
Number of pages:	322
Number of references:	None

REFERENCE NUMBER: 2.2.3 DEVELOP TESTS

CITATION:

Gronlund, N. Preparing criterion-referenced tests for classroom instruction. New York: Macmillan, 1973.

ABSTRACT:

Gronlund presents a practical guide to preparing and using criterion-referenced tests (CRT) in classroom instruction. Chapter 1 discusses the nature of six requirements for effective CRT. The six requirements are: (a) a clearly defined and specified domain of learning tasks; (b) clearly specified standards of performance; (c) clearly defined behavioral objectives; (d) adequate sampling of student performance within each area of performance; (e) test items that reflect the behavior specified in the instructional objectives; and (f) criterion scores measuring performance to an objective standard.

Chapters 2 and 3 discuss use of CRT at the mastery level (i.e., achievement of minimum standards) and at the developmental level (i.e., achievement beyond minimum standards, such as thinking and understanding skills).

Chapter 4 describes the procedures for planning a test as: (a) delimit the unit of instruction to be measured; (b) state the objectives in specific terms; (c) make a content outline; (d) prepare a table of specifications; (e) set pass-fail standards; (f) select the type of test item to be used; (g) write the test items; (h) organize the item pool into a test; and (i) create a test-results report form for student use.

Chapter 5 tells how to write short-answer, multiple-choice, true-false, and matching test items. It also includes several rules for writing test items. They are: (1) ensure that the item elicits the specific behavior called for in the objective; (2) make the task to be performed clear and definite; (3) delete non-functional material from the item; (4) reject irrelevant factors that prevent the student from correct responses; (5) delete irrelevant clues that might lead to unintended correct or incorrect responses; (6) write the test item at the proper level of difficulty; (7) insure that the correct answer is agreed upon by subject-matter experts; (8) write the item in positive form whenever possible; and (9) write enough test items so that a validated test item pool may be selected.

Chapter 6 discusses the use and appraisal of criterion-referenced tests.

Three examples of tables of specifications for 40-, 60-, and 100-item tests are given which allow a clear breakout between the number of test items per subject content area and specific performance type. Appendix A contains a check list for evaluating CRTs which may be used after test item construction to ensure that the test plan, test items, and test format will adequately measure behavioral outcomes.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.2 Develop Tests
Authoring aid type:	Tool
Number of pages:	55
Number of references:	12

REFERENCE NUMBER: 2.2.4

DEVELOP TESTS

CITATION:

Stevens, J. C., and O'Neil, H. F., Jr. Some guidelines for development and review of multiple-choice questions. Austin: University of Texas Press, 1976.

ABSTRACT:

This report from Stevens and O'Neil is divided into two sections. The first section is a discussion of the advantages of multiple-choice questions, the different forms of multiple-choice questions, and methods for varying item difficulty. The second section lists, with examples, eight guidelines for writing and reviewing multiple-choice questions. The guidelines are as follows. First, the multiple-choice item should be meaningful by itself and should present a definite problem. Second, the item stem should include as much of the problem as possible and should be free from irrelevant material. Third, negatively-stated item stems should be avoided whenever possible. Fourth, all alternatives should be grammatically consistent with the stem of the item. Fifth, a multiple-choice item should contain only one correct or clearly best answer. Sixth, all alternatives should be plausible; ensure this by drawing alternatives from the same domain of information, by excluding uncorrelated facts, and by considering the previous learning experience of the student. Seventh, avoid verbal association between the stem and the correct answer; an example of verbal association between a word in the stem (locality) and a word in the alternative (local) is given by the following question:

"Which of the following agencies should you contact to find out about a tornado warning in you locality"?

a. State farm bureau
b. Local radio station
c. U.S. Post Office
d. U.S. Weather Bureau.

Eighth, the relative length of the alternatives should not provide a clue to the answer.

Three additional guidelines are given without examples: (a) seldom use special alternatives such as "none of the above" or "all of the above"; (b) place the correct answer in each alternative position approximately an equal number of times, but in random order; and (c) have a competent colleague independently review the test items.

In addition, twelve undesirable multiple-choice item constructions with examples and four desirable constructions with examples are given.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	2.2 Develop Tests
Authoring aid type:	Tool
Number of pages:	22
Number of references:	7

REFERENCE NUMBER: 2.2.5

CITATION:

Stevens, J. C., and O'Neil, H. F., Jr. Suggestions for development of test items. Austin: University of Texas Press, 1976.

ABSTRACT:

An operational definition for test item development has two components. First, test item development is a set of operations by which a syntactic structure is assigned to an instructional sentence. Second, test item development is a set of operations performed on that syntax which transforms the relevant segments of the instructional sentence into test items. Stevens and O'Neil argue that the operational definition of test item development is useful for deriving test items from actual instructional sentences through a technique called item transformation. The technique assigns a syntactic structure to an instructional sentence in terms of subject, verb, object, and prepositional phases and transforms the sentence components into questions. The technique is illustrated with five different types of questions. The first two techniques are suitable for rote memory testing situations; the last three are intended for comprehension and higher level testing.

First, verbatim instruction can be made into yes/no, true/false, short answer, and multiple-choice questions. Yes/no questions can be derived by simply taking a sentence directly from the instructional material, deleting the period, and adding a question mark. True/false questions can be made by simply taking a sentence from the instructional material and adding the appropriate directions at the beginning of the test; since most true/false tests have a large porportion of true statements, three ways are suggested for deriving false items. Short-answer questions can be created by identifying the desired sentence component (a subject phrase, for example) and deleting it for the question. Multiple-choice questions can be derived by a similar procedure. Base sentences are transformed into stems by identifying the segment to be deleted and then deleting it. Alternatives are generated by identifying the structure of the correct response and taking words, phrases, or sentences with similar structure from the instructional materials and using them as distractors.

Second, transformed verbatim instruction can be made into questions by using the wh-transformation. To accomplish the wh-transformation, a test writer must: (a) study the structure of the sentence; (b) select the segment to be tested; (c) delete the segment; (d) replace the deleted phrase with a wh-word and (e) shift the wh-word to the front of the sentence. There are four groups of wh-words. First, who and what are used to replace human and nonhuman nouns, respectively. Second, which is used to replace noun modifiers. Third, how, when, where, and why are used to replace the various adverbial categories. Fourth, a form of what do is used when the verb is deleted. Alternatives are generated by the process noted above.

Third, paraphrase questions can be developed by paraphrasing the base sentence, deleting a segment from the paraphrase, or transforming the paraphrase into a wh-question. A statement is defined as a paraphrase of another if (a) they have no substantive word in common, i.e. nouns, verbs, and modifiers, and (b) they are equivalent in meaning. The authors note that not all sentences can be paraphrased, especially those using proper nouns and words of a highly specific or technical nature.

Fourth, questions can be formed by substituting particular terms for superordinate terms. A term is superordinate if at least some of the members of the class can be named without repeating the superordinate term. For example, the word "tool" is a superordinate term because each member of the class has a particular name, i.e. pliers, hammers, wrenches, etc. To derive a question formed by substituting particular terms for superordinate terms, (a) replace every superordinate term in the base sentence with a particular item, (b) substitute synonyms for every remaining substantive word, (c) delete a segment, or (d) form a wh-question.

Fifth, questions can be formed by applying the opposite process, that is, by substituting superordinate terms for specific terms. The meaning of the sentence is enlarged but not changed completely by the procedure. For example, the superordinate term "supplies" was substituted for the particular term "pencils" in the following sentences:

base sentence: "The phrase Base Service Store Item tells you that pencils are not subject to normal issue procedures."

transformed sentence: "The phrase Base Service Store Item tells you that certain supplies are not subject to normal issue procedures."

To create questions by substituting superordinate terms for particular terms, (a) replace particular terms with superordinate terms, (b) replace all substantive words with synonyms, or paraphrase where appropriate, (c) delete a segment, or (d) form a wh-question.

Although some of these transformations may appear quite complex, numerous examples are clearly presented which show how each transformation "works" on actual instructional materials.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	2.2 Develop Tests
Authoring aid type:	Tool
Number of pages:	23
Number of references:	7

REFERENCED NUMBER: 2.2.6

DEVELOP TESTS

CITATION:

Swezey, R. W., and Perlstein, R. B. Developing criterion-referenced tests (Report No. 287-AR18(2)-IR-0974-RWS). Arlington, Va.: U.S. Army Research Institute for the Behavioral and Social Sciences, Unit Training and Educational Technology Systems Area, Performance Measurements and Standards Work Unit, March 1974. (NTIS Document Reproduction Service No. AD A014 987)

ABSTRACT:

Though the difference between normative-referenced tests and criterion-referenced tests (CRT) may not always be obvious, Swezey and Pearlstein argue that a test is criterion-referenced if: (a) the test items are based upon training objectives developed from performance objectives external to training; (b) the test itself is primarily used to measure mastery; and (c) the test score is based upon absolute standards such as job competence rather than relative standards such as class standings. Based on those three criteria, the authors present a how-to guide for development and administration of CRT. The guide contains review questions and answers for each chapter as well as large fold-out flow charts which identify the CRT developmental step to which a chapter refers. The CRT developmental process is divided into four steps.

The first step is to develop adequate objectives. Three levels of objectives are defined. Level 1 objectives are prepared according to doctrine and/or actual, meaningful units of work which occur in an operational environment. Level 2 objectives are modified Level 1 objectives which match training resources and safety requirements and indicate what a student must be able to do at the end of training. Level 3 objectives -- commonly called Enabling Objectives or Learning Elements -- indicate what a student must know and do as prerequisites to attaining Level 2 objectives.

The second step is to develop a test plan by examining practical constraints, deciding the type, number, and fidelity (realism) of the test items, planning item sampling or sampling among conditions, and documenting the entire test plan. Practical examples and a test plan worksheet are given.

The third and fourth steps are to build an item pool and select the final test items for instruction. For the item pool, the authors recommend that twice as many items be developed as are specified in the test plan so the pool can be evaluated, appropriate items selected, and alternate test forms developed.

For selecting final test items, specific guidelines for determining the correct tryout sample size (versus total student flow), conducting the tryout, analyzing tryout results, and reducing the item pool are given. The PHI coefficient was chosen as an item analysis technique, and practical examples thoroughly illustrate its use. Two worksheets are given, one for recording feedback from tryouts and another for summarizing the results of item pool reviews in terms of organizational flow.

The final sections of the manual, Administering and Scoring CRTs and Assessing Reliability and Validity, are essentially dependent upon specific testing environments and available statistical resources and, therefore, may not be readily transferable as authoring tools or procedures.

Five appendices are included: (a) Checklist for Constructing CRTs; (b) Checklist for Evaluating CRTs; (c) Glossary; (d) Square Root Tables; and (e) Review Questions and Answers.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Army)
Key number:	2.2 Develop Tests
Authoring aid type:	Tool
Number of pages:	210
Number of references:	None

REFERENCE NUMBER 2.3.1

DESCRIBE ENTRY BEHAVIOR

CITATION:

Bierbaum, G. A., and Planisek, R. J. An index and procedure for readmitting the the academically dismissed student. Kent, Ohio: Kent State University, 1969. (ERIC Document Reproduction Service No. ED 063 555)

ABSTRACT:

An index and procedure were developed to establish the probable academic success of students seeking readmission after academic dismissal. Covering the period 1959 to 1969, data were obtained on 1460 students from four college deans. The data were analyzed, and an index and procedure based on the minimum grade point average (GPA) needed to graduate were created.

The data indicated the range of dismissals for students returning for one term as follows: (a) for freshmen, the range of dismissals was 79% to 94%; (b) for sophomores, 62% to 79%; (c) for juniors, 44% to 56%; and (d) for seniors, 9% to 40%. The farther along a student was at the time of his academic dismissal, the better were his chances for graduating after readmission. Readmission data indicated: (a) 10% to 20% finally graduated; (b) 35% to 50% were dismissed again; and (c) 15% to 30% did not return after readmission.

A chart was constructed with credit hours ranging from 1 to 200 along one dimension, and the GPA ranging from 0 to 2.00 in .05 increments along the other dimension. Two indices were then retrieved from the cells of the chart. The first index computed the minimum required GPA needed each term after readmission for graduation. The GPA multiplied by the credit hours needed to graduate (the total was called 'earned quality points') minus the earned quality points at the time of dismissal provided an indication of the quality point deficit to be overcome for graduation. The second index calculated the difference between the cumulative GPA at dismissal and the minimum required GPA needed to graduate. Thus, the minimum GPA to be maintained each semester after readmission was obtained.

Given the two indexes and the four samples of readmitted students, another chart was plotted to establish a criticality index. Successful readmissions were plotted as stars, and unsuccessful readmissions were plotted as black dots. A line drawn to optimize the discrimination between the stars and the dots indicated that,

for the Arts and Science College, a minimum GPA performance of 2.20 was required for readmission.

It is noted that more rigorous statistical approaches could be considered in relation to their effectiveness when compared to the ease of using this empirically-derived index. Samples plotted over time may suggest trends such as effects attributed to changing academic deans.

DATA SUMMARY:

Media:	None
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key Number:	Describe Entry Behavior
Authoring aid type:	Procedure
Number of pages:	17
Number of references:	None

REFERENCE NUMBER: 2.3.2 DESCRIBE ENTRY BEHAVIOR

CITATION:

Ecternacht, G. J., Reilly, R. R., and McCaffrey, P. J. Development and validity of a vocational and occupational interest inventory (Report No. AFHRL-TR-73-38). Lackland Air Force Base Texas: Air Force Human Resources Laboratory, Personnel Research Division, December 1973.

ABSTRACT:

An interest inventory designed to measure the vocational interests of enlisted men entering the Air Force was developed. The inventory, called VOICE for Vocational and Occupational Interest Choice Examination, was based upon 3,072 surveys returned by servicemen with at least six months on-the-job experience in eight Air Force career fields and an additional 300 recruits in basic training. The purpose of the effort was to develop and validate a prototype interest inventory to be used in the Guaranteed Enlistment Program.

Four hundred occupational interest items, each representing an activity, were written after completing a survey of the Educational Testing Service's test collection, a review of relevant occupational interest inventory, and an examination of Air Force Manual 39-1 (which contains descriptions of all Air Force jobs) and the Dictionary of Occupational Titles. The items were grouped into four sections: (1) occupations (90 items); (2) work tasks (210 items); (3) leisure activities (70 items); and (4) desired learning experiences (30 items). These sections composed the interest inventory.

Four job satisfaction scales were also developed. They were: (1) Job, which measured "intrinsic satisfaction with the actual work activity;" (2) Peer, which measured satisfaction with one's co-workers; (3) Supervision, which measured satisfication with one's supervisor; and (4) Air Force, which measured satisfaction with Air Force working conditions.

Starting with scales developed on half-samples, an elaborate cross-validation technique described in Section IV was used. Briefly summarized, a comparison was made of the number of "hits" (i.e., correctly predicting that an individual was a member of a career field) achieved when using the instrument versus the number

of hits achieved without it. It was concluded that the instrument was useful in measuring vocational interests. However, test-retest reliability was unsatisfactory, and the authors remark, "The actual correlations for each scale have not been presented since such a presentation might result in an inaccurate condemnation of scale reliabilities. Estimation of scale reliabilities should be performed in the future under rigid conditions so that the estimates may be reported."

An appendix provides a listing of items in the interest inventory.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	Method: Cross-validation and test-retest correlation. Sample size: 1,537 airmen for Sample 1, 1535 airmen for Sample 2.
Environment:	Military (Air Force)
Key number:	2.3 Describe Entry Behavior
Authoring aid type:	Procedure
Number of pages:	83
Number of references:	17

REFERENCE NUMBER: 2.3.3 DESCRIBE ENTRY BEHAVIOR

CITATION:

Mockovak, W. P. Literacy skills and requirements in Air Force career ladders (Report No. AFHRL-TR-74-90). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, December 1974.

ABSTRACT:

Fifty-six Air Force career ladders representing 35 career fields were examined in order to determine: (a) the reading requirement level (RRL) of each career ladder; (b) the reading ability level of personnel in each career field; and (c) whether a "literacy gap" existed between the two measures. Subject matter specialists in each career field performed a readability analysis of random samples of training materials, technical orders, and Career Development Course (CDC) materials. Also, scores on Airman Qualification Examinations (AQEs) were converted to estimated reading grade levels by a validated conversion procedure.

It was concluded that: (a) reading skills and requirements varied widely among career ladders; (b) in many career fields, materials were not written to the reading ability level of the user; and (c) as reading ability level of personnel dropped in different career ladders, there was no matching drop in reading demands imposed on trainees and job incumbents.

Reading requirement levels (RRL) varied from a low of 10.6 in the Cook career ladder to a high of 14.0 in the Telephone Switching Equipment Repairman ladder. Two tables give RRL for the 56 career ladders and for the 35 career fields. Due to constraints, it was not possible to determine what effect job experience had on reducing a job's reading demand or to estimate the relative importance of reading in career ladders.

Reading grade level varied from an average of 9.1 in the Aircraft Pneudraulic Repairman specialty to 14.6 in the Programming Specialist ladder. The average reading grade level across the Air Force career ladders was 10.8.

Four decision rules for determining "literacy gaps" are given. They range from 50-50 (50% of the personnel can read and understand 50% of the reading

material they encounter) to 75-85 (85% of the personnel can read and understand 75% of the material encountered). The decision rules are applied to ten career fields, and it is was concluded. that reading improvement programs should be applied to career fields with minor "literacy gaps" while, for other career fields, rewritten materials should be considered. The author notes that the problem of "literacy gaps" is too complex and has too many implications for training to be discussed in detail in this report.

An appendix gives the estimate average reading grade level of USAF personnel by career ladder.

DATA SUMMARY:

Media:	None
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	2.3 Describe Entry Behavior
Authoring aid type:	Procedure
Number of pages:	32
Number of references:	15

REFERENCE NUMBER: 2.3.4

DESCRIBE ENTRY BEHAVIOR

CITATION:

Vitola, B. M., Mullins, C. J., and Brokaw, L. D. Quality of the all-volunteer Air Force - 1973 (Report No. AFHRL-TR-74-35). Lackland Air Force Base, Texas: Air Force Human Resources Laboratory, Personnel Research Division, April 1974. JSAS Catalog of Selected Documents in Psychology, 1974, 4, 153. (Ms. No. 820)

ABSTRACT:

Characteristics of aptitude, race, age, education, and geographic area of enlistment of all-volunteer force enlistees were studied. The following conclusions were reached; (a) average aptitudes of 1973 enlistees in the mechanical and electronics areas showed an increase over 1971 and 1972 enlistees; (b) average aptitudes of 1973 enlistees in the general and administrative areas showed a decrease when compared to 1971 and 1972 enlistees; (c) an appreciable loss of enlistees occurred who had completed post-high school education, which was accompanied by an annual downward shift of percentages of first-term airmen scoring in the higher centile levels of the Airman Qualification Examination (AQE); (d) compared to other areas, the 1973 aptitude level patterns of South-Southwest enlistees were not consistently low, as they were in 1970 through 1972; (e) 1973 aptitude levels of black enlistees were higher than 1970 through 1972 aptitude levels, across both geographic areas of enlistment and total sample; (f) a need may exist to offer incentives to high-aptitude people in the general and electronics areas; and (g) Air Force operational capability does not seem to be significantly affected by the zero-draft environment. The conclusions are based on data from 324,935 male, nonprior-service basic trainees. The data source was the Air Training Command (ATC) personnel processing files on nonprior-service accessions.

Three additional points are made. First, the removal of the draft as a motivator for enlistment resulted in a decreased number of accessions completing education beyond the high school level. In 1970, 18 percent of the total accessions had 13 or more years of education; by 1973, the number dropped to 7 percent. Second, the discharge rate for first-term airmen after four years was 79 percent. Third, the average difference on mean scores for AQE aptitude composites between blacks and nonblacks decreased.

DATA SUMMARY:

Media:	None
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	2.3 Describe Entry Behavior
Authoring and type:	Procedure
Number of pages:	14
Number of references:	7

REFERENCE NUMBER: 2.4.1 DETERMINE SEQUENCIAL STRUCTURE

CITATIONS:

Dansereau, D. R., Evans, S. H., Wright, A. D., Long, G. and Atckinson, T. Factors related to developing instructional information sequences: Phase I (Report No. AFHRL-TR-73-51(I)). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, March 1974.

Dansereau, D. R., Evans, S. H., Atckinson, T. A., and Long, G. L. Factors relating to the development of optimal instructional sequences (Report No. AFHRL-TR-73-51(II)). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, June 1974.

ABSTRACT:

In Phase I of the study, an extensive review and synthesis of the literature relating to the impact of selected variables upon the design and development of effective instructional sequences were conducted. A major conclusion drawn was that the findings of previous studies were consistently inconsistent. Some studies found greater performance with application of particular sequences while others did not. A portion of the inconsistency was attributed to methodological faults. For example, a number of studies reported that branching sequences (versus fixed sequences) resulted in better terminal performance and/or less time to complete instruction. Although branching was the variable being manipulated intentionally, it generally led to fewer items being presented in comparison to the fixed sequence. Thus, it was possible that the evident improvement was due in fact to a reduced number of instructional items rather than branching *per se*. Further, a fixed sequence with the right items dropped may produce the same results as the branching technique.

Three other factors causing inconsistent findings were: (a) lack of systematic procedures for describing information structures and for developing instructional sequences; (b) lack of sensitive dependent measures for assessing sequence effects; and (c) lack of attention to individual differences in information processing styles and capacity.

In addition to the literature review and analysis, three pilot studies were conducted in preparation for the main experiment reported in Phase II. The pilot studies: (1) identified an appropriate presentation rate for the main experiment (45 seconds per page); (2) selected Air Force materials of differing difficulty for the main experiment; and (3) chose two instructional sequences plus the original Air Force sequences for the main experiment.

The main experiment, reported in Phase II, was designed to: (a) assess the utility of multidimensional scaling (called INSCAL) as a procedure for describing the information structure of Air Force instructional material and to investigate INSCAL's potential for generating effective instructional sequences; (b) determine if information sequence requirements interacted with a measure of intellectual ability, namely, the Delta Reading Vocabulary Test; (c) determine the effect of two alternative presentations (verbal and pictorial/graphic) on test performance; (d) assess the interaction of instructional material difficulty with other independent variables; and (e) determine the usefulness of two new performance measures, a concept-close procedure and a similarity-judgement methodology.

Based on data from 180 students, the conclusions were: (a) INSCAL was useful for defining information complexity of technical material, developing instructional sequences within technical material, and providing an index of expert inter-rater consensus; (b) alternative instructional sequences affected student performance; (c) small performance differences resulted when pictorial technical information sequences were compared to verbal print sequences; (d) increased technical difficulty of instructional materials decreased student performance; (e) reading aptitudes were significantly related to performance in both pictorial and verbal print presentation modes; and (f) instructional sequences did not interact with student aptitudes.

DATA SUMMARY:

Media:	Programmed text and visual
Application:	Individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	2.4 Determine Sequence and Structure
Authoring and type:	Procedure
Number of pages:	91 + (Phase I), 37 (Phase II)
Number of references:	110 (Phase I), 1 (Phase II)

REFERENCE NUMBER: 2.4.2 DETERMINE SEQUENCE AND STRUCTURE

CITATION:

<u>Intensification of the learning process: Diagnostic instruments -- Learner state check list evaluation response form</u>. Doylestown, Pa.: Bucks County Public schools, February 1970. (ERIC Document Reproduction Service No. ED 063 345)

ABSTRACT:

Intended for elementary public schools but also useful for more advanced grades, check lists for determining students' positions along a curriculum scale are presented. A behavioral objectives evaluation response form is included. The checklists and response form are designed to clarify such questions as: (a) should behavioral objectives, and, hence, instructional materials, be grouped by grade or across grade level by subject matter; and (b) should behavioral objectives be grouped by curriculum area? Clarification results from the clear listing and specification of learner states for various curriculum areas, and from the response form which describes the extent to which a concept or skill being taught is learned and provides a means for recording successive trials or responses until mastery is achieved (maximum number of trials in this particular application was 4).

To determine how well a student achieves behavioral objectives, the response form uses four numbered codes. The first code is 0 (zero) and indicates that the student is utterly unable to perform the behavioral objective performance requirements. Reevaluation of the diagnostic input as related to the individual's prescription is needed. The second code is 1 and indicates some measurable ability to perform in the manner prescribed but only after additional prompting. Reevaluation is still necessary. The third code is 2, meaning that the learner's operational level indicates partial mastery, but requires strengthening in the specific context of the prescribed objective(s). Reevaluation is still necessary. The fourth code is 3, indicating that the learner's operational level approaches the optimum level. He is able to achieve the performance level required by the objective. In fact, such outstanding performance may be achieved that reevaluation is needed in order to restructure future objectives.

Although the above procedure is a simple approach, it may provide a good manual backup for assessing student performance and determining learning sequences in computer-based learning systems.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	2.4 Determine Sequence and Structure
Authoring aid type:	Tool
Number of pages:	71
Number of references:	None

REFERENCE NUMBER: 3.1

SPECIFY LEARNING EVENTS/ACTIVITIES

No tools or procedures were identified for this activity.

3.2 Specify Instructional Management Plan and Delivery System

This ISD activity consists of three principal steps. First, appropriate media for use in the instructional system are selected. A systematic approach to media selection requires consideration of the nature of the objectives and of the learning category for each group of objectives, the use of learning guidelines and the learning activities required by those guidelines. Since instructional requirements vary for different learning objectives, equipment and faculty constraints, cost of procurement and replacement, development costs, and study characteristics must be considered. Second, a course management plan is developed. It indicates exactly how instruction is to be conducted, how students are to be managed and tested, what instructors and support personnel are to do, and how all system elements interrelate. Third, a system management plan based on these decisions is prepared which, in addition to being a clear explication of system policy and operation, assists in internal evaluation of the system.

More than any other ISD step in the IPISD model, specifying an instructional management plan and delivery system hinges on decisions based upon policy. Virtually no decision is made in this activity which does not affect several different activities, commit various resources, or affect the utilization of personnel and facilities. The decision-maker must be aware of the possible alternatives to a particular plan and provide--or be provided with--information about facilities, personnel, and other available resources. Decisions made in the execution of this ISD activity are based upon something beyond, or in addition to, the evidential rightness or wrongness of a technical approach. The decisions are based upon constraints, implications and priorities. In a word, they are based upon policy, and policy cannot be proceduralized in the form of a generalized, transportable tool or procedure for course developers.

For this reason, the references in this section are handled differently from references in other sections. First presented are six abstracts of documents which are seen as useful to the decision-making process in any environment or instructional setting. Following that is a list of citations <u>only</u> which are representative of the type of literature which may aid the decision-making process that is so much a part of specifying an instructional management plan and delivery system. Whether or not a particular citation is considered a tool or procedure depends upon the context of the instructional or delivery system being considered. These citations are offered to provide some indication of the types of activities contained in this ISD step and, for those interested in a specific area, to provide some leads to additional literature.

REFERENCE NUMBER: 3.2.1

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

CITATION:

Bretz, R. The selection of appropriate communication media for instruction: A guide for designers of Air Force technical training programs (Report No. R-601-PR). Santa Monica, Calif.: RAND Corporation, February 1971.

ABSTRACT:

Bretz defines communication media as a complete system for the communication of messages, which generally encompasses a process for the production of programs, a process for the delivery of these programs, and a means for program display. The primary input to the system is the message it processes. Secondary inputs to the system consist of capital equipment, labor, expendable materials for program planning and production, and engineering and administration functions. The primary output of the system is the message that was put in a suitable format, i.e., displayed programs or displayed data. It is but one element of an instructional system, since it helps the instructional system to bring about student learning. When the primary purpose of a communication medium is to cause learning, then it may be considered an instructional medium. This report addresses only "self-contained communication systems which have reproducable software; supplementary media such as audio and visual aids, which only assist a teacher in presenting a lesson, are not considered."

Communication media, equipment configuration, and program content for eleven different uses of communication in instruction are discussed: (a) providing knowledge of learning objectives; (b) motivating the learner; (c) presenting information; (d) stimulating discussion; (e) directing learner activities; (f) conducting drill and practice; (g) reinforcing learning; (h) providing a learner-simulator interface; (i) evaluating learner progress and program effectiveness; (j) assisting the administration of instructional systems; and (k) assisting the research and development function of instructional systems. A procedure is described for selecting media based on a given instructional need. The selection is based on required learning objectives, subject matter content, learner population characteristics, and the instructional method chosen (such as lecture, self-paced, or a combination of both). Four specific questions in media selection are

considered: (a) is there a need for visual presentation; (b) is there a need for audio presentation; (c) is there a need for full motion; and (d) what media mix is optimum for presenting abstract information?

A comprehensive glossary of terms used in the report and for media use in general is given.

DATA SUMMARY:

Media:	Audio, visual, video
Application:	Individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Authoring aid type:	Procedure
Number of pages:	65
Number of references:	10

REFERENCE NUMBER: 3.2.2

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

CITATION:

Lonigro, J. K., & Eschenbrenner, A. J., Jr. A model for selecting the media in technical/vocational education. In H. Hitchens (Ed.), Selecting media for learning: Readings from Audiovisual Instruction. Washington, D.C.: Association for Educational Communications and Technology, 1974.

ABSTRACT:

A model is presented for selecting media for technical/vocational education. Five factors are considered: (a) types of learning required for a job task; (b) proficiency levels required; (c) types of learning/media matches; (d) proficiency levels achieved by various learning types/media matches; and (e) relative production costs of various media.

Two applications of the model are discussed in the area of electronics technical training. Three steps are required for applying the model: (a) identify the type of behavior to be learned; (b) specify the selection constraints in terms of required proficiency and acceptable cost; and (c) plot proficiency which can be achieved by specific media versus costs for specific media.

A "Gameboard for Media Selection" is given. One axis indicates proficiency levels from low to high. Another axis indicates production costs from low to high. Data for plotting the gameboard are given in Figures 1 and 2. Figure 1 has eight rows for media and five columns for types of learning. The cells of the matrix contain the proficiency levels which can be achieved by using the types of media. Figure 2 gives the production costs for eight types of media in terms of relative lows to highs. When the required proficiency level for a type of learning and the acceptable cost for media production are identified, they are plotted on the gameboard. A clear comparison of type of media versus cost and proficiency level results.

DATA SUMMARY:

Media:	Still pictures/graphs, motion pictures, television, simulation, audio recordings, programmed instruction, tape/slide, computer assisted instruction.
Application:	Media Selection
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Authoring aid type:	Tool
Number of pages:	4
Number of references:	6

REFERENCE NUMBER: 3.2.3

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

CITATION:

National Security Industrial Association. Survey of data-presentation concepts and techniques. Washington, D.C.: Author, Technical Publications Panel, Logistics Management Advisory Committee, January 1973.

ABSTRACT:

One way to reduce the growing maintenance expense of increasingly complex military systems and equipment is to provide more effective technical documentation, i.e., better maintenance procedures and reference manuals, for use by technicians with little training and experience. This report, in the format of a user's guide, describes new maintenance concepts and techniques which, compared to conventional techr[illegible] manuals, usually results in superior technician performance. "In general, this is true for the time required to isolate faults, the number of errors made during maintenance, and often the length of the technician's training period."

The new concepts and techniques are designed to solve two kinds of problems: maintenance/troubleshooting, and documentation. The second problem is perhaps of more interest to course developers who are concerned with text-handling and instructional materials reproduction methods. The report breaks the documentation problem into eight areas: (1) providing condensed detail level; (2) decreasing manual size/bulk; (3) improving access to information; (4) supplying more durable product; (5) reducing shipping/storage requirements; (6) facilitating updating; (7) ensuring timely availability; and (8) reducing costs of manual production.

The new concepts and techniques which address the documentation problem are: (a) Computer-Aided Trouble Analysis (CATA) developed by Vought Aeronautics Co. (b) Malfunction Detection, Analysis and Recording System (MADAR) and its Ground Processing System (GPS) developed by Lockheed-Georgia Co.; (c) Condensed Servicing Data (CONSD) developed by General Electric Co.; (d) Microfilmed Maintenance Manual Data Dissemination (M3DD) developed by the 3M Co.; (e) Automated Data Preparation Evaluation Program developed by McDonnell Aircraft Co.; (f) SAFEGUARD Maintenance Data System (MDS) developed by Western Electric Co.; (g) Functional Layout and Presentation System (FLAPS) developed by Hughes Aircraft Co.; (h) Condensed

Maintenance Guides developed by Hughes Aircraft Co.; (i) Spares Test Capability Report developed by General Dynamics Corp.; and (j) Computer Graphics and Visual Module System developed by William Fetter and currently used by the Boeing Company.

Details about each new concept and technique were obtained from replies to a questionnaire sent to member companies and organizations of the National Security Industrial Association (NSIA). Specific details about each concept and technique include: (a) name of concept/technique; (b) name of developer; (c) description of concept-technique; (d) operation/maintenance/manual problems which concept is intended to solve; (e) how the concept solves the operation/maintenance/manual problem(s); (f) where the concept is being used; (g) test/study results, if any; and (h) the person to contact for additional information.

Since the primary purpose of the report was to collect, organize, and disseminate information, no concept or technique was evaluated by the NSIA.

"The reader should use this report for a brief description of the data presentation concept/technique submitted, and contact the contributors and sources given in the report body, if additional information is desired."

DATA SUMMARY:

Media:	Print, Computer-based
Application:	Text-handling and instructional materials reproduction systems
Evaluation:	None
Environment:	Civilian
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Authoring aid type:	Procedure
Number of pages:	153
Number of references:	None

REFERENCE NUMBER: 3.2.4

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

CITATION:

Pritchard, R. D., Von Bergen, C., Jr., & DeLeo, P. J. Incentive motivation techniques evaluation in Air Force technical training (Report No. AFHRL-TR-74-24). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, November 1974.

ABSTRACT:

Application of incentive motivation techniques has resulted in improved performance in classrooms, mental institutions, and industry. This report describes a study conducted at Chanute Air Force Base which evaluated the effectiveness of incentive motivation in Air Force technical training. The incentive motivation program was implemented in two courses, Weather Observer and Aircraft Electrical Repairman. The program was evaluated in terms of feasibility, effect on training performance, and cost-effectiveness.

Three incentive systems were implemented sequentially: (a) high feasibility incentives awarded on the basis of performance; (b) high feasibility incentives awarded on the basis of effort; and (c) high and low feasibility incentives awarded on the basis of effort. The first system's incentives consisted of commendation letters, time off, avoidance of work details, choice of uniform, and avoidance of marching in formation. The incentives were dispensed through a point system whereby a student earned points by improving his exam scores or decreasing his time-to-complete. The points could then be spent on the incentives. The second system's incentives were similar to those of the first system but points were awarded for effort rather than pure performance. A student was assigned a target score according to his ability. Achievement above this target score was considered a reflection of effort, and points were awarded accordingly. The third system's incentives were financial and consisted of U.S. savings bonds, gift certificates, chits for various base facilities, and round trip bus transportation. Students earned points by the individual target score method.

Results of the study indicated that: (a) the third system had the greatest positive impact on the time to complete the Aircraft Electrical Repairman course; (b) none of the incentive systems improved exam scores; (c) all incentive systems

generally decreased remedial instruction probations, and counselling sessions of the Weather Observer course; (d) all incentive systems produced increases in reenlistment intentions in both courses; (e) the incentive systems had neither a positive nor negative effect on job satisfaction or overall attitude toward the Air Force; and (f) students slightly favored the incentive system while instructors were slightly unfavorable toward it, but neither group found the mechanics of the systems overly burdensome.

Conclusions of the study were: (a) incentive systems 1 and 2 were not effective because the incentives, while highly feasible to implement, were relatively weak in attractiveness; (b) implementation of system 3 resulted in significant increases in course performance; (c) cost benefit analysis indicated that the savings were more than enough to offset the cost of the incentive systems (d) the lack of impact on the Weather Observer course was due to the ceiling effect where average performance was already at a very high level; and (e) the effort-based incentive system was not understood by students.

Implications of the study for successful implementation of incentive motivation techniques in Air Force technical training were: (a) incentives must be fairly powerful; (b) increases in course performance for trainees must not be difficult to attain; (c) self-paced courses are most appropriate for incentive techniques; (d) more frequent reinforcement should occur; and (e) authority figures and peers should provide positive social reinforcement in order to enable the student to achieve high performance.

DATA SUMMARY:

Media:	None
Application:	Student Management
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Authoring aid type:	Procedure
Number of pages:	294
Number of references:	173

REFERENCE NUMBER: 3.2.5

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN
AND DELIVERY SYSTEM

CITATION:

Richardson, F. C., O'Neil, H. F., Jr., Grant, R. D., & Judd, W. A. Development and preliminary evaluation of an automated test anxiety reduction program for a computer-based learning situation. Austin: University of Texas at Austin, Computer-Assisted Instruction Laboratory, January 1973.

ABSTRACT:

This report concerning an automated test anxiety reduction program is divided into two parts. First, the literature investigating the nature of test anxiety and its remediation by behavior therapy techniques is reviewed. Second, the development of an automated program for the reduction of test anxiety in a computer-based learning situation is described.

The test anxiety program consists of four components. The first component is a 90-page manual written for the program. The manual describes and diagrams the process whereby attention is directed to the task (i.e., the test) instead of to oneself, provides detailed information about the behavioral and emotional dynamics of test anxiety and various strategies for coping with it, and contains a series of written exercises in which the student outlines for himself behavioral strategies for coping with test anxiety. The second component of the program is a videotape presentation of a female student modeling effective and ineffective management of test anxiety. The third component of the program consists of a modified desensitization procedure of deep muscle relaxation and self-visualization of coping with mild anxiety in a graded series of test-taking scenes. The final component of the program requires that students practice responding to test-like questions at a computer terminal. In addition to the test-like questions, the terminal also presents instructions that remind students of the slow, deep breathing technique for combating physical tension and anxiety, and of the importance of paying attention to the test and avoiding self-oriented worry.

The test anxiety reduction program was applied to 16 undergraduate education majors at the University of Texas at Austin taking a required course in Educational Psychology during the fall semester of 1972. One part of the course was a sequence

of five computer-managed instructional modules. The results of the program indicated: (a) a striking reduction in general test anxiety and state anxiety for the treatment as compared with control subjects; (b) no difference between the module test scores of the treatment group before and after treatment, and no difference between the module test scores of treatment as compared with control subjects after the former had completed the test anxiety program; (c) subjects expressed generally strong positive feelings about the program; and (d) subjects felt that the manual written for the program related much useful information concerning test anxiety coping strategies.

It was noted that deep muscle relaxation and visualization of hierarchy scenes occasionally (though not in this particular situation) give clients difficulty and requires the assistance of a professional. It was recommended that a probable next step would "explore eliminating the relaxation and desensitization component of the program in favor of an increased emphasis on practicing test-taking and anxiety management skills at the terminal on test-like materials."

DATA SUMMARY:

Media:	Print and videotape
Application:	Student management
Evaluation:	None
Environment:	Civilian
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Number of pages:	41
Number of references:	74

REFERENCE NUMBER: 3.2.6

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

CITATION:

Siegel, A. I., Federman, P. J., & Sellman, W. S. A survey of student measurement and course evaluation procedures within the Air Training Command (Report No. AFHRL-TR-74-5). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, July 1974.

ABSTRACT:

The reactions of 139 training evaluation, student measurement, and training manager/instructor personnel to the Air Force Instructional Systems Development (ISD) system are reported. The Air Force ISD system consists of five steps. The first step is analysis of system requirements. Tasks performed within the overall operational environment are identified. The second step is definition of education or training requirements. The tasks requiring instruction, the proficiency levels desired, and the required resources are determined. The third step is development of objectives and tests. The fourth step is planning, developing, and validating instruction. The fifth step is conducting and evaluating instruction. The general purpose of the ISD process is to graduate students who meet job performance requirements.

Although each group generally regarded the ISD procedures favorably, a number of problems with the use and implementation of ISD were identified. First, there was a need for a more general and extensive method for orienting supervisory personnel in the attributes and goals of the ISD system. Second, there was a need for more personnel who are trained not only in their individual assignments but who also possess adequate insight into the specific aspects of other ISD requirements. Third, there was a need to reduce the time required to apply the ISD procedures. Fourth, there was a need for streamlining the ISD procedures. Fifth, there was a need for evaluation of how well each of the ISD steps is performed. And sixth, some users elected to implement ISD through performance of a selected subset of the ISD system steps. Since each ISD step is dependent on a prior step, such abbreviation leads to faulty implementation.

Student measurement techniques and course review techniques were also surveyed. The general consensus toward each set of techniques was favorable but, again, some problems were identified. Problems with student measurement techniques included: (a) some written tests lacked reliability: (b) standards for updating tests were inconsistent; (c) parallel test forms may have been required but were not available; and (d) use of confidence and hierarchical testing approaches were rare. The principal criticisms of course review techniques (student, instructor and graduate critiques) were (a) their lack of objectivity; and (b) the interpretation of data by personnel unfamiliar with the total subject matter content or with the context in which the recommendations were set.

Among the recommendations for program improvement are: (a) development of an information dissemination program designed to clarify misconceptions about the ISD system and to orient training personnel in the attributes and goals of the ISD program, (b) increased training for personnel involved in ISD use and application, (c) development of job aids and work methods, along with an increase in communications efficiency for the purpose of "streamlining" the ISD procedures, (d) evaluation of the proficiency with which each ISD step is performed, (e) establishment of guidelines for updating tests, (f) use of alternative or parallel tests where required, (g) determination of the predictive validity of tests used, (h) allowing sufficient testing time for the purposes on hand, and (i) development of course review techniques that can yield logitudinal, objective, and quantitative information.

Although these results and conclusions may not apply to other branches of the service or to the civilian environment, the methods and procedures of this interview survey may prove useful to other course developers who are concerned with the effectiveness of their particular materials development methodology.

Appendix A provides details about the interview procedures.

DATA SUMMARY:

Media:	None
Application:	Instructional materials and system evaluation techniques
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.2 Specify Instructional Management Plan and Delivery System
Number of pages:	114
Number of references:	5

ADDITIONAL CITATIONS UNDER REFERENCE NUMBER 3.2: SPECIFY INSTRUCTIONAL MANAGEMENT PLAN AND DELIVERY SYSTEM

Course Management-Students

Beavers, W. S. Effect of two counselling treatments upon the task-oriented behavior of seventh graders. Paper presented at the Personnel and Guidance Association Annual Convention, Atlantic City, New Jersey, April 1971.

McKeen, R. L., & Eisenberg, T. A. On using student-generated sequences in the development of a learning hierarchy. Improving Human Performance. A Research Quarterly, 1973, 2, 97-106

Scheuerer, D. T. The placement of students in viable learning situations through the use of achievement tests and systems engineering rather than through annual promotion and retention. Volume II of II. Final Report. Boulder: University of Colorado, Biological Sciences Curriculum Study, June 1970. (ERIC Document Reproduction Service No. ED 057 069)

Stewart, J., & Clark, R. L. University of Maryland student scheduling algorithm. Proceedings of the 23rd National Conference of the Association for Computing Machinery. 1968, 555-562

Timmreck, E.M. ADVISER - a program which advises students on courses. Proceedings of the 23rd National Conference of the Association for Computing Machinery. 1968, 535-553

Course Management-Instructors

Devaughn, J. E. A manual for developing reasonable, objective, nondiscriminatory standards for evaluating teacher performance. State College: Mississippi State University, Educational Services Center, September 1971. (ERIC Document Reproduction Service No. ED 059 151)

Manis, D., & Solomon, W. Using task analysis to generate teacher training objectives and activities and evaluate their adequacy. Paper presented at the meeting of the American Educational Research Association, Chicago, April 1974.

Course Management-Support Personnel, Facilities, and Equipment

Defense Documentation Center. Government acronyms and alphabetic organizational designations used in DDC. Alexandria, Va.: Author, April 1975. National Technical Information Service Reproduction Service No. AD/A 006 800)

Defense Research Analysis Establishment. Computer-aided sequential testing for equipment reliability. Ottawa, Ontario: Author, June 1973. (NTIS Reproduction Service No. AD 919 179)

Resta, P. E., & Hanson, R. A. Installation requirements for the SWRL first year communication skills program. Evaluation data, 1968-69. Inglewood, Calif.: Southwest Regional Educational Laboratory, June 1971. (ERIC Document Reproduction Service No. ED 057 993)

Sullivan, D. J., & Smith, E. A. Instructional media carrel systems (Report No. AFHRL-TR-72-48). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, February 1974.

Course Management - Text-handling and Courseware Reproduction Systems

Human Resources Research Organization. Project IMPACT: Computer-administered instruction: Preparing and managing the content of instruction. IMPACT text-handling subsystem. Alexandria, Va.: Author, September 1971. (ERIC Document Reproduction Service No. ED 055 450)

National Security Industrial Association. The military technical manual industry. Washington, D.C.: Author, Logistics Management Advisory Committee, Technical Publications Panel, June 1972.

Course Management - Organizational Interaction

Andrews, F. M., & Pelz, D. C. Dimensions of organizational atmosphere (Analysis Memo No. 7). Ann Arbor: University of Michigan, Institute for Social Research, Survey Research Center, February 1961.

Bidwell, C. E. The social psychology of teaching. In R.M.W. Travers (Ed.), Second Handbook of Research on Teaching. Chicago: Rand McNally, 1973.

Dreeben, R. The school as a workplace. In R.M.W. Travers (Ed.), Second Handbook of Research on Teaching. Chicago: Rand McNally, 1973.

Lortie, D. C. Observations on teaching as work. In R.M.W. Travers (Ed.), Second Handbook of Research on Teaching. Chicago: Rand McNally, 1973.

REFERENCE NUMBER: 3.3.1 REVIEW/SELECT EXISTING MATERIALS

CITATION:

Computer assisted planning: A user manual for computer-based resource units. Buffalo, New York: State University College Buffalo, Faculty of Professional Studies, Research and Development Complex, October 1972.

ABSTRACT:

This user manual describes computer-based resource units and gives directions for obtaining the units. Computer-based resource units are instructional packets consisting of objectives, content statements, activities, materials, and evaluative devices which are coded to various learner variables. A request form and a listing of approximately 40 unit titles are given.

Listed with applicable grade levels, typical titles include: (a) Alcohol; (b) Career Education; (c) Communications; (d) Drugs; (e) First Aid and Survival; (f) Illinois Test of Psycholinguistic Abilities; (g) Measurement; (h) Nutrition; (i) Safety Education; (j) Speaking and Listening; and (k) Mental Health.

For group requests, up to five units may be requested. For individual requests, student-teacher planning is encouraged in order to select appropriate units. Student variables such as sex, reading level, mental age, chronological age, general interests, developmental tasks, and physical handicaps may be indicated on the request forms. When the resource guides have been received, an evaluation form included with the guide should be completed.

Additional information may be obtained from:

Research and Development Complex
State University College at Buffalo
1300 Elmwood Avenue
Buffalo, New York 14222
(716) 862-5433

DATA SUMMARY:

Media:	Computer-based
Application:	Individualized instruction
Evaluation:	None
Environment:	Civilian (grades K-12)
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	9
Number of references:	None

REFERENCE NUMBER: 3.3.2 REVIEW/SELECT EXISTING MATERIALS

CITATION:

Department of defense audiovisual information system: A user guide for the audio-visual products data base. Arlington, Va.: Department of Defense Directorate for Audio-Visual Activities, Office of Information for the Armed Forces (OASD/M&RA), October 1975.

ABSTRACT:

This detailed user guide is intended to provide the required information for participation in the Defense Audiovisual Information Network, and to utilize the Audio-Visual Products Data Base in that Network. Instructions, procedures, and background information are provided that cover the initial delivery, installation, and start-up operations of terminal equipment used to remote-access the centralized audio-visual data files. The user's guide is divided into two sections.

The first section of the report gives general information including: (a) terminal installation of Hazeltine equipment; (b) terminal operations of the Hazeltine equipment; (c) communications features, including Wide Area Telecommunications Service (WATS) service numbers; (d) a list of individuals and their official responsibilities for system management; and (e) a glossary of terms.

The second section presents specific information about the: (a) concept of the system, including hardware and software configuration; (b) file access procedures; (c) retrieval processing; and (d) input processing, including operations of the on-line text editor and the off-line data preparation requirements.

Several detailed appendices provide: (1) input data guidelines for DD Form 1995, an official Department of Defense form for data coding; (2) data descriptions; (3) segment descriptions; (4) search instructions; (5) output options; (6) on- and off-line tabulations; (7) tutorial messages for users; and (8) default conditions.

DATA SUMMARY:

Media:	Computer-based
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Joint Service)
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	150+
Number of references:	None

REFERENCE NUMBER: 3.3.3 REVIEW/SELECT EXISTING MATERIALS

CITATION:

Index of Army motion pictures and related audio-visual aids (Pamphlet No. 108-1). Washington, D.C.: Department of the Army, Headquarters, September 1974.

Index of Army motion pictures for public non-profit use (Pamphlet No. 108-4). Washington, D.C.: Department of the Army, Headquarters, May 1975.

ABSTRACT:

The first report is a catalog with annotations of official Department of the Army motion picture films and related audio-visual materials, including slides, audio-visual kits, recordings, and tape recordings. It is intended for use by instructors, information officers, and other film users (including defense contractors) of the Army and active Reserves. Both classified and nonclassified materials are listed.

The second report lists annotations for motion picture films for nonprofit use by Government agencies, civic, religious, fraternal and educational groups, schools, colleges, universities, and other agencies. Use of portions of the films or of soundtracks only is prohibited, and no admission fee may be charged in connection with showings. Films are shipped free of charge, via parcel post, and the reverse side of the mailing card is franked in order that they may be returned free of charge. Films coded with an "S" in the annotated entries may be purchased by civilian organizations.

The films and related audio-visual aids in the first volume are primarily oriented to Army career fields and specific activities. The films in the second volume are concerned with items of more general interest such as Civil Defense preparedness, information and education, sports, professional, medical, research and development films. State-by-state listings of Army Audio-Visual Support Centers are given in both volumes.

DATA SUMMARY:

Media:	Audio-visual, transparencies, sound recordings, films
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Army)
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	236 (first report), 50 (second report)
Number of references:	None (both reports)

REFERENCE NUMBER: 3.3.4 REVIEW/SELECT EXISTING MATERIALS

CITATION:

National network for curriculum coordination in vocational-technical education. Washington, D.C.: Department of Health, Education, and Welfare, Office of Education, 1975.

ABSTRACT:

Development, publication, and distribution of curriculum guides and various curriculum support services are available from a national network of six regional curriculum management centers.

Since all regional centers operate under the same charter from the Office of Education and provide essentially the same kinds of services, the Northwestern Vocational Curriculum Management Center, located at Olympia, Washington, may be discussed as a typical center. One person appointed by the State Director of Vocational Education Education from each state served by the center provides a 10-state Advisory Committee. The Advisory Committee sets operating policy and emphasizes the inventorying and cataloging of curriculum and other vocational materials currently in use within the ten-state area. Information is also collected about curriculum development activities currently underway so that curriculum developers may become aware of the work of others. A curriculum guide of materials available for distribution within the service area is periodically published. Curriculum entries in the guides provide information about the content of the curriculum material packages. Additional entries specify the use level (for example, "sec, postsec."), number and length of pieces in the package, when the package was developed, whether the material is listed in ERIC, whether it was field-tested, and ordering information, including cost. Curriculum materials are available in specific content areas as well as in more general areas such as individualized education, innovative practices, guidance, and teacher education. Lending library listings are also given.

Curriculum guides are published in the form of brochures, booklets, and microfiche. The Northwestern Center curriculum guide is published in newspaper format.

Since curriculum material holdings of individual centers are too extensive to be usefully annotated here, curriculum guides and additional information may be obtained from:

William Reynolds, Director
Illinois Curriculum Mgt. Center
Board of Voc. Ed. and Rehabilitation
1035 Outer Park Drive
Springfield, IL 62706

Dr. Joseph Kelly, Director
Voc. Curriculum & Media Research
Division of Vocational Education
225 West State Street
Trenton, NJ 08625

Dr. James Becket, Director
Western Curriculum Coord Center
Vocational Education Section
Dept. of Education
721 Capital Mall
Sacramento, CA 95814

Dr. James E. Wall, Asst. Dean (R&D)
Mississippi State University
P.O. Draw DX
Mississippi State, MS 39762

Mr. Ron Meek, Coordinator
Curriculum Instructional Mtrls. Center
State Dept. of Voc. and Tech. Ed.
1515 West Sixth Avenue
Stillwater, OK 74074

Mr. James L. Blue, Director
Voc. Curriculum Management Center
Coordinating Council for Occupational Education
Building 17, Airdustrial Park
Olympia, WA 98504

DATA SUMMARY:

Media:	Print, microfiche
Application:	Conventional and individualized instruction
Evaluation:	Individual curriculum packets may be field-tested
Environment:	Civilian
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	Varies with each center's publications
Number of references:	Varies with each center's publications

REFERENCE NUMBER: 3.3.5

REVIEW/SELECT EXISTING MATERIALS

CITATION:

Special reserve components educational video tape catalog (Pamphlet No. 350-4). Fort Monroe, Va.: Department of the Army, Headquarters, United States Army Training and Doctrine Command, 25 March 1975.

ABSTRACT:

This well-indexed pamphlet contains a listing of educational video tape programs specifically selected for unit training. Primarily intended for use by Reserve Components, it may be used by other services, Army schools, and training centers. Video tapes requested by users will be copies furnished in 3/4-inch U-Matic video cassettes or in 1/2-inch reels for use with Sony Television Trainers. TRADOC Form 517-R (contained in Appendix B) will be completed by the user and forwarded to the appropriate Training Aids Support Office (TASO). The addresses and support areas of specific TASOs are listed in Appendix A. Loans are made for up to 60 days. A permanent retention program (loans in excess of 60 days) allows copies of tapes to be made on user-supplied raw cassettes/reels. Cost per 30-minute blank 3/4-inch cassette is approximately $25.10 and for a 30-minute 1/2-inch blank reel is approximately $23.50.

Listings of video tape programs are arranged by: (a) subject matter; (b) alphabetical index, cross-referenced by title or subject-matter key word; and (c) key-word in title, including more than one key-word per title. Video tape program entries include the number, title, subject and target audience (normally by career specialty).

The subject matter of the video tape programs are: (1) Air Defense; (2) Armor; (3) Field Artillery; (4) Aviation; (5) Engineer; (6) Intelligence; (7) Military Assistance; (8) Military Police; (9) Ordnance; (10) Quartermaster; (11) Signal; (12) Transportation; (13) Women's Army Corps; and (14) Non-Proponent.

DATA SUMMARY:

Media:	Video tape
Application:	Conventional and individualized instruction
Evaluation:	Individual programs may be evaluated
Environment:	Military (Army)
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	200+
Number of references:	None

REFERENCE NUMBER: 3.3.6

REVIEW/SELECT EXISTING MATERIALS

CITATION:

Vocational education. State instructional materials for office occupations. Washington, D.C.: U.S. Government Printing Office, 1973.

ABSTRACT:

An annotated listing of curriculum materials available from state education agencies is provided in order to assist planners, administrators, vocational educators, and course developers in obtaining existing curriculum materials. This particular title applies to office education. Other guides in the series are available in the following areas: (a) agriculture; (b) distributive education; (c) health occupations; (d) home economics; (e) technical education; and (f) trade and industrial occupations. They may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Requests for specific material in a guide should be addressed to the appropriate state education agency.

The material in the guide is arranged by coded entry. The first 2-digit position indicates the subject matter area (14, Office Occupations). The second 2-digit position indicates the principal segment of subject matter (14.02, Business Data Processing Systems Occupations). The third 2-digit position indicates division of principal segment (14.0202, Peripheral Equipment Operators). The last 2-digit position indicates the first-level detail of division of principal segment (14.020201, Key Punch and Coding Equipment Operators). A discussion of the coding system is contained in:

> U.S. Department of Health, Education, and Welfare, Office of Education. Vocational Education and Occupations (OE-80061). Washington, D.C.: U.S. Government Printing Office, July 1969.

Curriculum materials listed in this particular guide include: (a) Accounting and Computer Occupations (Bookkeeping); (b) Business Data Processing Systems Occupations (Key Punch and Coding Equipment Operators, and Other); (c) Filing, Office Machines, and General Office (File Clerks, General Office Clerks, and Other); (d) Stenographic, Secretarial, and Related Occupations (Stenographers, and

Others); (e) Supervisory and Administrative Management Occupations (Budget Management Analysis); (f) Typing and Related Occupations (Typists and Other); and (g) Office Occupations, Other.

There are two additional sections in the guide. The first contains a listing of more general manuals and courses useful to administrators and teachers, such as New Jersey's Student's Manual for Supervised Teaching of Vocational Subjects and Oklahoma's Procedure for Establishing Area Vocational Schools. The second contains a state-by-state listing for ordering procedures. Some state education agencies charge for publications; others send one complimentary copy of a curriculum package, and others send everything free. Curriculum developers in a particular state should check that state's order requirements.

DATA SUMMARY:

Media:	Printed, programmed text, and audio-visual
Application:	Conventional and individualized instruction
Evaluation:	Individual states may evaluate their materials
Environment:	Civilian
Key number:	3.3 Review/Select Existing Materials
Authoring aid type:	Tool
Number of pages:	25
Number of references:	None

REFERENCE NUMBER: 3.4.1

DEVELOP INSTRUCTION

CITATION:

Best, E. The development of visual materials for CAI (Technical Memo No. 5). Austin: The University of Texas at Austin, Computer-Assisted Instruction Laboratory, August 1971.

ABSTRACT:

Various procedures and materials used to minimize expense and time in the preparation and production of computer-controlled films are discussed. The films were intended to be used on a computer-controlled rear screen projector which could contain up to 1,022 different frames in either color or black and white. Frames were addressable in the standard sound track area. For text-typed, one-color, 20-frame filmstrips, the cost of production was approximately $97 and processing time was two to three weeks.

The first step in the production of the filmstrips was the decision by the author of what portion of his program to display on the terminal output device and what portion to display from the rear screen projector. The next steps were to meet with a media specialist, discuss possible layouts, and approve a text-frame master for the preparation of 8 x 10-inch black-and-white negatives. Author approval for the negatives was required, for filmstrips, once produced, are difficult to change.

Text masters were prepared on frosted acetate. Artwork masters were done on 8 x 10-inch poster board, and photographed without enlargement. Typing was done in an area 4-1/2 x 6-1/2 inch, which enlarged proportionately to 8" x 10" with a 1/2-inch to 3/4-inch border. Typing compared favorably with pressure-sensitive and photocomposed letters in terms of cost and speed of production. It was noted that no more than nine lines of type should be put on a master if fast reading is expected.

Once the 8" x 10" color-backed negatives were obtained, they were photographed in sequence on a light-box. Inexpensive and easily built, the light-box and its materials and dimensions are discussed in the text. The light-box was also used

for alignment of the negative on a clear piece of acetate. A registration pen bar was taped to the top of the box, and an Acme field chart was used to align the negative on the acetate. This assured squared and centered frames, which were essential for accurate photography.

For local production shops, this report provides much information required for processing filmstrips into slides for either computer-controlled rear screen projectors or for transparencies.

DATA SUMMARY:

Media:	Filmstrips, slides
Application:	Conventional and individualized instruction
Evaluation:	None for procedure but materials used were evaluated
Environment:	Civilian
Key number:	3.4 Develop Instruction
Authoring aid type:	Tool
Number of pages:	12
Number of references:	None

REFERENCE NUMBER: 3.4.2

DEVELOP INSTRUCTION

CITATIONS:

Deterline, W. A., & Lenn, P. D. Coordinated instructional system. Lesson book. Palo Alto, Calif.: Sound Education Inc., 1972.

Deterline, W. A., & Lenn, P. D. Coordinated instructional system. Study resource materials book. Palo Alto, Calif.: Sound Education Inc., 1972.

ABSTRACT:

This self-study course teaches a set of skills and techniques called CISTRAIN for designing, developing, and implementing instruction. CISTRAIN means Coordinated Instruction System for Training. During the full course of instruction, the student prepares two lessons in his subject matter area and tests them on other students. Course completion times range from 20 hours to 50 hours. Average completion time is 35 hours but one significant factor affecting that time is the size and scope of the two lessons prepared by the student.

The Study Resource Materials Book contains all instructional articles, sample lesson materials, and procedural guides necessary for completing the course. The Lesson Book guides the student through the appropriate portions of Study Resource Materials Book and provides reinforcement when required. Both books are concerned with three processes of instructional design and development: (a) lesson development including testing instruments; (b) evaluation and tryout of the lesson; and (c) selection of the correct media for lesson presentation.

Lessons are also called study units. Evaluation of student performance on each study unit depends upon a human monitor (called an Enabler) who conducts group discussions and peer critiques. There are six components to each study unit. First is an introduction that discusses the topics, scope, and purpose of the lesson. The next component contains descriptive objectives that discuss what the student should be able to do at the end of the study unit. Study resources and directions are then provided that indicate what the student is to do, what resources are required, and when and how the instruction is to be carried out. Next are practice exercises which help students apply what they have learned in the lesson. Questions are asked and tasks are carried out. Discussion (feedback)

of the practice exercise results is the next component of a study unit. Correct responses for both questions and tasks are shown, and explanatory feedback is given. The last component of a study unit is actual self-evaluation and discussion, which basically provides further practice and more detailed discussions.

A glossary of 29 terms is included.

DATA SUMMARY:

Media:	Programmed text
Application:	Individualized instruction
Evaluation:	"The course materials underwent three tests and revisions, and more than one hundred faculty and administrators from California Community Colleges participated in the developmental tests....The final revision was based on data from the final field tryout."
Environment:	Civilian
Key number:	3.4 Develop Instruction
Authoring aid type:	Tool
Number of pages:	106 (Lesson Book), 94 (Study Resource Materials Book)
Number of references:	None (both books)

REFERENCE NUMBER: 3.4.3

DEVELOP INSTRUCTION

CITATION:

Guidelines for developing computer based resources units. Revised. Buffalo: State University of New York, Educational Research and Development Complex, March 1972. (ERIC Document Reproduction Service No. ED 073 586)

ABSTRACT:

Guidelines for writing computer-based resource units are presented and organized into two operations. The first operation involves formulating behavioral objectives, instructional content, activities, materials, and measuring devices for each unit of instruction, which is termed a "computer-based resource unit." The second operation involves coding these five component items for future computer retrieval. Every content item, activity, material, and measuring device is coded to a behavioral objective, and each behavioral objective is coded to several learner characteristics.

Specifications are given for writing objectives, coding components to objectives, and coding objectives to learner variables. Objectives written for computer-based resource units must: (a) be behavioral with measurable performance; (b) be oriented to the grade level of the student; (c) be relevant, based on "some social demand, student need, or philosophical imperative;" (d) call for a single behavior in order to minimize confusion in the evaluation procedure; and (e) yet be general enough so that different approaches may be made for accommodating individual differences in students. Coded components have unique identification numbers, beginning with "1" and continuing in consecutive fashion. For coding objectives (and thus the instructional material coded to each objective) to learner variables, an appendix of fourteen variable categories containing 248 instructional variables is given. The fourteen variable categories are: (a) student interests; (b) sex; (c) developmental tasks; (d) major social functions, i.e., "those societal conditions in which all individuals must participate at some time in their lives;" (e) reading level; (f) instructional activity; (g) suggested approach to instruction; (h) taxonomical sophistication of the objective; (i) material descriptor; (j) instructional grouping, i.e., "the one designation which would provide the most effective environment for learning;"

(k) evaluation devices; (l) mental age of the student and chronological age of the material (its "social appropriateness"), which may differ according to the specific material; (m) physical handicaps; and (n) learning environment, such as classroom or field trip.

In addition to the appendix mentioned above, three other appendices provide: (a) a coding sheet for objectives; (b) appropriate categories for coding component parts of a computer-based resource unit; and (c) a coding sheet for learner variables.

DATA SUMMARY:

Media:	Computer-based
Application:	Individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	3.4 Develop Instruction
Authoring aid type:	Tool
Number of pages:	33
Number of references:	None

REFERENCE NUMBER: 3.4.4 DEVELOP INSTRUCTION

CITATION:

How to design and produce individualized instruction programs. St. Paul, Minnesota: Minnesota Mining and Manufacturing Co., Visual Products Division, 1972.

ABSTRACT:

This pragmatic workbook is intended to be used for developing audio-visual programs for the 3M Sound-On-Slide System. With minimal instructional theory, the following sample worksheets and forms are given:

1. Task Listing. Task Listing Sample, Action Verbs Sample, Task Listing Worksheet;
2. Task Analysis. Task Analysis Sample, Task Analysis Worksheet;
3. Performance Objectives. Performance Objectives Sample and Worksheet;
4. Evaluation Checklist. Evaluation Checklist Sample, Evaluation Checklist Worksheet;
5. Learning Activities Guide. Learning Activities Guide Sample, Learning Activities Guide Worksheet;
6. Sound-On-Slide Unit Design and Script. Story Board (Picture Descriptions), Story Board Worksheet, Completed Story Board;
7. Self-Evaluation. Instructional Systems Development Evaluation Form, Individualized Instruction Materials Development Evaluation Form, Package Objectives Evaluation Form; and,
8. Development Schedule. Instructional Materials Development Schedule Worksheet.

In keeping with the no-frills approach, the job area used as an example for the development steps listed above is Service Station Attendant.

DATA SUMMARY:

Media:	Audio-visual
Application:	Individualized instruction
Evaluation:	None
Environment:	Civilian

Key number: 3.4 Develop Instruction

Authoring aid type: Tool

Number of pages: 23

Number of references: None

REFERENCE NUMBER: 3.4.5

DEVELOP INSTRUCTION

CITATION:

Nesbit, M., & O'Neil, H. F., Jr. Guidelines for editing programmed instruction. Austin: University of Texas Press, 1976.

ABSTRACT:

Course authors need two kinds of information. First, to communicate with instructional designers and educational psychologists, course authors need accepted definitions for types of frames and rules used in programmed instruction (PI). Second, to write effective programs, course authors need specific guidelines for separating lesson content into rules and examples which can be integrated into a series of logical frames. Nesbit and O'Neil present both kinds of information.

The report's first two sections define 23 basic terms of PI (such as frame, step size, and fading) and discuss three models of PI (linear, branching, and autoelucidative). In linear programs, all learners proceed sequentially through the same content in the same way; hence, individualization occurs according to the rate of student progress through the program. In branching programs, learners proceed along individual paths determined by answers to multiple-choice questions. Right answers move a student forward; wrong answers move him backward or forward to reinforcement frames or remedial material. In autoelucidative programs, all learners progress through linear steps that also contain branching opportunities. Large step sizes, i.e., large amounts of text in single frames, and multiple-choice questions, allow students to progress quickly for correctly answering questions or to reread summaries of specific material for incorrectly answering questions. The authors present diagrams and examples for each type of model.

The third section of the report presents guidelines for editing PI text which allow authors to check lesson content and style for logical consistency and to tailor programs to the student population. For example, it is suggested that: (a) typed lines should not be more than ten words or 4-1/2 inches long; (b) definitions should be separated for emphasis; and (c) testing should be confined to the major issue of the frame.

Examples of good and bad frames are also given. Two typical errors in frame design are illustrated: (a) a student is not required to respond to all material in a frame, i.e., too narrow a response; and (b) a student is given too much material to "digest" at once, i.e., too broad a stimulus. The authors also caution against over- or under-prompting, using page numbers as multiple-choice question alternatives that inadvertently cue the right answer, and using indiscriminate fading, which leads to memory, not understanding.

DATA SUMMARY:

Media:	Programmed text
Application:	Individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.4 Develop Instruction
Authoring aid type:	Tool
Number of pages:	35
Number of references:	14 annotated references

REFERENCE NUMBER: 3.4.6 DEVELOP INSTRUCTION

CITATIONS:

Siegel, A. I., Federman, P. J., & Burkett, J. R. Increasing and evaluating the readability of Air Force written materials (Report No. AFHRL-TR-74-28). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, August 1974.

Siegel, A. I., Lambert, J. V., & Burkett, J. R. Techniques for making written material more readable/comprehensible (Report No. AFHRL-TR-74-47). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, August 1974.

ABSTRACT:

In a previous survey of readability research, Siegel, Federman, and Burkett (1974) synthesized the findings most useful to writers. In the second report, Siegel, Lambert, Burkett (1974) illustrated the findings with very good examples. The topics covered include: (a) morphemes (the number of sounds within words); (b) center-embedding (putting a clause between the subject and predicate of a sentence); (c) sentence depth; (d) vocabulary diversity; (e) linking stated thoughts with intended conclusions; (f) seeing generalizations; (g) cutting out unnecessary facts in diagrams and charts; (h) repeating facts; (i) organizing material; and (j) avoiding abbreviations. Several examples will indicate the usefulness of the report.

Morphemes. The more morphemes contained within a word, the harder the word is to understand. Instead of "disassemble the linkage," write "take apart the linkage."

Center-embedding. Instead of "The president, having no intention of yielding to the repeated demands of the citizens, was forcing them to revolt," write "The president was forcing the citizens to revolt because he had no intention of yielding to their repeated demands."

Sentence depth. Breaking a long sentence into shorter sentences increases readability. Instead of "The new car which the neighbors bought and which has already been delivered, is a gift for their son who is graduating from college this semester," write "The new car has already been delivered. It was bought by the neighbors as a gift for their son. He is graduating from college this semester."

Vocabulary diversity. Find the words you want to use and stick with them. A thesaurus is heavy in more ways than one. "One little piggy went to market, one little piggy stayed home" is less burdening then "One little piggy went to market, one diminutive porkster stayed home."

Linking. Don't force your reader to make his own conclusions or to make a guess as to what goes with what. Instead of "Deliver the beer and the milk to the NCO club and the commissary," write "Deliver the beer to the NCO club and the milk to the commissary."

Seeing generalizations. In theory-oriented instruction, make generalizations when necessary. Instead of simply saying "The voltage in a circuit is equal to the product of the intensity of the current and the resistance of the current," add "Therefore, the voltage can be increased by decreasing resistance or by increasing current intensity."

Repeating facts. Important facts should be repeated. Instead of saying "After you have tightened the three wing-bolts, attach the antenna" and then dropping it, write "After you have tightened the three wing-bolts, attach the antenna. Tightening the three wing-bolts before antenna-attachment simplifies later steps. If you fail to tighten the three wing-bolts before antenna-attachment, the result will be..."

Organizing material. Provide memory aids for your reader whenever possible. Acronyms are memory aids (RADAR for Radio Detecting and Ranging). Another type of memory aid is Psalm 145, where the first letter of each line forms the alphabet sequence. A third type of memory aid is rhyming or jingles such as "Hey diddle diddle, the cat and the..."

Avoiding abbreviations. Excessive use of abbreviations can paralyze our ability to think. Instead of "The STS, POI, and OSR are useful for TA," write "The Specialty Training Standard, Plan of Instruction, and Occupational Survey Report are useful for task analysis."

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	3.4 Develop Instruction
Authoring aid type:	Tool (second report)
Number of pages:	88 (first report), 28 (second report)
Number of references:	35 (first report), 1 (second report)

REFERENCE NUMBER: 3.4.7

DEVELOP INSTRUCTION

CITATION:

Thiagarajan, S. The programming process: A practical guide. Worthington, Ohio: Charles A. Jones Publishing Co., 1971.

ABSTRACT:

Thiagarajan divides the programming process into five stages: task analysis; design; editing; developmental testing; and validation testing. In addition to those stages, this self-paced guide to programming printed texts also considers effective behavioral objectives and various kinds of testing instruments. Completion time for the program is estimated to be 40 hours. The last frame of each chapter requires the student programmer to apply the concepts learned in the chapter and analyze a topic of his choice. He is required to design, develop, and validate a program on that topic. The resulting program is evaluated by using specific checklists found in either the main part of the book or in the confirmation section. The total number of points that can be awarded for the assignments is 100, and students scoring 95% or more receive an "A" while those scoring between 90% and 94% receive a "B". No grades are indicated for other scoring ranges.

A Magic Square is used as a consistent example for explaining task analysis, behavioral objectives, and criterion tests (including entry tests, pretests, and posttests). A Magic Square is a multicellular square containing an odd number of cells with numbers placed in them such that each horizontal row, each vertical column, and each diagonal sum to the same number. The numbers may be either consecutive or increased by increments of five. (If you want to know how to construct a Magic Square, check p. 18 of the text!) Since a set of rules and procedures exist for creating the product, a task analysis of a Magic Square can be done. Thiagarajan explains task analysis. Since there is an intended visible outcome, behavioral objectives for a Magic Square can be constructed. Thiagarajan explains behavioral objectives. Finally, since there are correct Magic Squares and incorrect Magic Squares, criterion tests can be written for Magic Square construction. Thiagarajan explains that also. It is a novel way to explain task analysis, behavioral objectives, and criterion tests, but the intricacies of the Magic Square sometime create confusion.

Editing frames, developmental testing and revision, and validation testing are discussed without using the Magic Square. The discussion on editing is directed toward external language and subject-matter editors to which the student-programmer presumably has access. Emphasis is given to three types of editing: (a) revision of subject matter involving changes in language and frame sequence; (b) revision of language not involving changes in subject-matter or frame sequence; and (c) revision of program involving changes in language but not in subject matter. In the developmental testing and revisions, importance is placed on introductory comments which help reduce students' test anxiety, aversion to criticism, and aversion to self-instruction. Validation testing, it is noted, collects and evaluates four kinds of data: (a) description of the students involved in validation testing; (b) indication of gain or loss in the students' achievement; (c) time taken by the students to complete the program; and (d) the instructional situation in which the validation testing took place.

A confirmation section at the conclusion of the book contains correct responses to the questions embedded in the text.

DATA SUMMARY:

Media:	Programmed text
Application:	Individualized instruction
Evaluation:	32 students at Indiana University
Key Number:	3.4 Develop Instruction
Authoring aid type:	Tool
Number of pages:	122
Number of references:	11

REFERENCE NUMBER: 3.5.1 VALIDATE INSTRUCTION

CITATION:

Abedor, A.J. Development and validation of a model for formative evaluation of self-instructional multi-media learning systems. Paper presented at the meeting of the American Educational Research Association, Chicago, April 1972.

ABSTRACT:

A revision model was developed and field-tested in order to: (a) identify instructional deficiencies through data collection; (b) analyze the deficiencies which require revision of materials; and (c) design, integrate, and evaluate the revisions. The study was conducted in four phases. The first phase was design of a MK I flowchart revision model based on a review of the literature. The second phase was tentative evaluation of the MK I model based on interviews with several developers of multi-media instructional treatments. The third phase was to incorporate the results of the interviews into a KM II revision model which used small-group tryout and debriefing procedures as the primary technology for identifying instructional problems and recommending effective revisions. The fourth phase was empirical testing of the MK II revision model in three separate experimental situations.

Abedor notes that revision of materials used in a multi-media instructional system can be a monumental task, and that persuasive data (in terms of both quantity and quality) are needed to convince developers that revision is required. "In other words, the delivery vehicle must have several serious discrepancies before it warrants an overhaul." He also notes that developers usually do not have the time or resources to make multiple, iterative revisions of materials. Therefore, the MK II model was designed to generate large amounts of corroborative data on instructional problems in a one-shot trial of the prototype lesson.

Unlike other formative evaluation models, this model uses face-to-face interviews between the lesson developer and small groups of students. The optimal size of the group was determined to be nine students plus the lesson developer. The procedures for group debriefings included the following: (a) selection and orientation of the volunteer students who vary in their entering abilities; (b) individual use of the prototype lesson materials by these volunteers; (c)

administration and assessment of learning and attitudinal measures to provide data for the debriefing (d) development of a debriefing document; and (e) implementation of the group debriefing.

Empirical testing of the MK II model was conducted in five field experiments with three Michigan State University faculty members and students in their courses. The validity of the MK II model was defined as enabling the lesson developer to identify unsatisfactory sequences of instruction, and as resulting in development of substitute, satisfactory sequences. If one-third or more of the group of students indicated dissatisfaction, boredom, confusion, or lack of understanding with a particular sequence, then it was deemed "unsatisfactory." Experimental and control groups were used to validate the model.

In two experiments, significant differences were obtained (p. <01) favoring the lesson revised according to the model on all four dependent measures (posttest, gain score, percent achieving 80% criterion, and student attitudes). In the third experiment, a significant difference (p. <01) was noted only on the posttest.

The author notes that, because of social and psychological interactions, the overall effectiveness of the MK II for data gathering will perhaps vary from situation to situation. For example, "in the case of developer B, the prototype lesson was so ineffective and the derogatory comment of students so devastating that by the end of the debriefing he was simply unwilling to continue the process for the seemingly ungrateful students... In the case of developer C, he appeared unwilling or unable to handle the relatively large number of derogatory comments. Thus, he closed off discussion prematurely and refused to revise the prototype lesson." In another instance, the author notes that the "groups appeared to develop a 'momentum' phenomenon. If they got started on a deragatory theme they kept going and the comments became increasingly derogatory until the author was forced to become defensive and begin justifying the lesson rather than exploring ways to improve it." Since the effectiveness of the MK II model depends on the data gathered during group debriefings, the serious disruptions undermined the process. Whether these weaknesses are a fault of the methodology or of the group dynamics was not determined.

The use of Abedor's model should be explored since, unlike most models, it attempts to function in a real-world, operational environment. Further, data seem to indicate that it works effectively in identifying and generating useful revisions.

DATA SUMMARY:

Media:	None
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	3.5 Validate Instruction
Authoring aid type:	Procedure
Number of pages:	45
Number of references:	17

REFERENCE NUMBER: 3.5.2

VALIDATE INSTRUCTION

CITATION:

Aleamoni, L.M. MERMAC: A model and system for test and questionnaire analysis (Research Rep. 330). Champaign: University of Illinois, Office of Instructional Resources, Measurement and Research Division, March 1970. (ERIC Document Reproduction Service No. ED 055 097)

ABSTRACT:

An evaluation model was developed and implemented which provides instructors with basic data required for decision-making about student abilities, course attitudes, grade distributions, and test appropriateness. The data are provided in useable formats and give quick feedback to students. Specifically, the model is useful for test analysis and course evaluation questionnaires by allowing the user six options.

First, test items are scored. Up to forty subscores may be produced for each individual, and each item and response may be weighted either the same or differently for any subscore. A sample output from this SCORE program is given in the text.

Second, scores for groups of individuals may be analyzed and the following descriptions produced: (a) frequency distribution and histogram; (b) mean, median, and standard deviation; (c) Kuder-Richardson reliability; (d) standard error of measurement; (e) Spearman-Brown prophesy for .90 reliability; (f) raw scores, standard scores may be weighted, and the sum assigned a letter grade. A sample output from this TOTAL program is given in the text.

Third, a test item analysis printout may be given to the student. His test score, a list of items missed with his responses, and the correct responses are printed. A sample of this ERROR program is given in the text.

Fourth, item analysis data are provided as a plot of the percentage of individuals responding to the correct response by fifths of the total. Item alternative analysis data are provided as a proportion of individuals responding, a point biserial correlation, and the number responding to each alternative by

fifths of the total. A sample output of this ITEM program is given in the text.

Fifth, item data may be analyzed according to some external criterion other than the keyed test score. The output format of this SELECT program is the same as the ITEM format.

Sixth, data from course evaluation questionnaires, attitude scales, and other measures with no known correct response may be summarized. A frequency distribution of responses, a weighted mean, and a standard deviation for each item are provided. Subscores may be generated with means, standard deviations, split-half reliabilities, and percentage of individuals responding to the noncriterion items. A sample output from this QUEST program is given in the text. The QUEST program has been applied to the Illinois Course Evaluation Questionnaire, which yielded responses to fifty items and provided six subscores concerning general course attitude, instructional method, course content, interest-attention, instructor effectiveness, and unique items requested by a user.

The MERMAC manual and system documentation can be obtained from the University Press, University of Illinois, Urbana, Illinois 61801.

DATA SUMMARY:

Media:	Computer-based
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	3.5 Validate Instruction
Authoring aid type:	Tool
Number of pages:	14
Number of references:	1

REFERENCE NUMBER: 3.5.3 VALIDATE INSTRUCTION

CITATION:

Bloom, B.S. Learning for mastery. Evaluation Comment, 1968, 1(2)

Hummel-Rossi, B. A formative evaluation of Bloom's mastery learning concept. New York: Van Valkenburgh, Nooger, and Neville, 1972.

ABSTRACT:

This two-part evaluation exercise is based on the article by Bloom, and is conducted in accordance with the twenty-item, multiple-choice test by Hummel-Rossi. The test is designed to assess understanding of the concepts given in Bloom's article and understanding the use of formative evaluation.

The article discusses the variables present in a mastery learning strategy, and the approach used by Bloom to derive a mastery learning strategy. There are five variables in a mastery learning strategy: (1) aptitude for particular kinds of learning; (2) quality of instruction; (3) ability to understand instruction; (4) perserverance; and (5) time allowed for learning. Bloom outlines the preconditions necessary for mastery learning, the operating procedures required, and the outcomes to be evaluated. One important precondition is a performance standard by which to judge the achievement of students. Another important precondition is formative evaluation, accompanied by diagnosis and followed by prescription. Outcomes may be measured in both cognitive and affective domains.

The test is composed of an instruction sheet; a specially-treated answer sheet which, when rubbed, displays the answer; and the testing instrument. The answer sheet (or card) provides immediate feedback. If the wrong answer appears in the spot being rubbed, then alternative choices are rubbed until the correct answer appears. The whole testing package is called a "Trainer-Tester Self-Scoring Student Response Device." A reprint of Bloom's article is included in the package.

One's belief in the competency of course developers and evaluators is usually a matter of faith. This is one example of an instrument which may provide some data concerning that competency.

DATA SUMMARY:

Media:	Print, chemically-treated answer card
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	3.5 Validate Instruction
Authoring aid type:	Tool
Number of pages:	11 (article), 4 (test)
Number of references:	18 (article), none (test)

REFERENCE NUMBER: 3.5.4 VALIDATE INSTRUCTION

CITATION:

Rayner, G. T. An empirical study of a methodology for the revision of systematically designed educational material (Report No. 24). Tallahassee: Florida State University, Computer-Assisted Instruction Center, March 1972. (ERIC Document Reproduction Service No. ED 067 877)

ABSTRACT:

A revision model for systematically designed educational materials was developed and tested. The model can be applied to a course which: (a) has been developed using some systems model; and (b) includes several subcomponents, including specific objectives clustered in some "unitized" way (commonly called modules), instructional materials, criterion-referenced diagnostic tests, remedial prescriptions, pretests, and posttests. These components furnish the information needed for effective revisions. Data sources include both students and subject matter experts. Measuring instruments consist of content examinations, attitude scales, and collections of informal and solicited student comments.

Application of the model results in content revisions and procedural revisions. Content revisions can be made on any or all of six components of instruction noted above. A change in any one component may necessitate changes in other components. Procedural revisions include all operational changes made in the process of providing instruction to students. Attention is focused on problems identified by student criticisms. Procedural revisions are mainly made in pretesting, student orientation, instructional operation, posttesting, and grading.

The revision model was applied to a required course in health education for elementary education majors at Florida State University. Students were enrolled in the course for two successive quarters, and were randomly assigned to either of two treatments: computer managed instruction (CMI); or conventional instruction (CI). The CMI treatment was individualized while the CI treatment was group-paced and managed by a professor. In both treatments, modularized instruction consisted of objectives, sample test items, selected instructional materials, diagnostic tests, remedial prescriptions, and posttests. During the first administration of the course, only 17 percent of the students reached criterion of 80 percent or

more. After the course was revised according to the model discussed here, 71 percent of the students reached criterion. No significant attitude changes occurred across the administrations. Course completion times and total time signed-on to the computer terminal increased after the revision, even though the number of course objectives dropped from 32 to 23. The number of minutes logged-on to the terminal versus criterion performance was analyzed. Of those students spending 200 or more minutes on the terminal, 92% reached criterion; of those spending between 100 and 200 minutes on the terminal, 56% reached criterion; of those spending 50 to 100 minutes on the terminal, 73% reached criterion.

After two successive administrations of the health education course, it was recommended that the principal content change in the model itself should be establishing more stringent criterion for test item revision. Since the overall goal was 80 percent mastery, test items with a posttest difficulty level below 80 percent should be reviewed for ambiguity, isomorphism with the objective, clarity of related instructional material, accuracy of prescriptions, and comments from students who missed the item. Three procedural changes were also recommended: (1) within-course reviews; (2) small-group help sessions; and (3) intra-course deadlines to prevent students from leaving the entire course to the last few days or weeks. The need for the last change was indicated by the fact that, in the second administration of the course, 34 percent of the tests were taken in the last week.

Debriefing questionnaires for the CMI and CI groups are given in two appendices.

DATA SUMMARY:

Media:	Computer-assisted instruction
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	3.5 Validate Instruction
Authoring aid type:	Procedure
Number of pages:	163
Number of references:	29

REFERENCE NUMBER: 3.5.5 VALIDATE INSTRUCTION

CITATION:

Ward, M. E., Examination and application of formative evaluation for author utilization during the preparation of a CAI course (Doctoral Dissertation, University of Pittsburg, 1972). (ERIC Document Reproduction Service No. ED 076 056)

ABSTRACT:

Ward investigated an author's use of formative evaluation during the preparation of a CAI course. Four specific questions were examined: (1) what models exist for formative evaluation related to the development of course materials; (2) of those models, which one is more appropriate for use during CAI course preparation; (3) using the selected model, what results obtain for formative evaluation during CAI course preparation; and (4) what guidelines and forms can be identified for inclusion in an author's manual for formative evaluation of the materials development process?

Five evaluative models were studied. The first model, developed by Stake, was based on: (a) descriptions of what intended antecedents or entry behaviors were expected, what intended instructional processes were planned, and what outcomes would be evaluated; (b) descriptions of what actually occurred versus what was intended to occur; and (c) two evaluative judgements, one subjective by an evaluator's personal standards and the other objective by comparison of the particular program to alternative, similar programs. Briggs proposed a second model, the procedures of which would take effect during the development and evaluation phases of the material development cycle. Instructional materials would be selected and modified on the basis of: (a) learner characteristics; (b) intended outcomes; (c) learning alternatives such as dual-track programs; and (d) performance test results from small-group tryouts and classroom tryouts. In a third model, Baker and Schultz outlined seven steps, or components, in the instructional development process. They are: (1) formation; (2) instructional specification; (3) item tryout; (4) product development; (5) product tryout; (6) product revision; and (7) operations analysis, in order that effective procedures may be clearly identified. The fourth model, by Abedor, (Reference 5.5.1) relied on technical review by subject matter experts, group tryouts, and face-to-face debriefings between students who took the lessons

and authors who developed them. Glass proposed an evaluation model for finished products. Tne model, prepared for use by outside evaluators in evaluating finished instructional products already on the market, considered nine points: (1) the product description; (2) goals evaluation; (3) point of entry of the evaluator; (4) trade-offs; (5) comparative cost analysis; (6) evaluation of technical quality, content, medium and availability; (7) evaluation of outcomes; (8) summative judgements and recommendations; and (9) scope and value claims modifying the summative judgements.

After consultation with the dissertation committee, Ward decided to follow the Baker and Schultz model and add to it an outside evaluation component at the Instructional Specification stage. The model was applied during the development by the author of a CAI course for regular classroom teachers in education of visually-handicapped children. The course was delivered to rural school teachers via a mobile CAI laboratory. Early evaluation comments indicated the need for a handbook to accompany the on-line lesson materials, and so a handbook was written. Fifteen college students comprised the field test for the course. Revisions to the on-line course and the handbook were based on: (1) student response records; (2) on-line time records for each chapter and for the total course; (3) print-outs of unanticipated responses to course questions; (4) print-outs of student comments made on-line by students who had branched themselves into the comment routine; and (5) results of the final examination. The Operations Analysis phase of the model identified points where critical time delays occurred, where problems developed, where specific activities facilitated the development process, and what forms and procedures would be useful for transfer to other developmental projects.

Four procedures and forms were identified which, according to the author, "may be useful to other CAI course authors preparing course material for the [IBM] 1500 system while at the same time conducting formative evaluation. Some discussion of these procedures and forms might be appropriate to include in a manual for authors of CAI materials." The procedures and forms are as follows.

First, the Baker and Schultz cycle for instructional materials development provided an appropriate framework for scheduling activities for course development. The model served the purposes of formative evaluation very satisfactorily.

Second, time spent on-line learning the capabilities of the 1500 system gave the author ideas about how system capabilities could be used effectively, about the disadvantages and advantages of certain formats for content presentation and queries, and about various forms of and reaction to feedback for both correct and incorrect responses. This is a simple idea but how many times is it overlooked? When an author and a software programmer work in consort to develop a CAI lesson, the author should spend the maximum permissible time on-line.

Third, author revisions done prior to submitting lesson materials to the CAI Laboratory eliminated changes and corrections which would otherwise have consumed time either on-line or in discussion with a software programmer in order to clarify the author's intent.

Fourth, outside evaluation was facilitated by use of comment cards devised by the author. The cards, with spaces for identifying the lesson label and medium, reduced the author's time needed to identify the material being evaluated and commented upon. The comment cards were chosen by Laboratory personnel to replace blank cards previously used, which was another indicator of usefulness. Comment card formats are given in Appendices G-2 and G-3 of the report.

Examples of author format sheets, audio message program sheets, and a CRT coding sheet for development of CAI lessons are given in Appendix I of the report.

DATA SUMMARY:

Media:	Computer-assisted instruction
Application:	Individualized Instruction
Evaluation:	Formative evaluation by twelve outside evaluators
Environment:	Civilian
Key number:	3.5 Validate instruction
Authoring aid type:	Procedure
Number of pages:	146
Number of references:	41

REFERENCE NUMBER: 4.1.1

IMPLEMENT INSTRUCTIONAL MANAGEMENT PLAN

CITATION:

Air Force Advanced Instructional System. Weapons Mechanic implementation plan (Revision 4). St. Louis, Mo.: McDonnell Douglas Astronautics Company - East, 30 September 1975.

ABSTRACT:

An implementation plan is a detailed document covering every aspect of conducting and administering a course of instruction. This particular plan was written for a course in a computer-assisted, computer-managed, multi-media, multi-track prototype instructional system being developed for the Air Force Air Training Command. Topics covered by the Weapons Mechanic implementation plan include: (a) development and validation of instructional materials; (b) manual management procedures; (c) development and validation of entry testing procedures; (d) sequence and structure of lesson materials, including alternative learning strategies; (e) resource requirements for instruction; (f) media overlap, multi-track, and computer-assisted instruction strategies; (g) incentive management procedures; (h) acceptance tests for instructional materials; (i) computer-managed instruction capabilities and application; (j) media, media devices, and individualized carrels; (k) maintenance, testing, and procurement of media devices; and (l) facility modification and hardware/equipment support.

Since the specific detail in an implementation plan cannot be widely transferred as an authoring tool or procedure, this discussion will center on three characteristics of value to other course developers: (1) the kind of detail required in an implementation plan; (2) the sequential treatment of instructional components; and (3) the support documentation accompanying the narrative text.

First, the detail in an implementation plan consists of concrete, specific statements which allow personnel to implement the intended course and, more importantly, to identify possible flaws in that implementation. For example, the Weapons Mechanic implementation plan specifies the exact levels of review for instructional materials and in what functional departments lesson reviewers work. In defining resource requirements for large-group tryouts, the implementation plan specifies, "The primary resource which shall be required for large-group tryouts is

instructors. The procedures for using instructors to collect data for dependent variables and criteria are described in the Section on Manual Management Procedures. At least 2 instructors per block, shift, and week will be required. Their roles are described in the Section on Manual Management Procedures." And concerning the maintenance of carrels, the implementation plan states, "Based on the nature of carrels (e.g., no moving parts, no primary optical alignments, etc.) preventative maintenance shall be performed on a 40-day cycle...Preventative maintenance shall include inspection for surface damage, structural damage and rigidity. Figure 3-1 shows the logic tree for preventative maintenance." In other words, the clearly stated procedures and requirements in an implementation plan are intended to prevent the confusion and unintentional mistakes that result from unplanned initiation of an instructional system or its component parts.

Second, by using a systematic, sequential treatment of component parts, very few details are "forgotten" or buried. For example, in this document, the section on carrels reads, "3.2 Carrels, 3.2.1 Implementation of Carrels, 3.2.2 Maintenance of Carrels, 3.2.3 Quality Control of Carrels, 3.2.4 Testing of Carrels." Other sections follow the same format. It may read mechanically, but the thoroughness and detail assured by such a format are required in an implementation plan.

Third, the support documentation accompanying an implementation plan is designed to answer possible questions raised in the text and to provide a factual basis for the scheme of the plan. For example, in this document it is stated that "During the initial tryout period, three methods are explained in the text. One method is by personal interview, for which Appendix A contains a structured questionnaire." Similar documentation in the form of figures and tables also exists for course outline, small-group tryout schedule, facility modification, computer terminal installation, and other activities discussed in the text.

An effective implementation plan will have these three characteristics of great detail, logical treatment of component parts, and support documentation. Once a complex operation like implementing an instructional system is "nailed down" with an implementation plan, system developers and system users have a common ground for reviewing and refining the system.

DATA SUMMARY:

Media:	Computer-assisted instruction, audio-visual, and programmed text
Application:	Individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	4.1 Implement Instructional Management Plan
Authoring aid type:	Procedure
Number of pages:	75
Number of references:	None

REFERENCE NUMBER: 4.2.1

CONDUCT INSTRUCTION

CITATION:

Air Force Advanced Instructional System. Learning center instructor (LCI).
St. Louis, Mo.: McDonnell Douglas Astronautics Company - East, 1 March 1976.

ABSTRACT:

A self-paced, individualized, instructor-training package was written for use in a computer-assisted, computer-managed, multi-media, multi-track prototype instructional system being developed for the Air Training Command. The package is divided into two parts. The first part consists of textual discussion concerning the instructor functions in the Advanced Instructional System (AIS). The second part consists of performance-orinented internship and certification training documents for three specific courses: (a) Inventory Management and Materiel Facilities; (b) Precision Measurement Equipment; and (c) Weapons Mechanic.

The first part of the package contains: (a) a glossary of terms related to computer-based instruction; (b) an introduction to the AIS; (c) a discussion of the functions and responsibilities of learning center instructors; (d) details, procedures, and input forms for the computer-managed portion of the system; (e) a discussion of how to maintain favorable learning conditions in the learning center; and (f) a discussion of programmed texts and audio-visual modules for instructional use in the AIS.

The second part of the package is a proceduralized guide to instructor duties in a learning center. Topics covered include: (a) computer terminal operations for grading and for learning center management; (b) instructional preparations and student-centered activities in learning center operations; (c) entry testing procedures; (d) administrative duties required of learning center instructors; and (e) curriculum development responsibilities for lesson materials reviewing and career progression.

DATA SUMMARY:

Media:	Print
Application:	Individualized instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	4.2 Conduct Instruction
Authoring aid type:	Procedure
Number of pages:	70+
Number of references:	None

REFERENCE NUMBER: 4.2.2 CONDUCT INSTRUCTION

CITATION:

Askren, W. B., & Valentine, R. I. Value of job experience to teaching effectiveness of technical training instructors (Report No. AFHRL-TR-70-8). Wright Patterson Air Force Base, Ohio: Air Force Human Resources Laboratory, Training Research Division, June 1970. (NTIS Document Reproduction Service No. AD 709 876)

ABSTRACT:

Is teaching effectiveness related to field job experience? After comparing Air Force technical training instructors with and without field experience, the authors found no evidence of significant differences in teaching effectiveness between the two groups of instructors. However, grades for students who had field-experienced instructors increased from start to finish of course, while grades for students who had non-field-experienced instructors decreased in the same period.

Both groups of instructors were also rated in twelve categories by supervisors. Field-experienced instructors were generally rated higher than non-field-experienced instructors in three categories: (a) Knowledge of Subject Matter; (b) Student Interest; and (c) Student Participation. No difference was noted in the instructor ratings for four categories: (a) Lesson Plan Preparation; (b) Organization of Material; (c) Use of Training Aids; and (d) Evaluation of Student Progress.

Interaction between type of instructor and course unit indicated that non-field-experienced instructors were more effective with lecture-theory units. Field-experienced instructors were more effective with equipment-oriented units.

DATA SUMMARY:

Media:	None
Application:	Conventional instruction
Evaluation:	None
Environment:	Military (Air Force)
Key number:	4.2 Conduct Instruction
Authoring aid type:	Procedure
Number of pages:	
Number of references:	2

REFERENCE NUMBER: 4.2.3

CONDUCT INSTRUCTION

CITATION:

Popham, W. J., & Baker, E. L. Classroom instructional tactics. Englewood Cliffs, N.J.: Prentice Hall, 1973

ABSTRACT:

Learning and attitude are closely related. Since instructors wish to promote reasonable attitudes in students (and thus create a better environment for learning), repressive techniques in class management should be avoided. Popham and Baker suggest six rules for rational classroom management based on educational and psychological research.

Rule No. 1. Attend to observable behavior. Criteria for judging the propriety of students' actions should be established, of course, but simply because you "sense trouble" is seldom a reason for punishment.

Rule No. 2. Tell students what type of behavior is expected of them. This information should not be expressed in a threatening manner nor should it be hidden and then released bit by bit when a student is caught misbehaving.

Rule No. 3. Do not reward undesirable behavior.

Rule No. 4. Avoid punishing undesirable behavior.

Rule No. 5. Provide acceptable alternative student responses for undesirable behavior. Rules 3, 4, and 5 are closely linked to each other. The idea behind them is: if you want a behavior to continue, reward it; if you want a behavior to disappear, ignore it and offer an alternative response.

Rule No. 6. Reward appropriate behaviors. When a student has substituted or has begun to substitute a desirable response for an undesirable response, reward him. An appropriate reward -- called a positive reinforcer -- depends upon the context of the individual student and the learning situation.

The rules are presented in a printed, self-instructional program complete with an answer mask and a mastery test with answers. A coordinated filmstrip-tape program is also available from Vincet Associates, Inc., P.O. Box 24714, Los Angeles, California 90024.

DATA SUMMARY:

Media:	Programmed text (audio-visual is optional)
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	4.2 Conduct Instruction
Authoring aid type:	Tool
Number of pages:	158
Number of references:	None

REFERENCE NUMBER: 5.1.1 CONDUCT INTERNAL EVALUATION

CITATION: Bailey, R. W. Testing manual procedures in computer-based business information systems. In W. B. Knowles, M. S. Sanders, & F. A. Muckler (Eds.), Proceedings of the 16th Annual Meeting of the Human Factors Society, 1972, 395-401

ABSTRACT:

Testing of manual procedures as an essential part of the total systems development process is discussed. The Bell System personnel subsystem testing program is used as an example. It consists of six steps. The first step is Preliminary Evaluation, which consists of design verification of personnel subsystem products by checklists and low-level simulation techniques.

The second step is a Position Package Test which evaluates position packages by using representative subjects in a simulated operational environment. A position package consists of position practice, training materials, performance aids, forms and/or information displays, and a statement of the minimum qualifications required of position holders. Position may be defined as job responsibility.

The third step is a Subsystem Test which analyzes the proper information flow for processing every transaction that enters a system and triggers system processing. Sequential information flow into and out of positions is also considered.

The fourth step is a System Test, consisting of performance tests for the personnel subsystem and the computer subsystem in separate simulated operational environments.

The fifth step is a Total System Test. The total business information system is performance-tested in a simulated operational environment.

The sixth step is a Trial. The final step of the testing program is conducted in a real-time operational environment to determine if the system achieves specified system performance objectives under normal operating conditions.

A test report containing quantitative results and recommendations records not only the number and kinds of errors made during the test but also the probable causes for the errors. Accuracy objectives are set before testing begins, and estimated error rates derived from the tests are compared with the accuracy objectives to determine what changes are required to make the system meet its performance objectives.

The author notes that errors can be caused by seven factors: (a) design; (b) documentation; (c) training; (d) personal; (e) source data; (f) environmental; and (g) man-machine interface.

DATA SUMMARY:

Media:	Simulation
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	5.1 Conduct Internal Evaluation
Authoring aid type:	Procedure
Number of pages:	7
Number of factors:	None

REFERENCE NUMBER: 5.1.2

CONDUCT INTERNAL EVALUATION

CITATION:

Miller, G. G., and Sellman W. S. Development of psychometric measures of student attitudes toward technical training: Norm group report (Report No. AFHRL TR-73-15). Lowry Air Force Base, Colorado: Air Force Human Resources Laboratory, Technical Training Division, October 1973.

ABSTRACT:

Development of a new student critique form (SCF) for the Air Training Command (ATC) is discussed. The study had four objectives: (a) generate more items for a previously-developed prototype scale in order to increase its reliability; (b) administer the improved SCF to large numbers of officer, NCOs and airmen enrolled in technical courses; (d) factor analyze the SCF in order to ensure scale unidimensionality; and (d) norm the SCF for officers, NCOs, and airmen. Factor analyses revealed seven unidimensional scales: (a) Instructor Competence; (b) Study Environment and Testing; (c) Specialty Training; (d) Training Impressions; (e) Classroom Facilities and Environment; (f) Training Devices and Audio-Visual Aids; and (g) Training Materials Adequacy.

A 69-item SCF was administered to officers, NCOs, and airmen enrolled in technical training courses at six Air Force bases (Chanute, Keesler, Sheppard, Lowry, Lackland, and Goodfellow). Scores were returned for each rank, Air Force Specialty Code (AFSC), and Air Force base where the training center was located, as individual average scores and as scale scores. Scores for each unidimensional scale were also reported by rank, AFSC, and base.

Analyses of scores returned by 1,669 trainees indicated: (1) attitudes of trainees toward technical training were "slightly" positive; (2) the most positive attitudes toward technical training were held by NCOs, followed by officers, and then airmen; (3) since statistically significant differences existed among scores at the six bases, the SCF should be normed separately for each base; (4) the Instructor Competence scale received the most consistently-positive response from trainees; and (5) the Specialty Training Scale received the most

consistently-negative response from trainees, which indicated a lack of assurance -- especially among airmen -- that technical training was adequately preparing them for on-the-job performance.

The next phase of the critique improvement program will be development and implementation of computer software for managing the entire student critique program.

Appendix A contains a sample ATC Form 736, Student Critique. Appendix B contains the improved student critique form.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	Internal statistical analysis
Environment:	Military (Air Force)
Key number:	5.1 Conduct Internal Evaluation
Authoring aid type:	Tool
Number of pages:	42
Number of references:	18

REFERENCE NUMBER: 5.2.1 CONDUCT EXTERNAL EVALUATION

CITATION:

Anastasio, E.J. An evaluation of the demonstrations being conducted by The University of Illinois and the MITRE Corporation of their respective computer-assisted instructional systems (ETS PR-72-19). Princeton, N.J.: Educational Testing Service, 1972. (ERIC Document Reproduction Service No. ED 072 070)

ABSTRACT:

Development and structure of a plan for evaluating the cost performance and educational benefits of the TICCIT and PLATO projects in 1971-72 are reported. Included with the report are: (a) an annotated bibliography of documents relating to computer-based education in general, and to research and development and evaulation concerns of each project; (b) Appendix A, Survey of Instructor Activities and Attitudes; and (c) Appendix B, Attitudes toward Reading Questionnaire -- Grade 2 and Grades 4 and 6. Due to schedule slippages in each project's development, the field-test evaluation has been repeatedly postponed. However, as an example of evaluation procedure, the Educational Testing Service (ETS) report is useful. The report is divided into three sections.

The first section discusses cost analysis of PLATO and TICCIT in terms of five cost categories: (a) hardware; (b) software; (c) courseware; (d) administration; and (e) incremental site (out-of-pocket). A distinction is made between one-time costs (developmental and implementation expenses) and recurring costs (operating costs). In the TICCIT cost analysis section, there are four parts to hardware costs: (a) the processor facility; (b) the communication system; (c) the terminal; and (d) audio-video and other, including personnel costs. There are three parts to software costs: (a) application software; (b) authoring software; and (c) delivery software. Courseware costs are figured in dollars-per-hour for courseware development by the following specialists: (a) instructional psychologist; (b) instructional design technician; (c) empirical design technician; (d) packaging specialist; (e) author; and (f) program implementation. Administration costs are determined monthly on the basis of the ratio of each course-development cost of the total monthly developmental costs. Incremental costs include expenses for modifying a site for instruction (including air conditioning, and electrical and facility modification). Cost categories for the PLATO system have been similarly

divided, although it is noted that the very different natures of the two systems make direct comparisons misleading.

The second section discusses educational analysis of the two systems in terms of: (a) achievement and attitude measurement; (b) experimental design; and (c) data collection. Student achievement would be measured by standardized achievement tests, with addition of item-analysis and multiple-matrix sampling techniques for obtaining group measurement. Student attitude would be measured by five standardized attitude surveys and by ETS-developed items. The five attitude surveys are: (a) Student Instructional Report; (b) Comparative Guidance and Placement Program Student Questionnaire; (c) College Student Questionnaire-Part 2; (d) College and University Environment Scales; and (e) Student Reactions to College. Several of these scales were still under development in 1972. Not all scales would be completed by any one student. Faculty attitudes would also be assessed. Experimental design considers the comparability of groups taking different treatments, comparability of content taken by taking different treatments, obtaining matched pairs of students with and without CAI, and appropriate statistical analyses to assess CAI program effectiveness. Data would be collected from each project's own records concerning system cost and maintenance, i.e., system reliability. In addition, system performance variables such as terminal response times, queueing effects, ease of updating both software and hardware, and user satisfaction with the system would be examined. The terminals would be examined for comfort, safety, durability, and special environmental or wiring requirements.

The third section covers technical analysis, which consisted of a number of visits by ETS to TICCIT and PLATO for detailed briefings on the projected hardware and system design. No conclusive findings are given.

DATA SUMMARY:

Media:	Computer assisted-instruction, computer-managed instruction
Application:	Self-paced, individualized instruction
Evaluation:	None

Environment:	Civilian
Key number:	5.2 Conduct External Evaluation
Authoring aid type:	Procedure
Number of pages:	83
Number of references:	107

REFERENCE NUMBER: 5.3.1 REVISE SYSTEM

CITATION:

Havelock, R.G., Havelock, M.C., & Markowitz, E.A. Educational innovation in the United States. Volume I: The national survey: The substance and the process. Ann Arbor: The University of Michigan, Institute for Social Research, Center for Research on Utilization of Scientific Knowledge, June 1973.

ABSTRACT:

This report is an assessment of educational innovations in the public sector during the 1970-71 school year. The process by which those innovations come about or continue to operate is discussed.

Specific findings, which may be of some interest, are as follows: (a) of 353 school districts sampled, 346 (98%) reported at least one major innovation during the year, with "major" being defined as a "substantial reorientation on the part of the staff, a reallocation of resources, or adoption of new practices, programs, or technology," (b) individualized instruction and team teaching were the most frequently reported innovations; (c) 83% of the innovations were successful; (d) teachers played more key roles in the innovations, followed by assistant superintendents, and then principals; (e) the greater barrier to innovations was confusion among staff about the purpose of the innovation; and (f) school district size and per-pupil expenditure positively correlated with frequency of innovation, but no relationship was found between innovativeness and the percent of graduates going on to four year colleges, the pupil-teacher ratio, or the difficulty in obtaining financing for new or existing programs.

The data for this study were obtained through a very detailed but well-formatted mail questionnaire, which is given in Appendix A with an instruction sheet. The questionnaire could be easily adapted for obtaining data for revising an instructional system. The three-page questionnaire is designed to gather data: (a) describing the nature of the innovation and how it came about; (b) how much emphasis was given to several key innovation procedures; (c) what barriers to innovations existed; (d) what institutional changes in both the local school and school district resulted from the innovation; (e) what internal and external resources were used to implement the innovation; (f) how often and to what extent the innovation was used; and (g) specific characteristics of the school district,

including information on policies and procedures, system size and staffing, and frequency of teacher strikes and student-community group protests.

DATA SUMMARY:

Media:	Print
Application:	Conventional and individualized instruction
Evaluation:	None
Environment:	Civilian
Key number:	5.3 Revise system
Authoring aid type:	Tool
Number of pages:	234+ (Report), 3 (Questionnaire)
Number of references:	24 (Report)

REFERENCE NUMBER: 5.3.2 REVISE SYSTEM

CITATION:

Haverland, E. M. Transfer and use of training technology: A model for matching training approaches with training settings (HumRRO Tech. Rep. 74-24). Alexandria, Va.: Human Resources Research Organization, October 1974. (NTIS Document Reproduction Service No. AD A005 816)

ABSTRACT:

A model for evaluating training approaches or innovations in terms of requirements, resources, and constraints of specific training settings was developed and field-tested. The model contains two parallel sets of questions. The first set of questions concerns the characteristics of the training approach under consideration. The second set of questions concerns the requirements, resources, and constraints in the specific training setting. This report discusses the development of the preliminary version of the model, its field evaluation by Air Force training personnel, and its subsequent revision. A stand-alone version of the model with supporting material is given in the text. Relationship of the model to Air Force procedures for Instructional System Development (ISD), to the Rand Corporation's design system for instructional systems (MODIA), and to the Air Force's Advanced Instructional System (AIS) is discussed. The application of the model to several different training approaches and setting is discussed.

With matching, parallel sets of questions, the model operationally covers the following components of instructional systems: (a) resources required and resources available; (b) instructional design and management; (c) training content characteristics; (d) instructional personnel; and (e) student characteristics.

The model was applied to the training approach called peer instruction used in the Law Enforcement Specialist course (3ABR81230) at Lackland Air Force Base. Information for the model came from the Course Chart and the Plan of Instruction for the course. General information was gathered during a site visit to the School of Applied Aerospace Sciences at Lackland Air Force Base.

Because required information could not be obtained from this course, the application of the model was unsatisfactory, but plans were made to apply the model to another training setting in close collaboration with Air Force personnel. Critical data which could not be gathered during the original tryout included: (a) the objectives of persons working in the training setting who were responsible for its efficient and effective operation; (b) problems existing within the training setting; (c) availability of space, equipment, and support services; (d) lead times for course modifications; (e) school operating policies; (f) student characteristics; (g) availability of funds in the training setting; and (h) characteristics of the training content. It was concluded that the model could not be applied very successfully to a training setting at a distance and with documentation intended for other uses. In the proposed on-site application of the model, a more rigorous evaluation of the model will be conducted.

Results of the original application of the model to the peer instruction training approach are given in Appendix A.

DATA SUMMARY:

Media:	Print
Application:	Peer instruction
Evaluation:	Field test
Environment:	Military (Air Force)
Key number:	5.3 Revise System
Authoring aid type:	Tool
Number of pages:	78
Number of references:	24

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