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ABSTRACT

The state of the art of instructional technolcgy in the Army TRADOC Schools and Training Centers is reviewed. The report: 1) defines instructional technology, 2) describes the current usages of the products and processes associated with instructional technology, 3) assesses the value or potential value of these products, and 4) describes exemplary programs utilizing these products or processes. The conclusions are reached that the atmosphere within the Army training system is conducive to the use of instructional technology, but that management personnel need training in the design and implementation of instructional models and that greater dissemination of successful programs is needed. It is recommended that: 1) personnel be trained to develop training models utilizing technology; 2) middle and upper management personnel be prepared to administer programs; 3) systems for research, development, evaluation and dissemination in the areas of instructional technology and instructional systems be developed; 4) job performance evaluation instruments be built from real world performance objectives; and 5) all instructional approaches used in training programs be examined to determine the proper function of each. (PB)

ANALYSIS AND ASSESSMENT OF THE STATE OF THE ART IN

INSTRUCTIONAL TECHNOLOGY

FINAL REPORT: TASK I

CONTRACT NO. N61339-73-C-0150 BETWEEN THE
U.S. ARMY COMBAT ARMS TRAINING BOARD AND
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ANALYSIS AND ASSESSMENT OF THE STATE OF THE ART IN INSTRUCTIONAL TECHNOLOGY

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I. INTRODUCTION

The introductory paragraph in Task I of the referenced contract is:

> Assess the state of the art in empirically designed training technology, identify concepts appropriate to the mission of TRADOC Schools and Training Centers and recommend methods for institutionalizing these concepts within the TRADOC School and Training Center system. (See Appendix G.)

It is the intention of the report to: define training technology (instructional technology), describe the current usages of the products and processes associated with instructional technology, assess the value or potential value to TRADOC Schools of each of these products and processes, and describe exemplary programs utilizing these products or processes from the Army and the other services. Finally, a series of recommendations will be offered based on this analysis and on the analysis and assessment of the products and processes currently in use in TRADOC Schools and Training Centers.

It is noteworthy that no important product or process generally used by professional instructional or training technologists has been discovered which is not being applied with reasonable, if not outstanding, competence at a TRADOC School or Training Center. Certainly if one includes the other services, the entire field of instructional technology could be defined by selected examples from these institutions. This fact makes it clear that a climate of real opportunity for development and expanded utilization exists at this time. It is important to note then, that this report will not address itself to the discovery of new processes or products not already available. What it will be concerned with is recommending a methodology for institutionalizing and improving on these products and processes in order to gain maximum benefit from their use.

II. THE FIELD OF INSTRUCTIONAL TECHNOLOGY

A. Definition

Generally, instructional technology is the application of accumulated technical and research-based knowledge, research techniques, and invention to the solution of educational and training problems. Specifically, the products and procedures used in the field are articulated by applying systems-approach processes to achieve clearly defined missions. These processes have been derived from the management sciences and practices, the behavioral sciences, and the communications technologies and sciences.

It must be emphasized that this definition of the field has evolved during the past fifteen years and that, in the eyes of instructional technologists, there is a dramatic difference between the traditional definition--which usually only encompassed the hardware and software development aspects--and the definition used here. The existence and use of audio-visual or electronic hardware in a training setting is not a necessary or sufficient condition to satisfy the definition of the field. Many specific procedures and techniques used by instructional technologists require no hardware or recognizably unique software or materials (e.g., contingency management, behavior modification, empirically validated individual study materials).

This change in direction and emphasis has not been fully recognized in recent analyses of the uses of instructional technology in the public schools of the United States. A recent Ford Foundation report, A Foundation Goes to School (1972), indicated that instructional technology was not being adequately implemented in schools, and that much of the audio-visual equipment was going unused. This conclusion is obvious if one defines instructional technology as "innovation" or uses instructional technology as another word for "audio-vidual aids." The Foundation may have again intentionally limited its definition, for its recent report by Armsey and Dahl, An Inquiry into the Uses of Instructional Technology (1973) has continued to perpetuate the notion that instructional delivery systems are (rather than are a part of) instructional technology.

The evolution of the current definition of instructional technology has significant implications. First, as the scope of the definition widened, instructional technologists' attentions were focused on concepts, procedures, and products which had previously been outside their field. A second and more obvious implication is the necessity for evaluation and re-evaluation of old practices to determine their appropriateness to the new directions within the field.

To facilitate a more precise definition of instructional technology, some of these new concepts and new approaches to old concepts are examined below.

B. Systems Analysis

The major shift that has taken place within the practices, thoughts, and research of those who define the state of the art in the field is that of looking at instruction from a system analytic point of view. This procedure was clearly recognized by the Department of the Army in promulgating CON REG 350-100-1, Systems Engineering of Training, in 1968.

This regulation reflects the purposes, practices, and intents of instructional technology and has little, if any, conflict, except where improvements in the state of the art indicate a need for updating and revision of the regulation.

A systematic approach to instruction or training must begin, according to current thought, with an analysis of whether a discrepancy exists between what is and what ought to be. That is, if there is no requirement for higher trainee performance in the field, there is certainly no identified need for more or better training. Thus, training needs originate when new systems or procedures must be implemented, or when researchers or competent supervisors discover that personnel are unable to perform specific activities required in their duty position, diminishing a unit's capability to accomplish its mission.

C. Task and Training Analysis

Modern application of instructional technology calls for an analysis of what is required on the job before the design of the training system can be accomplished. Further, data gathered by those who define jobs (industrial engineers, human factors and man-machine systems specialists, etc.) is sufficient only to identify the job task and is not adequate to define training requirements. The analysis of a task into its training components is a different procedure than the analysis of a task into its job performance components. Consequently, training objectives which have been derived from job performance requirements through job task analysis procedures may well be different than the job task objectives.

In job performance, order and proficiency are very important, but the order of performance of a job is not necessarily the best order of training. Training objectives need to be analyzed according to contemporary learning analysis procedures in order to determine the most efficient method of learning the prescribed task. This analysis procedure is not covered adequately by CON REG 350-100-1.

The training system development model referred to in CON REG 350-100-1 (20 April 1972) on page 3 indicates a procedure which requires the development of a training analysis prior to the development of the evaluation instruments. Recent thought stresses the importance of deriving evaluation procedures at the earliest possible time in the design of the training system, preferably at the same time that the training objectives are developed. Research by Mager and others has indicated that the potential for payoff in instructional technology with many ability groups lies principally in simultaneously stating clear objectives and exact performance measures.

As indicated in the regulation such measures ought to be referenced to the objectives and not to the norm or average of the group of trainees. High school diplomas awarded by different schools are no longer a reliable indication of a student's knowledge or ability. Such diplomas may only mean that students have avoided disciplinary discharge.

D. Mastery Learning

A further refinement in conceptualizing training occurs with the combination of objectives-referenced measures with mastery learning practices. By allowing individual trainees to proceed through a training exercise at a rate suited to their learning requirements and by providing alternative instructional approaches, it has been found that 90% or more of the trainees can learn the knowledges and skills necessary to achieve mastery. If instructional time is held constant, the final performance of the trainees varies considerably from mastery performance on the high end to totally unacceptable performance on the low end.

This combination of evaluation and instructional procedures necessarily must change the administrative practices. Historically, it has been thought that the processing of records and trainees in groups was more desirable than individual processing. Research has indicated, however, that if performance is critical, then time and instructional procedures must be varied. Consequently, mastery performance must be demonstrated at the completion of instruction. End-of-course performance defines the product of instruction and is not, necessarily, concerned with the processes and procedures used to produce that performance. The product and process of training are explicitly independent concepts; the process causes the product.

E. Accountability

The instructional technologist through the use of the systems approach developed in the management sciences, has attempted to define clearly the purposes and intents of training: the definition of training mission. The past fifteen years have seen many refinements and improvements in techniques which are used to define and sharpen mission statements. With this improvement in the technical characteristics of mission definition and problem analysis, has come a philosophical shift toward the notion of instructional management accountability.

While many view the notion of accountability in a negative sense, the positive benefits to management are hard to overestimate. Ideally, the accountability principle would require procedural and process changes within the operation and planning of training in order to increase the probability that the mission can be achieved.

Simply stated, the accountability principle requires of each element in a training system that performance which causes the mission to be accomplished:

1. The trainee is required to participate actively in the activities designed for him.

2. The trainer must apply those techniques and procedures necessary to enable each trainee to master the objectives.

3. The instructional designer is required to produce instructional products and procedures which have demonstrated effectiveness.

4. The training manager must constantly strive to achieve more effective and efficient training.

One implication of accountability is that a training system should never be in static equilibrium. If the optimum proportion of trainees leaving the system has met minimum performance requirements within the planned time and cost constraints, then the question of improvements should constantly be asked.

If training system management is charged with the responsibility of achieving this aim, the optimization of output, then it should be further charged to investigate alternatives in practice which would reduce costs or trainee time, or make other system improvements which could yield system performance at a higher level of efficiency or effectiveness. In this context, system <u>effectiveness</u> refers to the continuum of the proportion of trainees meeting minimum acceptable standards. <u>Efficiency</u> refers to the continua of time and money. A training system then, improves itself by increasing its effectiveness or its efficiency or both.

F. Management

Management responsibilities required for the successful application of instructional technology include the appropriate use of resources in order to achieve a higher level of effectiveness or a higher level of efficiency, or both. The training manager must be constantly aware that traditional training systems have allocated approximately 90% of their budgets to personnel costs, making these systems highly labor intensive. In order to move from a labor intensive to a capital intensive system, prudent investments must be made which allow for the substitution of things, processes, or procedures for people.

Such thought is considerably different from contemporary training and educational practice. While many training managers believe that they have always used systems management techniques and concepts, careful inspection of training methodologies indicates that little change has been made in the conduct of training except in a few known and isolated circumstance.

Training system management is not a technology, it is an art. However, the development of cost-effectiveness, cost-benefit, and rate-of-return comparisons have made it possible for informed managers to achieve a better return for their training investment.

Measurement techniques which describe these changes need to be developed within the operating context of the Army system. Reductions in necessary man-days of training which can result in increases in man-days of operations. provide a reasonable basis for comparing training efficiency. Management thought and practice which keeps this goal constantly in mind should yield a high degree of sophistication in decisions relating to alternative proposals for the utilization of resources.

An investment in equipment or procedures which will be additive to costs and will not improve measured output should be seriously questioned. Historically, hardware systems and software packages have been bought in both the military and civilian community without this careful scrutiny.

G. Improving Instruction

It has generally been believed that the best way to improve instruction was to improve instructors. While one cannot seriously challenge the logic of this old approach to improving the quality of instruction, one can certainly review the historical, experimental evidence to see whether this claim has been verified. Overwhelmingly, results which have been obtained by attempting to improve platform teaching methods have been unsuccessful in improving measured learner performance. One must be careful here to distinguish between training in pedagogy and training in subject matter. The necessity for training in subject matter is not questioned, but increased training in platform instruction has not produced a measured increase in student performance.

Two things seem to be clear. First, evaluation of instructor performance which has traditionally been process oriented might well have its emphasis shifted to a product orientation. Second, if instruction is to be improved, the emphasis must be placed on the design and management of better systems of training.

H. The Role of the Instructor

The defined role of an instructor has changed from that of an organic delivery system to that of a manager of materials and personnel to the accomplishment of specific instructional objectives. This change in focus and requirement on classroom management has not come about without considerable social disruption and reorganization where such changes have been made. However, instructors and others who have been provided with <u>adequate training and skill</u> in new instructional practices have become quite adept at employing them. Further, it is commonly believed among professionals in the field that the greatest hindrance to the adequate implementation of modern instructional delivery systems is not that of <u>resistance from the staff</u>, but that of the inflexibility of the traditional management systems.

It has become clear, painfully clear in many instances, that archaic management practices cannot be used to implement modern instructional systems. Thus, much work must be done to improve the organizational integrity and management practices of those organizations wishing to upgrade their training through the application of instructional technology.

I. Summary

This section of the report has dealt with the definition, description, philosophy, and practices in instructional technology. The purpose was to provide a clear understanding of what instructional technology is and to establish bases for decision making which would result in improved training system performance. The following section will describe the processes and products of instructional technology and describe how they can be articulated in order to provide alternative instructional strategies. The goal is the development of cost-feasible solution strategies for training which improve training system performance. The following section will also serve as an operational definition of the field as interpreted by current practitioners.

III. THE PROCESSES OF TRAINING DEVELOPMENT

A. The Design Model

Analysis, planning, development, evaluation, revision, and management are common elements found in most modern treatments of instructional design and implementation. Regardless of whether one intends to deliver instruction through programmed instructional textbooks, instructional television, motion pictures, or other forms; the model for planning, design, and implementation remains essentially the same.

This report assumes a clear difference in the operational definition of job tasks and training tasks. This difference is elaborated elsewhere in this report. In this section, the procedure for instructional development begins with the clear identification of job tasks that represent the minimum acceptable performance for a duty position or a clearly identifiable subset of the skills necessary for a duty position. The job task analysis is a critical step in the instructional development model, because it provides the input to the other steps.

The developmental model presented on the following pages, then, is for the design of training and emphasizes the analytic and evaluative procedures relevant to the training environment. It should be noted that the configuration of the model is intended to provide an orderly means of describing the process of instructional design, and is not intended to prescribe an exact step-by-step procedure for such a design.

The process of training development involves three distinct phases. The first of these phases is the Instructional Design Phase and begins as indicated on the flow chart (see Figure 1) in block 1.0 with Analysis of Job Task.

INSTRUCTIONAL DESIGN PHASE

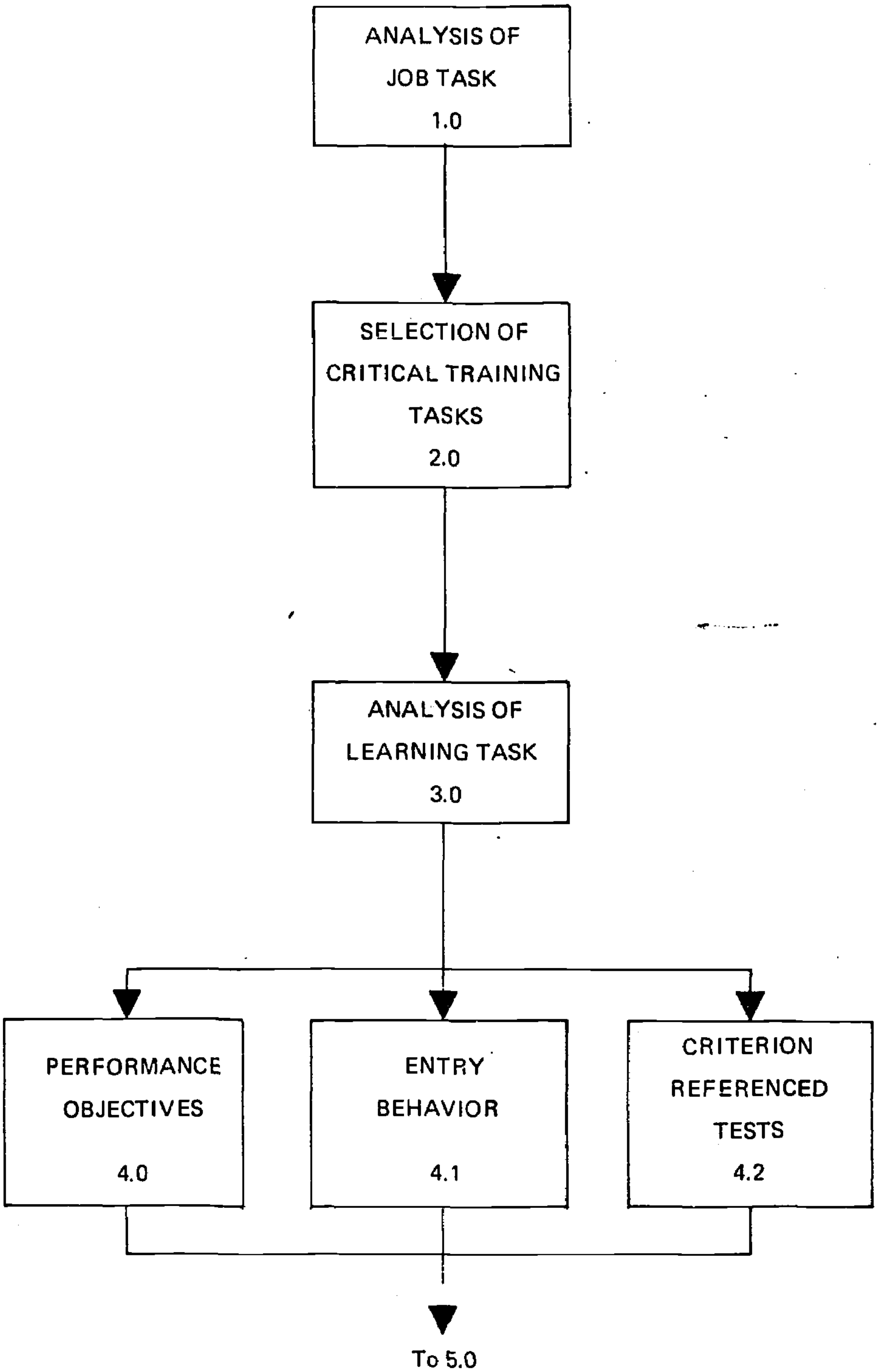

FIGURE 1

Analysis of Job Task (1.0)

The procedure followed in job task analysis is that of attempting to specify the tasks that must be successfully performed in the execution of a job. Job task analysis serves to establish the purpose for a course of instruction by clearly indicating the knowledge, skills, and attitudes that must be displayed by incumbents who occupy specific jobs. (See Appendix D.)

Selection of Critical Training Task (2.0)

Once the job task requirements have been clearly defined, then two alterntives are available: either select people for the jobs who already have the skills, or train sufficient numbers of people to meet the needs. Either alternaitve is useful under certain conditions.

If a decision is made to train for the job, then alternative training sites can be considered. Should they be trained on the job or in a formal school? Regardless of training site, the output of this step is a clear detailing of the training tasks for which learning experiences must be developed.

Analysis of Learning Task (3.0)

The logic and procedure of learning task analysis, specific to the peculiarities of training tasks, are carried out according to the framework described in Appendix C. Essentially, the kinds of learning and the conditions necessary to produce that learning are spelled out for each of the essential tasks.

Block 4 involves the clear specification of three interdependent steps:

Performance Objectives (4.0)

The standard behavioral objectives which describe the behavior, conditions and standards under which the performance will be exhibited are enumerated here.

Entry Behavior (4.1)

Each objective or training task will assume certain entry level skills and knowledges on the part of the trainee. These would include reading to a certain degree of proficiency, trouble shooting techniques, etc. Methods for determining entry behavior are also specified.

Objectives-Referenced Tests (4.2)

The performance measures and techniques for determining whether or not a student has satisfied the requirements of the objective are formulated here. The method for measurement, conditions of measurement, and procedures are all specified at this point. Questions of reliability and validity of the tests are settled here. At this point, one enters Phase 2 of the procedure, the Instructional Development Phase. This second phase (Figure 2), begins in block 5.0 with Learning Activity Selection.

Learning Activity Selection (5.0)

The learning task analysis as performed will, to a very large extent, specify the kinds of learning activities necessary to move trainees from their current level of knowledge and skill to mastery of the objective. In the learning activity selection step the instructional designer identifies the conditions of learning that have the greatest probability of being effective and efficient in producing the desired learning. This decision is based as firmly as possible on the research into human learning that identifies effective conditions of learning. The learning activities may or may not involve direct instruction, but would certainly encompass many of the products and procedures described in Section IV on Instructional Delivery Systems.

Media Selection (6.0)

The varieties of media available and the procedures available in the literature for selection among alternatives are quite large. It is not anticipated that a specially designed new media selection scheme will be developed but a number will be selected for possible consideration. Instructional media can be used in various delivery systems.

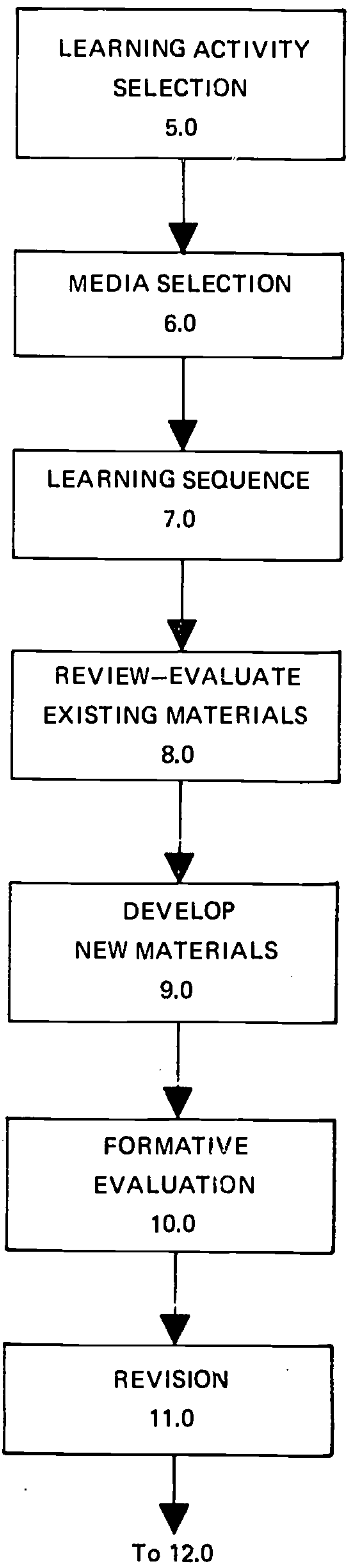
LEARNING ACTIVITY SELECTION 5.0
MEDIA SELECTION 6.0
LEARNING SEQUENCE 7.0
REVIEW–EVALUATE EXISTING MATERIALS 8.0
DEVELOP NEW MATERIALS 9.0
FORMATIVE EVALUATION 10.0
REVISION 11.0
To 12.0

FIGURE 2

Learning Sequences (7.0)

Once the activities and the media have been determined then the instruction can be sequenced. It must be sequenced according to the best order of learning as determined by the task analysis in the Design Phase. (See Appendix C.)

Review-Evaluate Existing Materials (8.0)

One of the more profound discoveries in recent years in instructional technology is that there is a very rich supply of available off-the-shelf materials dealing with almost any subject one might wish to review. Further, these materials exist in a variety of forms: videotape, slide/tape presentations, textbooks, etc. Hopefully, it will be possible to encourage instructional designers to look first for off-the-shelf existing materials before writing the specifications for new materials.

Develop New Materials (9.0)

Depending on the kinds of learning experiences in the learning analysis, the range of new materials to be developed would include everything from programmed videotape to computer managed instruction and special forms of job aids and training aids. Expenses can be minimized if new material development is held down.

Formative Evaluation (10.0)

Throughout the entire instructional development procedure, including the Design Phase, a continuous monitoring and evaluation procedure is in place. The most typical method of evaluating learning materials and procedures is to try them out under realistic conditions on a selected group from the target population. Typically, a very small group of trainees first goes through the materials and sequences and, if necessary, the materials are revised based on the data provided by these trainees. The data collected is intended to be used for decision making about the quality of the instruction. This process of collecting data from trainees is then expanded to encompass larger groups, and on the basis of the large group tryout, recommendations for further revisions are made.

Revision (11.0)

Revision applies to each of the steps in instructional development. It may be that the performance measures must be revised. It may be that the objectives must be refined. It may be that the learning sequences and learning materials have specific problems associated with them. Based upon the formative evaluation data, revision decisions are made and a product is then declared ready for Phase 3, the Instructional Delivery Phase. This phase of the model (Figure 3) begins in block 12.0 with Delivery System Alternatives.

Delivery System Alternatives (12.0)

Any instruction possible can be delivered in more than one form. There are many operating, environmental, and financial constraints to the selection of alternative delivery systems and equipment. Hopefully, there will be enough flexibility in delivery system and equipment alternatives to make the developed materials and learning experiences achieve planned objectives.

Implementation/Conversion Strategies (13.0)

Often, when the most desirable delivery system is not available it is necessary to implement the program by converting it to another form of delivery. This might include, for example, conversion from group mode to individualized mode or vice versa.

In many cases it will be necessary to implement systems developed instruction in a training environment that has remained traditional in its orientation. In such situations the conversion is often neither easy nor immediate. Thus, it is necessary to carefully plan for the change from traditionally developed instruction to systematically developed instruction.

Instructional Management (14.0)

The words and concept "management of instruction" have in the past fifteen years taken on a completely new meaning. Management, in this context, means precisely what it means

INSTRUCTIONAL DELIVERY PHASE

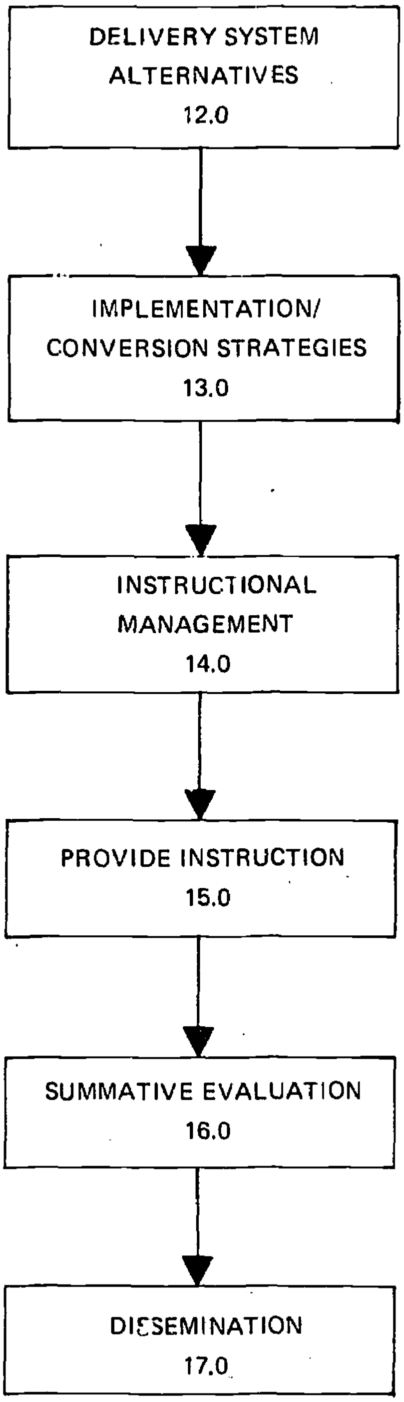

FIGURE 3

in other contexts: the utilization of men, material, and resources to achieve an objective. It specifically does not mean teaching (platform instruction). If the instructional system is to be effective, then a careful analysis of management requirements is essential. Alternate management techniques are also considered at this step in the model.

Provide Instruction (15.0)

Once the instruction has been developed and management techniques selected, it is possible to operate the instructional system. This simply means that one manages the implementation of the plan and facilitates appropriate trainee participation in the program.

Summative Evaluation (16.0)

After having delivered the instruction in an operational mode for a sufficient period of time it is necessary to compare actual results with planned results. Summative evaluation implies that results will be compared with plans. Should there be a discrepancy between what was planned and what was achieved the implication should be clear that further work, revision, and re-design may be necessary.

Dissemination (17.0)

The final and probably most misunderstood part of the instructional development process is dissemination. For a number of reasons including pride of authorship, the "not-invented-here (NIH)" syndrome, and lack of adequate planning, effective instructional presentations often exist in one location without being transported to another location having the same needs. It is clearly the responsibility of management to improve utilization of resources.

There are important aspects to the dissemination of innovative and empirically designed training programs. First is the marketing aspect. Whether the request for change from the old to the new system eminates from the bottom and is submitted for approval to commanding authority, or whether the impetus comes from headquarters and is promulgated as an order will make a very large difference in the approach one takes to institutionalizing planned changes in training. Experienced instructional technologists recognize that both levels must be informed, competent, and well intended in order for a well designed training program to be adopted, particularly if it was developed elsewhere. Alternative approaches to this problem are considered in the dissemination program.

Appendix E is a reproduction of a number of conclusions from a recent Ford Foundation Report by Armsey and Dahl. Inferences from these conclusions should be helpful in implementing the total instructional technology program.

B. Operational Practices

Scrivin has distinguished two evaluation processes, the formative and the summative. Formative evaluation is used during the development of instruction (products and processes) in order to provide guidance to the developers on the effectiveness of their materials. Tryouts of the materials, student interviews, ratings, and other techniques are used to gather data on effectiveness. Summative evaluation is used at the termination of the development process in order to provide data upon which final effectiveness decisions can be made.

The importance of formative evaluation becomes much more evident when it is seen as the key element in the iterative process. Further, formative evaluation applies to all aspects of the developmental process: task analysis, instructional design, performance measures, tryout procedures, and revision procedures. Each aspect of the development process is subjected to evaluation during development and after the product is completed. The use of formative evaluation procedures and the tryout and revision of materials (iteration) is known as the empirical validation of instruction.

Empirical validation is the only known process which guarantees that instruction will achieve its planned outcomes. The process is often slow and frequently expensive but, if followed according to established procedure, is virtually always effective. Whether instruction needs to be offered is, of course, a matter for determination by other means. However, once it has been determined that a given body of subject matter needs to be established in the behavior of a group of trainees, then empirical validation procedure is the only known way to guarantee such performance. The realization of this fact has become one of the significant advancements in instructional technology.

The concepts of diagnostic testing and advanced placement have been in the field of education and training for a number of years. Only recently, however, with the advent of the widescale use of objectives-referenced evaluation, have they truly offered immense savings in a training environment. By its nature, objectives-referenced evaluation implies absolute standards and a finite learning problem. If, prior to instruction, trainees are thoroughly examined on all of the objectives of training, and an opportunity exists for placing trainees in a course at a starting point other than the beginning, then this approach to placement can be highly cost-effective. Further, specific areas of difficulty can be identified and corrected.

C. Summary

The purpose of this chapter was to present a model representing the technologist's systematic approach to instruction. The next chapter will expand upon the Instructional Delivery Phase (Figure 3, page 17), by presenting a number of alternative instructional management and delivery systems.

IV. INSTRUCTIONAL MANAGEMENT AND DELIVERY SYSTEMS

It has become clear over the years that there is no such thing as a universal standard, all-around, multi-purpose system to deliver effective instruction. What may work well for law and medical students may be totally ineffective for infantrymen and radiomen. The abrupt realization of this fact has stimulated research on alternative instructional delivery processes and systems. The following list of alternative delivery systems and processes is not exhaustive but is intended to be exemplary. The advantages and potential target population for each are highlighted.

A. Articulated Multimedia Systems

Briggs and Markle developed a model program for the American Telephone and Telegraph Company which subsequently donated it to the American National Red Cross. The subject matter was First Aid and the approach was an empirically validated multimedia presentation using a variety of instructional treatments including 16mm film, audio tape, instructor guides, and workbooks designed to provide hands-on experiences. This approach should be thoroughly investigated, particularly as a means of improving non-resident instruction.

B. Contingency Management

In utilizing contingency management, one first determines a trainee's preferred activities or objects (work, play, cigarettes, entertainment) and then allows him access to these only when he completes a certain amount of work. Usually the trainee must complete an assignment and then he is allowed a fixed amount of time to enjoy his preferred activity or object.

Contingency management is an effective motivation controlling procedure and seems to work well with all levels of trainees. It seems to be particularly useful in organizing the behavior of chronic discipline cases.

C. Audio Systems

Much recent research has opened the field of audio technology and has offered opportunities for training improvement. Certainly the use of tape-cassettes, instructional radio, and compressed speech should be considered as appropriate forms of instruction when the conditions and constraints of the learning environment so dictate. Opportunities for radio instruction can be found worldwide through AFN and other radio systems, tape technology has virtually limitless applications, and compressed speech seems to be well enough established that a reasonable number of applications can be made in many school settings. Trainees with limited reading skills particularly benefit from audio instruction.

D. Computer Managed Instruction (CMI)

Except in a rather small number of limited applications, computer assisted instruction (CAI: where the student interacts "on line" with the computer for long periods of time) has not been found to be cost-effective. The use of the computer as a data processing, scheduling and management tool has, on the other hand, in many instructional applications proved to be cost-beneficial (Computer Managed Instruction). When large numbers of trainees are required to take the same kind of instruction and there are many elements to that instruction, computers can be a cost-effective means of instructional management. In CMI, the computer itself is not an instructional medium, it simply articulates the use of the various instructional storage and delivery devices and maintains the records of the students as they progress at independent rates of learning. The total CMI package is a delivery system. It has worked well with more sophisticated learners,

E. Empirically Designed Television Instruction

Television is an effective and efficient means of delivering instruction provided that the lessons have been subjected to validation procedures and that the medium is used to bring critical features of the environment to the student and not just as a means of reproducing a classroom. It works best when used in a modularized individual mode (e.g., video cassettes), but it may be more cost-effective used in a group mode. Supplementary note-taking guides generally increase the value of televised instruction. It is apparently effective for all levels of learners.

F. Teaching Machines

Some audio-visual devices have a capability of requiring a trainee's active response before subsequent information is presented. Some applications of this concept (e.g., the use of the computer to teach about the computer via a terminal; recognition, and discrimination learning) can be highly cost-effective. They often have the advantage of being portable for use in remote locations.

G. Audio-Tutorial Correspondence

Recent commercial enterprises have discovered the potential inherent in audio-tutorial correspondence courses. Specific examples of these courses are produced by CRM Books, Incorporated. The elements of the audio-tutorial package include a cassette player, a variety of print media including a workbook, problem book, associated visuals, small science kits for experimentation, data collection pads, progress evaluation checks, and other things which are necessary to complete the package. All of these materials are not delivered to the student at the same time but are sent to him as he progresses through a given segment of the material. These courses are very useful in individualized learning centers and in remote locations.

H. Programmed Texts and Adjunctive Programs

There is little doubt about the effectiveness and efficiency of programmed texts and adjunctive programs (which provide a structured guide, practice exercises and self-tests to be used in conjunction with field manuals, textbooks, and other media). They are more useful when the person has a defined need for the information and there is an obvious payoff for completion. They are probably best used for the learning of concepts and intellectual skills.

I. Learner Directed Study (Self-Managed Instruction; Learner Controlled Instruction)

Regardless of the type of information storage available, the implication here is that the learner is used as his own instructional manager. He is given a set of instructions, the objectives for the course, a listing of the learning resources available, some projected milestones, and sent to manage himself through the program. Ordinarily, this approach is combined with individual learning center facilities and an extended working day. It is particularly effective with mature trainees with average or above average reading and listening skills. It is particularly effective in resident instruction where trainees have the opportunity to interact with each other, and it ordinarily permits an increase in the through-put of the course at a reduction in cost.

J. Guided Learning Activities

In this application any instructional device (e.g., slide/tape presentation, videotape) in combination with whatever software or hardware are needed in the workspace are used to guide the learner through a set of procedures. These procedures can either be soft skills or hard skills provided that the learning equipment can be placed near the piece of equipment upon which one must train. These activities can be guided through the use of audio only lessons, and they can be guided through procedural check lists or job aids. Some producers have distributed two-person interactive games (e.g., marriage counseling, race relations) intended to guide the learners through practice exercises.

K. Simulations

Recent advances in computer and electronic technology make it possible to increase the number of reasonably authentic training environment simulations of real world problems and situations. Some simulations involve nothing more than standard training devices while others utilize much more sophisticated theoretical techniques. They can be useful in situations where one cannot have access to the real world situation.

L. Games

A great deal of recent work has been done in the use of games as training techniques. Specific applications include the use of the game as the critical element in the learning situation, that is, where the playing of the game is the point itself. Alternatively, interest holding games are quite often used to teach "incidental" subject matter. For example, one can use competitive games in the form of Monopoly, or other chance elements, to teach the nomenclature and recognition features of ammunition or other facts and concepts.

M. Programmed Sound and Film Systems

Recent advancements in hardware technology allow for combinations of audio cassettes and Super 8 film. These devices present visual displays in single frames or in motion or simulated motion. They are controlled by pulses on a tape which change the visual frames and stop the audio presentation to allow the student time for practice or other active responding. They could well be the most cost-effective of all delivery systems, if all levels of trainees are considered since they do <u>not</u> require reading proficiency.

N, Peer Tutoring

Peer tutoring is perhaps the oldest instructional method known to mankind. Properly managed, however, peer tutoring models using either advanced students to train new students or following the "each one teach one" model have been effective in teaching a wide variety of subject matter. Military applications are widespread, and civilian applications are even more so. Peer tutoring appears to be just as effective for intellectual skills as it is for hands-on training of hard skills. It may be more effective for category 3 and 4 trainees,

The longer term implications for properly managed peer tutoring may be important. It provides new trainees with initial skills in training others, an assignment they may well receive later. More importantly, it changes the form of their training and gets away from inappropriate forms of platform instruction.

O. Summary

The discussions of peer tutoring and the other alternative delivery systems in this chapter were presented to convey an idea of the options available to the instructional designer once he has reached the Instructional Delivery Phase. The following chapter will detail some instructional management and planning considerations also found in the Instructional Delivery Phase.

V. MANAGEMENT AND PLANNING CONSIDERATIONS

The planning aspects of instructional technology, from the management point of view, must take into account the potential alternative benefits:

1. reducing time of training,

2. increasing performance, and

3. reducing costs.

Each of these possible alternatives has direct implications for the management of training centers and schools and each of them may require a different set of procedures and techniques to achieve the objective.

A. Reducing Time of Training

If it is necessary to reduce the amount of time that students are spending in a given subject matter or course then the time consideration becomes a controlling design constraint at the outset. Specific techniques known to be capable of reducing total training time can be applied. Specific techniques which might be used to reduce the average time for completion of a course would include:

1. Diagnostic testing.

2. Advanced placement.

3. Bypassing procedures.--If it is possible to avoid teaching trainees that which they already know, a possible saving of time exists.

4. Computer managed instruction.--By the efficient management of students through the various instructional events and processes, a possible saving of time again is available.

5. Self-paced instruction.--By providing appropriate incentive for early completion, it is possible that the faster learners in a group can complete their assignment before the slower learners and thus decrease the average time of instruction.

6. Articulated multimedia systems.--Briggs and Markle demonstrated an approximate reduction of 25% in training time by developing specific materials for specific purposes and empirically validating them.

Some of these techniques, if not currently being used, may well require that development costs and adequate lead time be provided for their validation and implementation. Careful projections of the possible time savings and the cost necessary to produce those time savings must be made.

B. Increasing Performance

A second design consideration, that of increasing performance, would require a different set of procedures. Increased performance can result from the following:

1. Analysis of the learning requirements according to the conditions and types of learning and subsequently designing courses based on these different kinds of learning.

2. Increasing the amount of relevant practice and guided learning activities on an individual basis.

3. The use of peer tutoring techniques in order to provide increased feedback and evaluation of performance.

4. The use of validated articulated multimedia systems designed specifically to achieve minimum acceptable performance in trainees.

5. Re-evaluation of the training objectives on which instruction is being provided. Elimination of irrelevant and less critical objectives can allow for increased instructional time on more critical objectives.

Attempting to achieve a design specification of improved student performance necessarily implies a clear cut and valid statement of the level of performance that is acceptable.

Further, there must be general agreement among subject matter specialists on the quality of the performance and the ability to measure that performance regularly. Examples might include the training of pilots, training of nurses, hospital corpsmen, and other individuals who must perform consistently and regularly at a high level of proficiency in order to protect lives or property. It is not always true that increasing performance must take more time. However, the time and money invested in the design of instruction to increase performance must be amortized across the number of trainees until a reasonable and cost-beneficial point has been reached.

C. Reducing Costs

A third management consideration might be that of the reduction of training cost. Because of the labor intensive nature of the training environment, the reduction of training costs can come in three principal ways:

1. the reduction of staff,

2. the reduction of the amount of time trainees spend in training, and

3. the elimination of non-critical objectives.

The reduction of the amount of equipment, supplies, and materials used has only a modest potential for cost savings. Ordinarily, the reduction of trainee time in a program would offer the largest potential savings. A decision to reduce training time in order to reduce training cost must, at the same time, have with it a plan to utilize the time of the trainees in productive activities.

If it is questionable that such time can be properly used then it might be a better decision to reduce the number of staff assigned in the training system. These reductions can be made through the uses of alternative hardware arrangements including instructional television, audio-tutorial multimedia systems, learner directed study, computer managed instruction, and other appropriate delivery systems. In this context, staff reductions are not intended to be accomplished through reducing services.

It will probably be necessary to make an investment of time and money in order to design a system which will be less costly. The following techniques may well be effective in reducing costs:

1. An increased dependence on individual study and self-managed instruction.--This technique will not be effective in all learning environments, but can certainly be used in more advanced courses.

2. The re-deployment and reorganization of staff into a more effective management system, often called "differentiated staffing" in the civilian environment.--This technique changes the responsibility of the instructor from that of delivering instruction, to that of managing instructional processes.

3. Careful diagnostic and advanced placement procedures which allow students to proceed through the system at their fastest possible rate and provide appropriate incentives for their doing so, and the elimination of training which is not critical to the needs of the trainee in his next assignment and which will decay if too much time passes before the training is used.

A frequent problem arises when a school or department decides to offer instruction on an "individualized" basis. In this context, individualized instruction implies diagnostic pretesting and placement of a student at his appropriate starting point and managing the student through the program according to a schedule based on his performance as he progresses through the program. If, in addition to being individualized, the instruction is also self-paced, it will then be necessary for the management system to take into account the different completion dates of separate members of the class. If these different completion dates create more problems for the system than the man-days saved benefit it, perhaps alternative scheduling procedures must be employed.

Individualized programs create more trainee data on a much more regular basis than traditional forms of trainee management. Accordingly, this data must be carefully reduced and analyzed and used to plan the trainee's future program. Manual and automatic data processing procedures have been worked out for the handling of individualized learning data. A system must be used which meets the instructional and management needs of the particular location.

At the beginning of this report it was stated, categorically, that the most important advances made in instructional technology in the last decade have been those concerned with the analysis and planning of instruction according to specified needs, available funds, and environmental constraints. Delivery systems, then, serve the needs of the training environment rather than prescribe the training environment itself. The system analytic approach always takes into account the appropriate constraints and design features in articulating a course of instruction. It should be possible through careful management review and examination procedures to eliminate much current training. Recent analyses by appropriate military commands have identified dramatic redundancies, excessive training requirements, and discoveries of limited validity of training.

D. Specification of Goals

As was indicated earlier, it is possible with recent advancements in technology to specify the product of training with considerable precision and in adequate detail to permit good examination. To the extent the expected outcome of a training course can be stated clearly and objectively it is then possible to design instruction to achieve <u>only those specific goals</u> and to revise the instruction until it meets those goals.

The instructional technologist emphasizes the critical importance of defining training as a means to achieve a clearly specified goal, not as a process which is applied equally to all trainees regardless of their level of proficiency. He is not concerned with how long it takes to achieve a critical training objective provided that he has an effective and efficient means of achieving that objective. Conversely, it is of little value to specify that a trainee has received nine hours of instruction if there is no objective evidence that he could not have performed equally well prior to instruction. Training, then, is a means to an end stated in terms of the terminal performance of the trainee, not in terms of the number of hours of delivered instruction.

In a review of management and planning, reducing the time of training, increasing performance, and reducing costs are three of the most immediate considerations facing today's instructional designer.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions and Comments

Visits to TRADOC Schools and Training Centers have been made by senior project staff. Their most general observation is that the enabling regulation (CON REG 350-100-1, 1972) and the personnel, facilities, and materials available at the Training Centers and Schools make it highly feasible to increase competent applications of instructional technology (as defined in this report) at these locations.

Questionnaires have been administered to both military and civilian personnel assigned to TRADOC Schools. Interviews have also been held with selected groups. These questionnaires were intended to obtain an evaluation of the clarity and usefulness of CON REG 350-100-1 and to solicit suggestions for improving the regulation, and for ideas which would promote its full implementation. The result of these questionnaires and a summary of interview data is incorporated as Appendix B.

Further, at those schools where there has been a distinct emphasis on training new people in applications of instructional technology, significant changes are occurring. Much of this recent activity and increase in local competence has been caused by the planned efforts of the Combat Arms Training Board (CATB) in sponsoring and continuing to monitor training workshops obtained through Deterline Associates. While some of the Combat Arms Schools visited are more proficient in the administration of their instructional technology training programs, competence has definitely increased at all of these schools.

It is important that the changes observed in the schools have been principally noted in those persons actually performing the technical work. Little has been observed that would allow one to infer important changes in management attitudes or practices toward using alternative strategies in training technology.

It is clear that an articulated t ining program is required which provides each individua assigned to the school the necessary knowledge and skill to do his job within the modern context. Without the ability to train new people quickly in the techniques and procedures for instructional technology, institutionalization of these concepts in TRADOC Schools will require an extensive period of time.

More importantly, specifically designed training materials and exercises for middle and senior managers must also be provided. Whether these materials and procedures should be packaged and sent to the schools or located at a central facility to which the middle and senior managers are temporarily assigned, is a question requiring further discussion. If a senior manager has been officially trained by a proponent school it is much more difficult for him to avoid implementing and managing the new system. School training could be more expensive but the expense could be offset by the gains in performance.

It is increasingly apparent that instances of the application of instructional technology appear throughout the military and civilian world. Further, it is clear that good, specific programs found in one training center or school are not consistently picked up and used by other schools teaching the same course. Thus, dissemination of new and innovative programs has not been as effective as it could be.

An initial analysis needs to be made of the positive and negative incentives that might be available for encouraging improved performance in the design, implementation, and dissemination of systems engineered, empirically designed instruction.

B. Recommendations

Objectives

a) Train selected TRADOC School military and civilian personnel in those areas of the instructional design model where they will have a specific need for these knowledges and skills according to their assignments. For some this will mean the complete training system model, for others it will mean subsets of the total model (e.g., task analysis, performance evaluation).

b) Train all middle management personnel in the overview of the instructional development model and extensively in the management of empirically designed instruction with important emphasis on quality control procedures, and in the benefits of using alternative instructional models,

c) Train all Assistant Commandants and Department Heads in quality control procedures, the general purpose of the model, the potential benefits of using alternative instructional approaches, methods of measurement and estimating cost-effectiveness, and other topics which are relevant to the needs of senior managers.

(It is expected that the first three groups mentioned, civilians, military, and middle managers, will be trained at their school or training center. It is possible to train senior managers in specially conducted workshops at TRADOC Headquarters, universities, or elsewhere in order to emphasize command support for this effort.)

d) Establish a clear cut procedure based on research, for the development, validation, and determination of critical tasks. This should include emphasis on the prioritizing of critical tasks and the elimination of unnecessary training.

e) Study and establish a new method for determining staffing levels at TRADOC Schools. The platform hours staffing model does not serve other forms of instruction as well. If an instructional alternative is used which does not provide for platform instruction, it may well work against the staffing level of the school. Army and contractor personnel should work on this problem as a joint effort.

f) Development procedures for determining relevant, clear job performance evaluation instruments from real world performance objectives. (See Appendix D, "Job Task Training Plans.")

g) Develop a dissemination model and an orderly procedure for implementing empirically designed instruction procedures throughout the TRADOC School and Training Center system.

h) Analyze the various instructional approaches currently used in order to determine the function of each in the total training program and to eliminate redundant instruction wherever feasible and possible. This would also include an analysis of the purpose and function of the departments responsible for resident and non-resident instruction.

Specific Activities

a) Obtain publication rights or GSA schedule prices for the CISTRAIN model currently being used in a few TRADOC Schools. (This should include auxilliary software.)

(1) Either request revisions to be made by the copyright owner to adapt it to TRADOC requirements; or

(2) Obtain the rights to modify the materials and reproduce them.

b) Obtain copies of the Air Force Handbooks, AFP 50-58 and examine their usefulness and concepts in light of Army TRADOC plans.

c) Prepare a pamphlet and promulgating regulations establishing the task validation procedures developed by the four Combat Arms Schools in the eight MOS systems engineering projects as doctrine.

d) Analyze the alternatives of where to conduct the training for Assistant Commandants and Department Heads: TRADOC Headquarters, Civilian universities, a proponent school, all TRADOC Schools, a cooperative Joint Services school, or industry. This decision will be critical in the design of the multi-level workshop materials.

e) Consider the list of instructional technology applications in Appendix A as "Exemplary for TRADOC Schools," so that they may be included in the training materials produced. Have each described, analyzed, and evaluated before it is cited as an example.

f) Investigate alternative methods and formulas for determining staffing levels at TRADOC Schools. Change from "platform hours" basis to some form of an output basis.

g) Define the specific role of the Instructional Technology Support Group within TRADOC Headquarters. Define the support role of the Instructional Technology Staff within each of the TRADOC Schools and Training Centers and its relationship to TRADOC. (See Appendix F.)

h) Insure that all civilian and military personnel assigned to these instructional technology units have been given initial training in one of the current workshops or special university short courses on instructional technology.

i) Conduct a meeting of representatives in these specialties from TRADOC HQ, all of the TRADOC Schools and Training Centers, and selected contractor and other civilian personnel. Plan the agenda to maximize the amount of exchange of ideas and specific courses or learning materials and other articles that have immediate payoff.

j) The nine conditions of success listed in Appendix E (The Ford Foundation Report by Armsey and Dahl) pertaining to adequate command support or competence should be thoroughly considered. That technical competence not now available in the Army should be obtained through contractors until the need is satisfied.

APPENDIX A

EXEMPLARY PROGRAMS

In reviewing the state of the art of instructional technology in the Armed Services, it was found that virtually all of the concepts and techniques of instructional technology had been successfully applied in one or more places within the military. There is nothing of proven value in the field of instructional technology which does not exist somewhere in the Armed Services. Listed below are examples of places where elements of instructional technology have been implemented. Since not all of the examples have been subject to critical on-site inspection by the contractor, their inclusion does not represent an endorsement of them. In many cases the number of people involved in these examples is very limited, but their very existence indicates that the concepts are workable in the Armed Services.

Section A below contains examples of the implementation of the Systems Engineering model as a whole (CON REG 350-100-1). Section B lists examples of the implementation of particular steps in that model, including examples of delivery systems described in Section IV of this report.

A. Systems Engineering (General)

1. Army Military Police School, Fort Gordon, Georgia, Regulation #350-2, January, 1972. This regulation established the specific responsibilities of the branches of the school for the implementation of 350-100-1. It also provides for the application of the model in that school.

2. Army Signal Center and School, Fort Monmouth, New Jersey, "Reference Guide for Systems Engineering of Training" (DOI-CUD-1). This "information text" provides guidance for the application of 350-100-1 and is complete with examples.

3. Human Resources Research Organization (HumRRO), Technical Report 70-9, An Experimental Program of Instruction on the Management of Training, June, 1970. This report synthesizes research on the systems engineering of training and provides a 96 hour instructional prototype for Army officers in their roles as training managers.

4. Instructional Technology Division, USA Adjutant General School, Fort Benjamin Harrison, Indiana. A 56 hour program of instruction has been developed to train instructors and supervisors in a broad spectrum of expertise. The course was designed according to the proposition that, "today's instructor must not only be able to perform on the platform but must also be able to prepare instructional packages for nonresident instruction."

5. U.S. Army Engineering School, Fort Belvoir, Virginia, Guidance Package for Self-Study Advanced Instructor Training Course, 1973. This quick "how-to-do-it" course for implementing 350-100-1 uses adjunct programming.

6. U.S. Army Security Agency Training Center and School, Fort Devens, Massachusetts, The Development of Instructional Systems: Procedures Manual, December, 1970. This is a manual with references on the systems approach to instructional development and validation.

7. U.S. Air Force, Air Training Command, Regulation 52-33, "Instructional Systems Development," July, 1972. This is the Air Force's equivalent of CON REG 350-100-1. While this model compresses some of the steps in the CON REG 350-100-1 model, it is clear that the processes are the same in both models.

8. U.S. Air Force, Pamphlet 50-58, Handbook for Designers of Instructional Systems, July, 1973. This manual provides procedural guidance for the implementation of the Air Force ATC 52-33.

9. Marine Corps Development and Education Command, Quantico, Virginia, "Program of Instruction for Instructor Orientation: A Course," 1973. This is a four week instructor course in instructional technology.

10. Lowry Air Force Base, Course #3ABR 40430 for Precision Photo Repairmen. This is an example of the systems approach to entire career development.

11. Taylor, Michaels, and Brennan, HumRRO, "The Concepts of Performance-Oriented Instruction Used in Developing the Experimental Volunteer Army Training Program," 1972. This report describes the planning and implementation of the Experimental Volunteer Army Training Program (EVATP) at Fort Ord in 1971. This is perhaps the most comprehensive application of the systems approach which the contractor found in the Army and is used as a model for implementing the EVATP at other Army Training Centers. One of the important elements in the new system is the Soldier's Manual Army Testing (SMART) Handbook for basic combat training. Each soldier receives a pocket copy of the handbook which contains the 43 performance tests he must pass to graduate, each administered on a "go/no-go" basis.

B. Examples of the Successful Implementation of Particular Steps in the CON REG 350-100-1 Model (See Figure 4.)

1. Step One--Perform Job Analysis

a) United States Air Force occupational survey of job incumbents discovered that no one individual did more than 20% of all the tasks which had been identified.

b) Paul Whitmore, Draft HumRRO Technical Report, "The Concept of the Job Model: A Partial Job Model for Army Officers," December, 1972.

c) U.S. Army Engineer School, Fort Belvoir, Virginia, "Job Analysis." This student pamphlet is a unit of instruction which teaches how to perform a job analysis in accordance with CON REG 350-100-1.

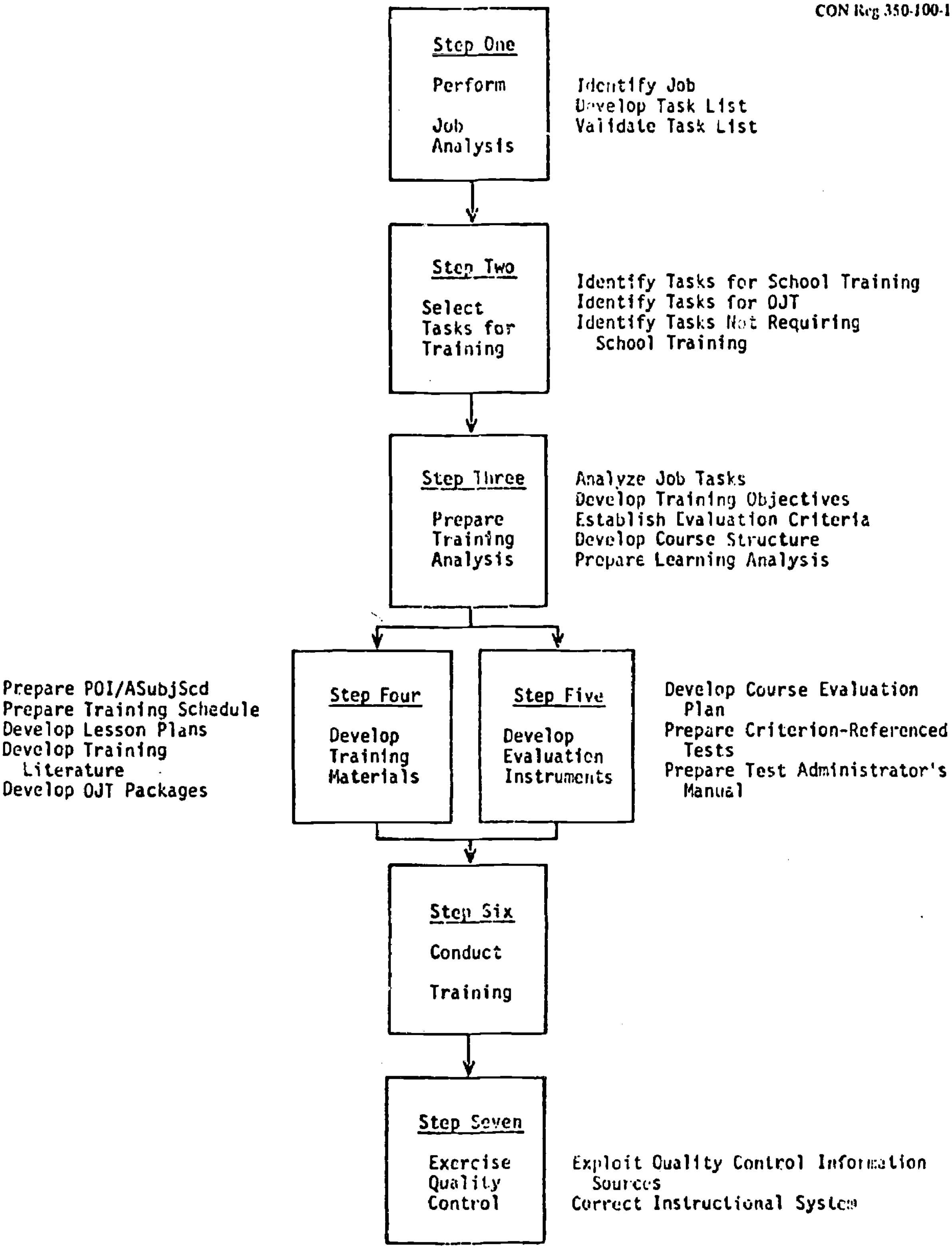

FIGURE 4. Procedural Diagram Listing Major Tasks Associated with the Systems Engineering Process.

2. Step Two--Select Tasks for Training

a) Raymond Cristal, Lackland Air Force Base, "Implications of Air Force Occupational Research for Curriculum Design." This regression model to simulate decisions to curriculum development presents nine factors and their interactions for consideration in deciding what tasks to train.

b) United States Navy, Common Core. This presents a methodology for identifying a core of tasks which are common to many occupations. The Individualized System for Common Core Electronics at the Naval installation in San Diego is based on this technique. The Army also uses this technique for common-based electronic training.

c) Army Engineer School, Fort Belvoir, Virginia, "Selecting Tasks for Training," 1972. This student pamphlet teaches how to select training tasks according to selection criteria in the CON REG 350-100-1.

3. Step Three--Prepare Training Analysis

a) HumRRO Report 73-10, "Instructional Strategies for Training Men of High and Low Aptitude," April, 1973. This study developed procedures for organizing training content and selecting appropriate training models in order to achieve more efficient instruction at different aptitude levels.

b) U.S. Army Engineer School, Fort Belvoir, Virginia, "Training Analysis." This pamphlet teaches how to write a "Job Task Data Card" and a "Training Analysis Information Sheet."

4. Step Four--Develop Training Materials

a) Redstone Arsenal, Missile and Munitions Center and School, "Criteria for Selecting Methods and Media," 1970. This is a methods and media selection guide.

b) U.S. Army Engineer School, Fort Belvoir, Virginia, "Program Objectives," 1969. This is a programmed text for preparing behavioral objectives and performance standards.

c) U.S. Navy, TECEP (Training Equipment Classification and Evaluation Plan). This Navy decision-making model for alternative media gives criteria to apply in the rank ordering of the alternatives with the cost criterion as the final one.

d) Rand Corporation, MODIA (Method of Designing Instructional Alternatives). This is an instructional design method developed by the Rand Corporation for the Air Force. It allows the designer to analyze instructional alternatives before putting the system into use. It simulates possible course decisions on the computer for potential cost-effectiveness.

e) Southeastern Signal School, Fort Gordon, Georgia, "A Guide to Planning Instructional Methods and Media Application in Army Training." Application of learning theory and research findings to media selection are discussed in this guide.

5. Step Five--Develop Evaluation Instruments

a) Army Signal Center and School, Fort Monmouth, New Jersey, "Performance Testing for Systems Engineered Courses," 1971. This describes types of performance tests used at the Signal School and gives directions for the development and administration of performance tests.

b) John Holden, Army Ordnance Center and School, Aberdeen Proving Ground, Maryland, "The Set Study." A research study to determine the effect of a self-evaluation technique on the performance of student welders found: (1) students' evaluations of themselves were not significantly different from evaluations made by technically qualified graders, and (2) students making self-evaluations scored progressively higher than students not making self-evaluations.

c) Army Military Police School, Fort Gordon, Georgia, "Performance Testing in MP NCOES." The sample test packet in this booklet contains an Evaluation Planning Information Sheet, a Test Administrator's Manual, and student test materials. This test measures four "paper-oriented" training objectives and a "people-oriented" training objective.

d) Army Armor School, Fort Knox, Kentucky, "After Action Report on the Officer Comprehensive Evaluation." A comprehensive evaluation for advanced course students is presented.

e) U.S. Army, "Go/No-Go Grading at the U.S. Army Southeastern Signal School," slide/tape presentation. Over 95% of the tests in the school are job-sample performance tests.

f) U.S. Marine Corps. Extensive mastery and proficiency codes as well as end of course skill inventories have been developed.

6. Step Six--Conduct Training

The examples given here follow the list of delivery systems described in Section IV of this report.

a) Articulated Multimedia Systems.--Course #30BR 3021, "Communication Electronics," at Keesler Air Force Base is designed as follows: students have a choice of three media modes for each of 85 sequenced objectives; (1) narrated slide/tapes, (2) audio narration and illustrated workbooks, (3) college texts and reference works.

b) Contingency Management.--The contractor is not yet aware of clear examples of this technique within the Armed Services, although the individualized instructor training course at USA MMC, Redstone Arsenal, is an approximation.

c) Audio Systems.--Cassette tapes are used for hands-on training in Army instructional programs for vehicle maintenance. The student hangs the tape recorder on his belt and follows instructions from the tape while performing mechanical operations on a motor vehicle.

d) Computer Managed Instruction.--The Army COBET project (Common Basic Electronics Training) at Fort Monmouth, New Jersey, and the Memphis Naval Air Station are presently employing CMI techniques.

e) Empirically Designed Television Instruction.--At present, 25 training centers in TRADOC have TV systems of varied sophistication for the transmission of programs into classrooms. Seldom, however, are the programs subjected to empirical validation.

f) Teaching Machines.--The Marine Corps' Amphibious Warfare School is developing computer aided instruction to simulate a battlefield, putting in all the variables for amphibious warfare. The Air Force Computer Directed Training System is using already in-place computers for CAI on how to use the computer for personnel problems.

g) Audio-Tutorial Correspondence.--Audio-tutorial programs of instruction are commonly used in the Army's Training Extension Courses. However, these are usually available in learning centers and have not yet been made available through correspondence.

h) Programmed Texts and Adjunctive Programs.--These techniques are widely used throughout the military, frequently in combination with other media. An example of this approach is Course #31E20, "Common Basic Electronics Training," at Fort Monmouth, New Jersey.

i) Learner Directed Study.--Course #3AAR39170, "Maintenance Analysis Technician," at Chanute Air Force Base is an example of a highly individualized, self-paced approach to instruction. The course is a low-flow (130 students per year), 7-week course for senior enlisted men in relatively sophisticated jobs. Each student has a key to the learning lab which is available 24 hours a day (with instructor personnel provided 12 hours per day) and the student can take the 15 units in any sequence.

j) Guided Learning Activities.--Perhaps the simplest type of guided learning activity is the written job performance aid. Lowry Air Force Base enjoyed great success with this technique in training Vietnamese pilots.

k) Simulations.--One example of this is the previously mentioned computer simulation developed at the Marine Corps Amphibious Warfare School. Another example is the Synthetic Flight Training System (SFTS) at the Army Aviation School, Fort Rucker, Alabama. SFTS Device 2B24 simulates all functions required for instrument flight in the UH-1H helicopter. The student is seated in a computer-controlled cockpit configuration.

The Army Aviation School also utilizes Device 15G16, a computer-controlled simulator device used in training military air traffic controllers. The system consists of a group of "mini-labs" receiving signals fed from a computer. Simulated targets, representing "live" air-craft, are fed to mini-lab radar consoles, permitting training for three Air Traffic Control Specialist positions working together at one time.

l) Games.--The Combat Arms Training Board at Fort Benning, Georgia, has developed a "tank games" kit which familiarizes the student with parts of the tank which he needs to know in order to perform certain operations.

m) Programmed Sound and Film Systems.--Florida State University is currently developing this type of material for the Army's Training Extension Courses. One such unit teaches the student to discriminate between critical features of the tanks of different countries and to be able to make a quick recognition of the tanks when they are presented from different angles and partly camouflaged.

n) Peer Tutoring.--HumRRO developed and tested a peer-instructional model for the "Field Wireman Course," (MOS 36K20), at Fort Ord, California. The model has since been implemented in the four remaining Field Wireman Courses across the country.

7. Step Seven--Exercise Quality Control

a) U.S. Army Transportation School, Fort Eustis, Virginia, "Educational Quality Control." This procedural statement specifies three distinct steps: (1) the establishment of control areas, (2) determination of standards of quality, and (3) systematic evaluation.

b) U.S. Army Engineer School, Fort Belvoir, Virginia, "Quality Control: Scoring and Grading" and "Quality Control: USAES Student Opinion Survey System." These self-instructional lessons provide instruction in implementing quality control at Fort Belvoir.

APPENDIX B

DATA FROM QUESTIONNAIRES AND INTERVIEWS

Part of the data which was used in preparing this report was obtained through questionnaires and group interviews. One questionnaire (13 responses) was aimed at evaluating an Instructional Technology Workshop (ITW), but yielded information which is relevant to the CON REG. The other questionnaire (22 responses) was intended to elicit users' evaluations of the CON REG itself. This was supplemented by group interviews with two groups of Army officers in an instructional systems course at FSU. This appendix attempts to summarize this information.

This and other data was compiled independently of the HumRRO consulting report, "Review of the CONARC Systems Engineering of Training Program and its Implementation at the United States Army Aviation School," Ricketson, Schultz, and Wright, April, 1970. The HumRRO report contains much useful analysis and one of the future steps in the revision of the regulation would be to reconcile the HumRRO findings with those presented here.

I. Areas most frequently mentioned by ITW participants as requiring further training were: media selection, criterion-referenced testing, the regulation itself (350-100-1), and soft skill course development.

II. For the question: "The regulation is:

a) quite adequate and does not need revision.
b) adequate but needs minor revision.
c) not adequate without substantial revisions.
d) unworkable and should be completely reorganized and rewritten,"

10 responded "b," 8 responded "c," and 1 responded "d."

III. Answers to the CET questionnaire indicate that most workshop participants considered all sections of the regulation to be "useful," but that most sections are unclear, especially the sections on: Training Analysis, Developing Training Materials, Developing Evaluation Materials, and Examples and Descriptions.

IV. 15 out of 20 respondents thought the regulation "does not give information which is detailed enough to facilitate implementation."

V. Points which were made in the group interviews or in responses to open-ended questions on the questionnaire were:

A. Management implications:

1. Need additional personnel and written support material

2. Need storage space for the data required for systems engineering

3. Need to stabilize personnel in key management positions to provide continuity

4. Need centralized management

5. Need to develop an organized approach to gathering job analysis information

6. Provide information on relationship of Systems Engineering, TEC and MOS testing and MOS Data Bank. There is duplicated effort.

7. Will the regulation give guidance to battalion commanders in the field who are also responsible for training? Will field people at battalion level, platoon level, squad level, be covered by the regulation?

8. How to utilize the time of the earlier finisher

9. Mobilization--what training models and strategies would be most adaptable in a mobilization situation?

B. Practical user problems:

1. Need good "how-to-do-it" course

2. Shortage of personnel forces shortcuts, skipping steps

3. OK for entry level courses, but does not have anything on NCOES (CMF) and officer courses

4. Need more guidance in developing soft skill courses

5. There should be some rough yardstick on how many man-hours it should take to systems engineer a particular type of course

6. Front end is good, but transition from analysis and design phase to preparation and development has gaps

7. Priorities in instructional development--what steps are most important if you can only do some?

8. Problem areas--soft skills, e.g., leadership management

C. Conceptual problems:

1. Conflicts with CONARC REG 351-3 (CR testing and ranking of students), also in conflict with CONETS or TRANETS concept

2. Need integrated view of quality control

3. Clarify what constitutes a subject-matter expert

4. Regulation is geared more to new courses, but most course development is up-dating existing courses. Courses are not developed; they evolve

5. Define the target population of the regulation

D. Deficiencies in the regulation:

1. Need "front end analysis" for existing courses

2. Need local guides

3. Examples cover only easy subjects

4. Instructors do not participate in the process

5. Integration of total task inventory to MOS training and career development (continuity of school training to OJT, unit training, and career development in advanced courses)

6. Identify constraints before developing courses

7. Describe the ideal systems engineering organization

8. Clarify the functions of various elements in the process (who does what?)

9. Second paragraph should explain the inadequacies of old system; explain why we are going to do systems engineering; where we were and where we are going

10. Examples used in job and task analyses relate more to a personnel man concerned with justifying job slots

11. Regulation should require that data be submitted along with the POI

APPENDIX C

TOWARDS A FRAMEWORK FOR TASK ANALYSIS

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Many models for the design of instruction include task analysis as one step in the model (Briggs, 1970; Banathy, 1968; Gropper, 1971.) As a result of this emphasis on task analysis, considerable confusion seems to have arisen concerning specific techniques for conducting a task analysis. The present paper seeks to present a scheme that will provide a common framework for viewing task analysis.

The failure to find a commonly accepted methodology for conducting task analysis stems from the desire of persons to establish one procedure for conducting the analysis of all types of learning tasks. It would seem that the appropriate starting point in the analysis of a learning task is to identify to which domain of learning the specific task belongs. Gagné (1971) has identified five separate domains (verbal information, intellectual skills, motor skills, attitudes, and cognitive strategies) that are particularly relevant to the topic of task analysis. As Gagné suggested it seems quite inappropriate to generalize research findings from one domain to another. The position taken in this paper is that while it is appropriate to apply one task analysis procedure to all tasks in a given domain, it is inappropriate to try to generalize one procedure for conducting task analysis from one domain to another.

The following section describes the five domains of learning. This section is taken from a book by Gagné and Briggs (1974).

> Intellectual skills. Intellectual skills are the capabilities that make the human individual competent (Gagné, 1970). They enable

him to respond to conceptualizations of his environment. They make up the most basic, and at the same time the most pervasive, structure of formal education. They range from elementary language skills like composing a sentence to the advanced technical skills of science, engineering, and other disciplines. Examples of intellectual skills of the latter sort are finding the stresses in a bridge, or predicting the effects of a currency devaluation. Their learning begins in the early grades with the three R's, and progresses to whatever level is compatible with the individual's interests, or as may be limited by his intellectual capacity.

Cognitive strategies. These are a special kind of skill, and a very important kind. They are the capabilities that govern the individual's own learning, remembering, and thinking behavior. For example, they control his behavior when he is attending in the process of reading with the intent to learn; and the internal ways he uses to "get to the heart of a problem." The phrase "cognitive strategy" is usually attributed to Bruner (Bruner, Goodnow, and Austin, 1956); Rothkopf (1968) has named them "mathemagenic behaviors;" Skinner (1968) "self-management behaviors." One expects that such skills will improve over a relatively long period of time as the individual engages in more and more studying, learning, and thinking. It has long been a goal of education to develop in students capabilities of creative problem-solving. If this is indeed a learnable and generalizable trait, or possibly a collection of traits, it deserves to be included with many simpler learning skills under the heading of cognitive strategy.

Verbal information. All of us have learned a great deal of verbal information, or verbal knowledge. We have readily available in our memories many commonly used items of information such as the names of months, days of the week, letters, numerals, towns, cities, states, countries, and so on. We also have a great store of more highly organized information, such as many events of American history, the forms of government, the major achievements of science and technology, the components of the economy. The verbal information we learn in school is in part "for the course only," and in part the kind of knowledge we are expected to be able to recall readily as adults.

Motor skills. Another kind of capability we expect human beings to learn is a motor skill (Fitts and Posner, 1967). The individual learns to skate, to ride a bicycle, to steer an automobile, to use a can-opener, to jump a rope. There are also motor skills to be learned as part of formal school instruction, like printing letters, drawing a straight line, aligning a pointer on a dial face. Despite the fact that school instruction is so largely concerned with intellectual functions, we do not expect a well-educated adult to be lacking in certain motor skills, some of which (like writing) he may use every day.

Attitudes. Passing now to what is often called the "affective domain" (Krathwohl et al., 1964), we can identify a class of learned capabilities called attitutes. All of us possess attitudes of many sorts towards different things, persons, and situations. The effect of an attitude is to amplify an individual's positive or negative reactions toward some person, or thing, or situation. The strength of a person's attitude toward some item may be indicated by the frequency with which he chooses that item in a variety of circumstances. Thus, an individual with a strong attitude toward helping other people will offer his help in many situations; whereas a person with a weaker attitude of this sort will tend to restrict his offers of help to fewer situations. The schools are often expected to establish socially approved attitudes such as respect for other people, cooperativeness, personal responsibility, as well as positive attitudes toward knowledge and learning, and an attitude of self-esteem.

The remainder of this paper discusses the use of task analysis procedures in these different domains.

The task analysis procedure recommended by Gagné (1968, 1970) for hierarchially arranging a final task and the subordinate tasks is based on the hypothesis that certain kinds of learning are necessary prerequisites, i.e., transfer positively, to other kinds of learning. It should be noted that this use of the task analysis to establish learning hierarchies pertains to those tasks that could be classified in the domain of intellectual skills and not to tasks in other domains. The learning hierarchy that results from the task analysis of an intellectual skill identifies the subordinate or prerequisite skills that must be learned before the final skill can be learned. The implied sequence is a learning sequence and does not identify the sequence in which the tasks may routinely be performed by a person who has mastered all the skills in the hierarchy.

In contrast to this, the task analysis procedure for analyzing motor skills does not identify which set of skills must be mastered before one begins to learn a final task. Rather, the task analysis of motor skills seeks to identify the performance sequence for that set of skills. This is similar to the concept of chaining in which the output from one task becomes the input for the next. The performance hierarchy that results from the task analysis of motor skills identifies the sequence in which the tasks must be performed. The implied sequence represents a performance sequence rather than a learning hierarchy, although the tasks are frequently learned in this sequence.

A different procedure is necessary for the analysis of tasks in the domain of attitudes. The purpose of this type of task analysis is not to establish a learning or performance hierarchy but rather to identify indicator behavior. This analysis may more correctly be termed goal analysis. For tasks or goals in the domain of attitudes, the desire is to examine goal statements that are generally more vague and less specific than the task statements found in intellectual skills and motor skills. The result of this goal analysis is the identification of specific overt behaviors that would indicate that the goal or task had been accomplished. The procedure suggested by Mager (1972) for goal analysis represents a clear concise manner in which the task analysis of attitudes can be done. In contrast to task analysis in the domains of intellectual skills and motor skills, the task analysis of attitudes does not imply any sequencing of tasks.

In the domain of verbal information a different task analysis procedure is recommended. The purpose of task analysis in this domain is two-fold: to specifically identify the information to be learned and to determine the larger context to which this specific information is meaningfully related. The procedures for task analysis of verbal information are similar to those for the analysis of attitudes, in that it is necessary in both to specifically identify the information that must be learned. However, the task analysis of information is related. This is recommended since information seems to be learned better if it is organized in a meaningful way and related to the learner's existing knowledge (Ausubel, 1968).

The domain of cognitive strategies differs from the other four domains in that it represents the learner's overall approach to managing the processes of attending, learning, remembering, and thinking. Thus, the cognitive strategy domain represents a higher order domain that is involved in the learning of tasks in the four other domains. It does not seem appropriate to talk of task analysis in the cognitive strategy domain; therefore, it is omitted from this paper.

It is hoped that much of the apparent confusion over the various techniques for conducting task analyses will be alleviated if one first identifies the domain of the learning task and then applies the appropriate task analysis procedure. While it is appropriate to generalize within a domain and apply the same task analysis procedure to other tasks in that domain, generalization to other domains is not recommended. As additional procedures for conducting task analyses are developed it will become necessary to examine their application to the tasks in the various domains of learning.

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APPENDIX D

JOB TASK TRAINING PLAN

A Job Task Training Plan (JTTP) is a complete statement indicating the total training exercises necessary to insure that a soldier meets adequate job task standards and where this training will be conducted. The components of the JTTP are:

1. A job task performance objective and the appropriate test items with their scoring standards and rules for administration.

2. The complete set of training objectives which will lead to the achievement of job performance.--The criterion test items for these training objectives are developed at the same time.

3. The procedure specifying the training experiences necessary to achieve the objectives.--In this procedure are set forth the media specifications, training conditions and method of evaluation.

Proposed Definitions

Job Task (CON REG 350-100-1)

A specific action taken by a soldier in performing his assigned duties is a job task. A task is a unit of work that has identifiable starting and ending points and results in a measurable product.

Job Task Performance Objective (JTPO or "PO")

The JTPO is a statement in behavioral terms of the real world performance required to achieve a job task. A reliable measure of job task performance is a necessary component of a JTPO.

Job Task Training Plan (JTTP)

The JTTP is a complete statement indicating the total training experiences required to insure that a soldier meets adequate job task standards. The components of the JTTP include:

1. Job Task Performance Objective.

    a) Real world test situation

    b) Real world test condition

    c) Necessary equipment

    d) Criterion tests (performance measures)

    e) Scoring standards (go/no-go)

    f) Rules for test administration (guidance for testor)

2. A listing of the training objectives which will lead to the achievement of job performance. A listing of the criterion tests corresponding to each training objective.

3. A set of specifications indicating the types and places of training for each of the objectives in the JTTP.--Some objectives will accomplished in TRADOC Schools; others will be accomplished in Training Centers; and the remainder must be accomplished in units, either as OJT, collective training, or in special training programs conducted by the unit commander.

4. For any non-school or training center objectives, there should be a job aid prepared for the unit trainer so that when he prepares to conduct the training, his procedures will be clearly spelled out. He will know the objectives, how to conduct the training, and how to determine if his traniees have met the objectives of the training. (This plan excludes those job tasks on which more advanced trainees--E-5 and above and officers--may be expected to obtain the information through individual or correspondence study.)

APPENDIX E

EXCERPTS FROM A FORD FOUNDATION REPORT

Chapter Five: The Conditions of Success

The conditions of success in the use of the things of learning are many, varied, imprecise, changeable, and changing. Within this uncertainty, projects that incorporate certain considerations enhance substantially their likelihood of achieving success.

A recognized and generally agreed-upon need must exist. Or, as Schramm and his colleagues say, the probability of success is greater if a project "grows out of a critical appraisal of needs and alternative solutions."[1] Although this may appear to be obvious, on several occasions a retrospective examination has evoked the question whether the project warranted the use of instructional technology.

A desire to meet the need and to do it through the use of instructional technology must prevade. The people who must use instructional technology should want to use it and believe in its efficacy. As Keppel and Cornog note,". . .machine and software combined cannot succeed unless those that use them are convinced they work and should be used."[2] It must be both appropriate and acceptable.[3] Apathy and indifference and damaging, but overt, opposition by those who must use, or be used by, the technology will almost certainly guarantee failure....

A purpose must guide and must be articulated. If there is no purpose, there should be no project. Both the initiators and the executors must know and comprehend the purpose of the project....Instructional technology is for the learner. Measurable success is more likely to result if the purpose is single rather than multiple; specific rather than general; limited rather than diffuse; unambiguous rather than vague; and agreed upon rather than imposed.

<u>A structure should exist which makes success possible, or at least does not in advance assure failure.</u> A system which is hospitable to instructional technology can enhance its adoption, use, and success; a hostile one can retard or even prevent it. Dietrich and Johnson pinpoint the problem. "Prior to any administrative reorganization to bring about change involving educational technology, certain steps need to be taken. First, change procedures need to be defined; second, a commitment to change must be negotiated and stated; and finally, a climate of change must be developed."[4] Unity of purpose among the authorities responsible for an instructional technology project and broad involvement in the educational system in which the project takes place are two factors, identified by Schramm and his colleagues, that increase the probability of success.[5] The structure alone does not automatically provide either unity of purpose of involvement, but unless the structure is changed positively on both fronts, unity of purpose will be temporary, and involvement minimal.

<u>Leadership must be exerted at the right level of authority, responsibility and control.</u> Strong backing by top authorities <u>is the basic requirement</u> for effecting swift innovation in a school system[6] . . . .

<u>Some substance must require the use of the things of learning.</u> The medium may affect the message, sometimes drastically, as applications have illustrated. It may even <u>be</u> the message, although that is not at issue here. If the technology is as powerful and as essential as its proponents claim, then its content should not be left to chance.

<u>A mechanism for measurement, for evaluation of the experience, must be included.</u> While there have been several reports of research many are old, and most are general and inconclusive. If the focus were sharper, the evaluation would be more precise.

<u>Finally, adequate resources must be provided at the beginning and for the duration of the project.</u> Instructional technology is expensive. Adequate financial resources are ctitical...."Experiments" and "demonstrations" launched by "outside" mondy usually wither and die when "inside" money must assume the responsibility. The financial resource picture is further complicated by the nature of the use of instructional technology. The things of learning have always been viewed as additional expenses

rather than as means to cut costs and/or increase educational effectiveness.[7]

The inclusion of these nine conditions in the planning, execution and evaluation stages of a project will increase its likelihood of success. The prospective user of the things of learning should also be cognizant of. . .other issues which will bear on the shape and ultimate form of the project.

The first is the appropriate use and amount of technology, the place of the multi-media approach to teaching and learning. Although no one would gainsay that the things of learning can make a definite contribution to the learning experience, the extent and manner of the contribution are concerns yet to be resolved by further experience.

The size of a project is also a consideration. Schramm and his colleagues select as one criterion of success a project of "feasible size."[8] They continue, "There may well be a 'critical mass' beyond which it becomes much easier to introduce instructional television."[9] El Salvador is countrywide; its instructional television project is said to be effective, but it is small. Niger's instructional television project is thought by some to be inherently good, but less effective because it is not countrywide. The question of effective size will remain unanswered until the results of more projects are evaluated.

FOOTNOTES TO APPENDIX E

[1]Wilbur Schramm, Philip H. Coombs, Friedrich Kahnert, Jack Lyle, The New Media: Memo to Educational Planners, UNESCO, International Institute for Educational Planning, Paris, 1967, p. 99.

[2]Francis Keppel and Michael L. Cornog, "Evaluation and Measurement of Instructional Technology," in Sidney G. Tickton, (ed,) To Improve Learning Vol. II. (New York and London: R. R. Bowker Company, 1971), p. 825.

[3]John E. Dietrich and F. Craig Johnson, "Changes in Administrative Organization Aimed to Effect the Introduction of Appropriate Educational Technology," in Sidney G. Tickton (ed.) To Improve Learning Vol. II. (New York and London: R. R. Bowker Company, 1971), p. 476.

[4]John E. Dietrich and F. Craig Johnson, op.cit., p. 469.

[5]Wilbur Schramm, et al, op.cit., p. 102.

[6]New Educational Media in Action: Case Studies for Planners-I, (Paris: UNESCO, Institute for Educational Planning, 1967), p. 49.

[7]James R. DuMolin and Robert P. Morgan, "An Instructional Satellite System for the United States: Preliminary Considerations," Internal Memorandum No. 71-2, Program on Application of Communications Satellites to Educational Development, (Washington University, July 16, 1971), p. 33.

[8]Wilbur Schramm, et al, op. cit., p. 99.

[9]New Educational Media in Action, op. cit., p. 81

From An Inquiry Into the Uses of Instructional Technology, J. W. Armsey and N. C. Dahl, 1973.

APPENDIX F

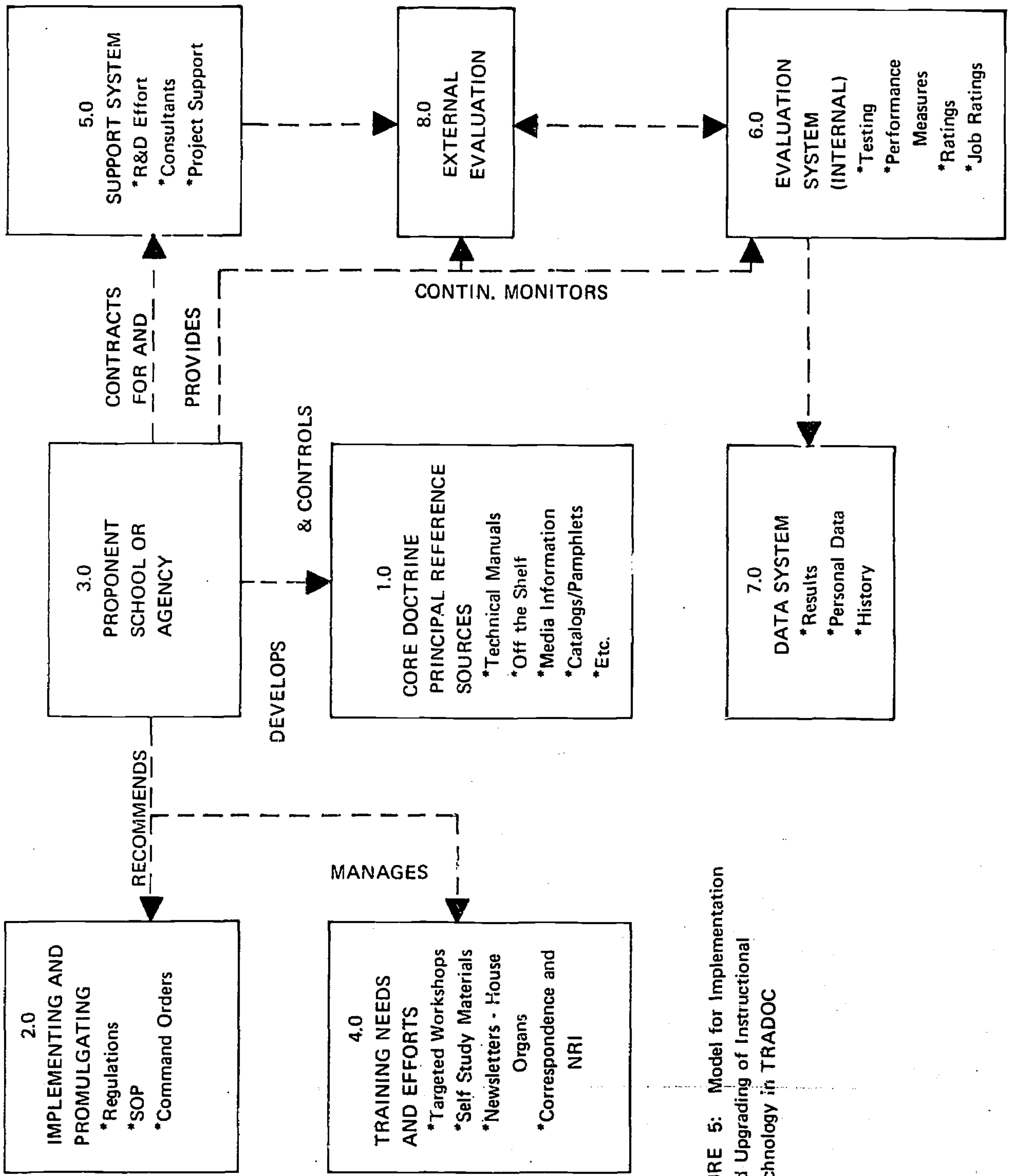

FIGURE 5: Model for Implementation and Upgrading of Instructional Technology in TRADOC

APPENDIX G

TASK 1 -- CONTRACT #N61339-73-C-0150

Task 1: Assess the state of the art in empirically designed training technology, identify concepts appropriate to the mission of TRADOC Schools and Training Centers and recommend methods for institutionalizing these concepts within the TRADOC School and Training Center system.

a. The Problem

Two fundamental questions confront Army trainers:

-- What to train?

-- How to train?

Modern training technologies--some of which owe their existence to early pioneering within the military training establishment--address both questions in an efficient, systematic manner. These technologies--based on empirical methods, analysis to determine training needs, criterion testing, performance oriented training, appropriate use of media, and feedback--are spreading rapidly in the commercial and educational spheres.

CONARC Reg 350-100-1, published originally in 1968, constitutes the principal guidance to Army schools in training technology. The regulation is deficient in two important respects:

-- It stresses job and task analysis to a fault. Systems engineering--analysis to determine training needs--has become an end in itself, an exercise in completing all the blocks in the specified forms.

-- Its treatment of the "How" question--how to take derived training needs and produce effective, efficient, training is thin to the point of being almost nonexistent.

It is easy to pay only lip service to the systematic approach to the design of instructional/training materials. The Army schools have paid such lip service for several years. However, most Army school courses and most units still use the old 50-minute, lecture-oriented lesson plan. Many courses still teach unnecessary trivia. The problem is that the new technologies are not really understood and therefore it is almost impossible to develop instructional/training materials in accordance with them.

b. Research Required

The contractor will assess the state of the art in training technology, ascertain concepts appropriate to the mission of TRADOC Schools and Training Centers and recommend methods for institutionalizing these concepts within the TRADOC School and Training Center system.

Both an expansion in the scope of the guidance provided and the manner in which such guidance is presented must be considered. Careful human engineering of the organization of guidance material is essential, particularly that providing "how-to-do-it" guidance to training analysists and instructors. An overview highlighting the key product of each phase of the training development process should precede any detailed procedural guidance. Critical factors that must be considered in the presentation of detailed procedures include:

-- Organization of the basic steps in the design of training to show their interrelationship and relative importance and the desired key products.

-- Description of acceptable alternative procedures that may be employed should situational constraints preclude using one particular method.

-- A clear recognition of any procedural inadequacies that currently exist within the state of the art.

c. Product of Research

-- Plan for research which will be approved by USACATB.

-- Interim technical reports.

-- Final technical report.