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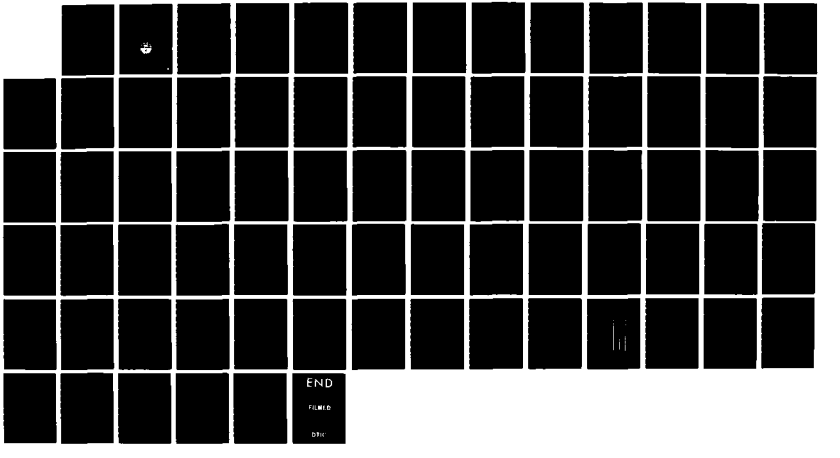

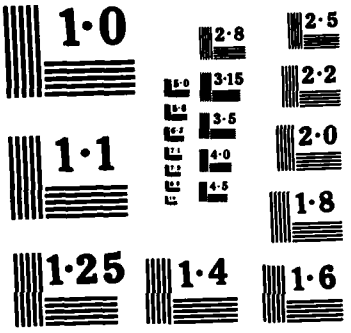

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AN EVALUATION OF MEDIA SELECTION

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FOREWORD

This project was conducted in response to a request from the Naval Air Systems Command (NASC) (NAVAIR-413E) under contract number N66001-79-C-0295 with Instructional Science and Development, Inc. NASC is developing a handbook for cost effective selection of instructional media using a four-step approach: (1) gather a representative set of instructional objectives from the P-3 aircrew training curriculum, (2) choose a media-selection model, (3) exercise the model with respect to training effectiveness and cost, and (4) incorporate the model into the handbook.

This report describes the representative set of objectives from the P-3 curriculum, three candidate media selection models, and the results of applying the model chosen by NASC to the representative objectives with respect to the criteria of training effectiveness. In accordance with NASC guidance, cost criteria were not addressed in applying the model.

The contracting officer's technical representatives were Joseph C. McLachlan and Walter F. Thode.

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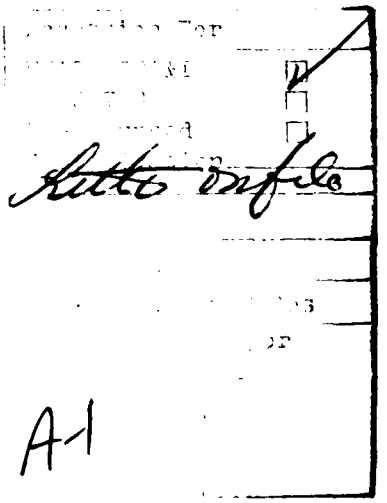

SUMMARY

Problem

Media selection can be a difficult task during the development of military training programs. One facet of the media selection process involves the evaluation of the effectiveness of different instructional media. In the absence of objective data obtained from controlled experimental studies, a variety of techniques are used, all of which are based on subjective interpretation. As the requirement to select media increases, it is necessary that current techniques be evaluated to determine which provide the greatest levels of objectivity.

Objective

The objectives of this study were to survey state-of-the-art media selection methodologies, to evaluate the techniques currently being applied to naval air training programs, and to present three of the techniques to the Naval Air Systems Command (NASC), who would select one for implementation and incorporation into a media costs handbook.

Approach

Media selection methodologies were surveyed, and the following three were selected to represent the state-of-the-art: (1) the Training Effectiveness and Cost Effectiveness Prediction (TECEP) technique, (2) a computerized technique using logic similar to TECEP, and (3) small-group process called the "DELPHI" method. The latter was included by direction from NASC because of specific interest in exploring its possibilities as a technique that is as efficient and as valid as the other techniques, and because of its perceived potential for minimizing subtle biases. After a review of the three methodologies, NASC selected the "DELPHI" method for test case evaluation.

Results

The team of experts evaluating the "DELPHI" method lacked sufficiently structured procedures to be successful and efficient in selecting media. They required a better definition of ground rules and assumptions than was provided by the "DELPHI" method to solve the problems inherent in the media selection process. Subsequent attempts at structuring centered on the definition of the media hardware, the media attributes that were useful in training, the meaning of the objectives, the use of the media, and the scales for ranking the media. During the course of the 9-hour session, a number of discussions were held that revealed a deep divergence of views among members of the group, all of whom are respected, experienced professionals in the field. The team evaluated only seven objectives for media selection during the session and never reached total agreement even on those seven.

Conclusions

The results indicate that any future use of the small-group process as a media selection technique will require more specific rules than those used during the test case evaluation. Further, the more rules and assumptions stated, the closer the "DELPHI" method resembles the more algorithmic techniques surveyed. The conclusion reached was that the "DELPHI" method, in fact, suffers from the same deficiencies as any other media selection technique, even when the ground rules and assumptions have been specifically stated.

Recommendations

Until critical decision data are available from additional media selection research, media selection techniques should include the rules and assumptions to be employed if the results are to be interpreted meaningfully.

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Media selection can be a difficult task during the development of military training programs. One facet of the media selection process involves the evaluation of the effectiveness of different instructional media. In the absence of objective data obtained from controlled experimental studies, a variety of techniques are used, all of which are based on subjective interpretation. As the requirement to select media increases, it is necessary that current techniques be evaluated to determine which provide the greatest levels of objectivity.

Background

In the early 1970s, the Training Analysis and Evaluation Group (TAEG) investigated the adequacy of existing techniques for choosing instructional media and embarked on a program to eliminate deficiencies. In a review of ten existing techniques (Braby, 1973), TAEG identified the following deficiencies that make the selection of instructional media for military training programs a difficult task:

1. The procedures are inexact.

2. The selection criteria are too general for identifying specific media for specific training.

3. Some procedures are too general to address the instructional requirements sufficiently.

4. Most procedures are too complicated.

5. Most procedures cannot be adapted easily to the range of military training needs.

TAEG identified several reasons for the deficiencies. First, the nature of military jobs provides an intrinsic difficulty in selecting an optimal media mix; that is, job performance frequently involves a combination of procedural, perceptual, motor, and knowledge components, perhaps including decision making, that must be integrated. Thus, the learning task may not consist of discrete components easily associated with media hardware attributes. Likewise, it is often difficult to associate one specific medium with the learning task, given a variety of attributes of concern. Often, the use of a medium and the resulting quality of the courseware determines a successful media application just as much as the unique attributes of the medium itself.

Instructional hardware has evolved continually, and a wide range of equipment is available for consideration. However, unbiased information on the instructional hardware is seldom available. There is little evidence for empirically determining which media hardware attributes are important to specific learning tasks, and little evidence that is related to how well specific media selection techniques work.

The initial survey of media selection techniques led TAEG to an ambitious program for developing a more appropriate technique for choosing instructional media. The result was the Training Effectiveness and Cost Effectiveness Prediction (TECEP) technique (Braby, Henry, Parrish, & Swope, 1975), which consists of a three-step procedure: (1) classify training objectives into groups and define the appropriate learning strategies for

each group of objectives, (2) identify the media capable of supporting the strategies, and (3) estimate the costs of alternative media. The technique was field evaluated in several cases and research has continued at TAEG on some aspects of it. Also, the TECEP technique has been incorporated into Phase III of the Interservice Procedures for Instructional Systems Development (NAVEDTRA 106A, 1975).

Despite the efforts expended on TECEP and other such programs, Naval Air Systems Command (NASC) personnel judged that many deficiencies still exist in the selection of media appropriate to naval air training programs.

Objective

The objectives of this study were to survey state-of-the-art media selection methodologies, to evaluate the techniques currently being applied to naval air training programs, and to present three of the methodologies to NASC, who would select one for implementation and incorporation into a media costs handbook. NASC was particularly interested in determining whether a small-group process called the "DELPHI" method was effective.

APPROACH

NASC assigned five tasks to accomplish the media effectiveness evaluation:

1. Review the candidate media to be used in the media costs handbook.

2. Develop a representative sample of training objectives to be approved by NASC.

3. Conduct a literature search on media effectiveness measures.

4. Identify and describe three media effectiveness methodologies.

5. Conduct a test evaluation of one media effectiveness methodology specified by NASC.

The first four tasks supported the fifth task--to conduct a test case evaluation. Task 1 determined the list of candidate media to be used during Task 5. Task 2 developed a representative sample of objectives sufficiently large to exercise the media effectiveness technique to be evaluated in Task 5. Tasks 3 and 4 produced a description of three alternative methodologies for selecting training effective media. NASC reviewed this description prior to specifying the media effectiveness technique to be evaluated in Task 5. The tasks are described in the following paragraphs.

Candidate Media

Since the purpose of the media costs handbook was to provide cost indices for media that satisfy training requirements for cognitive rather than psychomotor skills, no trainers or simulators were considered as candidate media. However, three general-purpose computer-assisted instruction (CAI) systems were included. The following list of media was specified for use:

1. Lecture (with limited visual support).
2. Programmed text.

3. Linear text (e.g., Naval Air Training and Operating Procedures Standardization (NATOPS) Manual).
4. Workbook.
5. Programmed filmstrip (e.g., Beseler Cue/See).
6. Slide with sound.
7. Random-access slide.
8. Videotape cassette (e.g., Sony U-Matic).
9. Videodisc.
10. Time-shared interactive computer-controlled instructional television (TICCIT) CAI.
11. Programmed Logic for Automatic Teaching Operation (PLATO).
12. General Electric Training System (GETS).
13. Microfiche (random-access and random-access with microprocessor control).

Training Objectives

The sample of training objectives was selected from the P-3 Fleet Readiness Squadron aircrew training program. The P-3 aircrew training program consists of approximately 6,000 cognitive learning objectives and a larger number of "hands-on" objectives. It covers three versions of the P-3 aircraft (B MOD, C, and C Update), found in Fleet Readiness Squadrons on both coasts (VP-30 and VP-31). The learning objectives are organized into courses for seven aircrew positions: pilot, flight engineer (FE), naval flight officer (NFO), sensor station operators 1 and 2 (SS 1/2), sensor station operator 3 (SS 3), ordnanceman, and communicator.

Given the size of the training program and scope of the study, the number of objectives for analysis was limited by:

1. Excluding learning objectives presented in device sessions using trainers, simulators, or aircraft, since the media costs handbook was designed for media that satisfy cognitive, rather than "hands on," training requirements. This focused attention on the 6,000 cognitive learning objectives.

2. Eliminating the aircrew positions of ordnanceman and communicator, since these courses did not provide many objectives suitable for the candidate media. This decreased the pool to 3,550 learning center objectives for five remaining aircrew positions.

3. Considering courses for only one version of the aircraft for those aircrew positions for which separate courses exist for different aircraft versions. This decreased the pool to 2,300 learning center objectives.

The goal was to identify a sample of learning objectives, building from basic knowledge provided in the learning center lessons to, but not including, "hands-on" skills provided in the device sessions. A sample of 254 learning objectives was selected. Table 1 provides a breakdown of the objectives by course.

To ensure a representative sample, the objectives indentified for each course were classified according to behavior and content using the classification system in the P-3 Subject Matter Expert (SME) Training Manual. This system classified the behavior as remember or use and the content as fact, concept, procedure, or rule. The definitions for behavior and content in the Instructional Quality Inventory (Wulfeck, Ellis, Richards, Wood, & Merrill, 1978) facilitated classification when added to the P-3 SME matrix.

Table 1

Summary of Objectives

Course	Total Learning Center Objectives	Number in Sample
B MOD/C Pilot	775	64
B MOD/C FE	225	29
B NFO	600	84
C SS 1/2	425	43
C SS 3	275	34
Total	2,300	254

Table 2, which summarizes the classification of the 254 objectives included in the sample, shows that 235 of them were classified as "remember" on the behavior dimension. This is because only learning center objectives were considered. Classification of objectives in the device sessions would result in large numbers in the "use" category. Of the 235 "remember" objectives, 223 were classified as facts or procedures on the content dimension. This is representative of the P-3 curriculum across aircrew positions.

Appendix A presents the sample of learning objectives by aircrew position. It includes a brief description of the course, a summary of the classification of the objectives, and a detailed listing of the sample objectives for each of the five aircrew positions.

Media Selection Methodologies

Technical reports describing and evaluating media selection techniques used in military training programs were reviewed. Appendix B provides a description of three alternative methodologies for selecting instructional media. Two of the media selection techniques were considered representative of the state-of-the-art. The TECEP technique described earlier is a good example of an algorithmic selection model. Another example is the computer-based Automated Instructional Media Selection (AIMS) model, which uses a logic similar to TECEP. The third, the "DELPHI" method, was included by direction from NASC. This method was of specific interest as a technique that might prove to be both efficient and valid for selecting media in naval air technical programs and that NASC believed possessed the potential for minimizing subtle biases.

Methodology Evaluation

After review of the three media selection methodologies, NASC selected the "DELPHI" method for evaluation. Although the methodology evaluated during the study was called "DELPHI," it had a number of characteristics that distinguished it from the Delphi technique described in the literature.

The classical Delphi technique is a set of procedures for achieving a consensus of opinion from a panel of experts for the topics under consideration. The methodology is usually based on a series of mailed questionnaires with information and opinion feedback

Table 2

P-3 Classification Matrix of All Objectives Included in the Sample

Type of Behavior	Content				Total
	Fact	Concept	Procedure	Rule	
	Recall or recognize names, parts, dates, places, etc.	Remember characteristics, or classify objects, events, or ideas according to characteristics	Sequence of steps remembered or used in a single situation or on a single piece of equipment	Remember or use a sequence of steps that apply across situations or across equipments	
REMEMBER-recall or recognize facts, concept definitions, steps of procedures or rules	144	10	79	2	235
USE-tasks that require classifying, performing a procedure, using a rule with job aids available or with no aids except memory	--	0	3	16	19
Total	144	10	82	18	254

from previous rounds provided in successive iterations. As stated by Keller and Koen (1976), anonymity is of primary concern. The procedures are designed to minimize (1) the effect of a dominant (but not necessarily more expert) individual, (2) the "bandwagon" effect, (3) the hesitancy to abandon a publicly expressed position once it has been refuted, and (4) the pressure that exists to renounce an unpopular position. The procedures offer the advantage of providing the expert with the opportunity to examine the opinions of other experts in his or her own time and benefit from the exposure to opinions of experts with different orientations and biases.

As described in Keller and Koen (1976), the traditional Delphi technique appears to be much too time-consuming for most instructional systems development tasks, including media selection. An alternative method, the E-T-E (estimate-talk-estimate) method (Armstrong, 1978) would be more appropriate for media selection. It has some of the same characteristics of the Delphi technique but is simpler and less costly to apply. Further discussion on the E-T-E method and on the traditional Delphi technique, in constrast to the "DELPHI" method evaluated in this study, is provided in Appendix B.

The "DELPHI" method selected by NASC can be described as a relatively nonstructured rating of individual learning objectives by a panel of media selection experts. The experts examine objectives one by one and, during open discussion of each objective, they are expected to reach agreement concerning the medium of instruction best suited for teaching the objective.

The goal of the "DELPHI" used in this study was to obtain a consensus of expert opinion in selecting media, based on effectiveness only, for the set of P-3 training objectives. The approach involved a team of four experts in media selection. All were senior behavioral scientists with 10 or more years of experience in human factors and training systems and extensive military training backgrounds. Each has a Ph.D. in experimental or instructional psychology. Two of the members had worked with the P-3 training program previously and one, in fact, was involved in the development of the aircrew training program. The level of expertise in particular media varied among participants, with some having particular expertise in simulators, programmed instruction text, and computer-assisted instruction.

The team was provided with several items to structure the selection process, including:

1. The list of candidate media specified by NASC in Task 1.
2. The sample of P-3 training objectives approved by NASC during Task 2.
3. A list of media attributes provided by NASC.
4. A brief, general description of the process to be followed provided by NASC.

As described earlier, the learning objectives from the P-3 training program were classified by learning type prior to the session and then presented to the team for use. The objectives were drawn from the pilot, NFO, and SS 1/2 courses in the sample in Appendix A. The selected objectives matched the candidate media and excluded "hands on" learning tasks that require simulators, other devices of high task fidelity, or any actual equipment such as the aircraft. This selection emphasized the study of media effectiveness techniques for learning center and classroom technologies.

The list of media attributes included color, text, motion, clarity, flexibility, audio/sound, maintainability, reliability, transportability, applicability across objectives, operability, quality of responses, and managability. Because the media selection process used in the study evolved as the study progressed, a more complete description of it is included in the results.

RESULTS

The results of the media selection exercise indicated that the team of experts evaluating the "DELPHI" method lacked sufficiently structured procedures to be successful and efficient in selecting media. They required a better definition of ground rules and assumptions than was provided by the "DELPHI" method to solve the problems

Table A-2 (Continued)

Sample of Training Objectives

Crew Position: Pilot

Number of Sample Objectives: 64

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
1/17/3	A. State when the autofeather system is used.	Remember	Fact
	B. State the number of engines that will autofeather when the system is activated.	Remember	Fact
	C. List the three criteria for activation of the autofeather system.	Remember	Fact
	D. State (1) the indication of an armed autofeather system and (2) the indication of an activated autofeather system.	Remember	Fact
	E. List the two situations when use of the autofeather system is not recommended.	Remember	Fact
1/17/4	A. State how the feather button is placed in the UNFEATHER position.	Remember	Procedure
	B. State the function of the pressure cutout override (PCO).	Remember	Fact
	C. List the five events initiated by placing the feather button in the UNFEATHER position.	Remember	Fact
	D. State the function of the 45 degree air start switch.	Remember	Fact
	E. List the two requirements to arm the 45 degree air start switch.	Remember	Procedure
	F. State the indication of 45 degree air start switch activation.	Remember	Fact
1/26/1	Given a diagram of the AFCS control panel, state the function/operation of the PB-20N control positions.	Remember	Fact
1/26/2	State the location and function of the PB-20N autopilot-associated equipment.	Remember	Fact

Table A-2 (Continued)

Sample of Training Objectives

Crew Position: Pilot

Number of Sample Objectives: 64

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
1/15/7	A. Given the center instrument panel, locate the BETA lights.	Remember	Fact
	B. State the propeller condition indicated by illumination of the BETA light.	Remember	Fact
	C. State the condition during which BETA operation should never be used.	Remember	Fact
1/15/8	List the three propeller brake positions and state the conditions which must be met for the propeller brake to be in each position.	Remember	Fact
1/17/1	A. List the three feather button positions.	Remember	Fact
	B. State when the feather button is used to shut down the engine.	Remember	Procedure
	C. List the three ways to place the feather button in the feather position.	Remember	Procedure
	D. State (1) the three components which are activated when the feather button is placed in the feather position, and (2) the function of each component.	Remember	Fact
	E. List the two cockpit indications of feather pump actuation.	Remember	Fact
	F. List the electrical power sources for the feather pumps.	Remember	Fact
	G. State (1) the condition which activates the PRESSURE CUTOUT switch, (2) the two functions of the pressure cutout switch and (3) the cockpit indication of feather termination.	Remember	Fact
1/17/2	List the eight functions of the E handle (Emergency shutdown handle) and state the method of actuation (electrical or mechanical) for each function.	Remember	Fact

Table A-2 (Continued)

Sample of Training Objectives

Crew Position: Pilot

Number of Sample Objectives: 64

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
1/15/1	Given a diagram showing the five exterior propeller components, label each.	Remember	Fact
1/15/2	A. List the (1) four major components, (2) functions and (3) power sources of the propeller pump housing.	Remember	Fact
	B. State the malfunction indicated by illuminated propeller pump lights.	Remember	Fact
1/15/3	State the function of the major propeller valve housing components.	Remember	Fact
1/15/4	A. State (1) when the propeller is in the flight (alpha) operating range and (2) the propeller governor action when temporary overspeed and underspeed conditions are detected.	Remember	Fact
	B. State the normal RPM limitations in the flight operating range.	Remember	Fact
	C. Given a diagram of the center instrument panel (1) locate the tachometer and (2) state the tachometer power source.	Remember	Fact
1/15/5	A. List the four subsystems of the electronic governing system (SYNC system) and state their functions.	Remember	Fact
	B. State the function of the electronic governing system controls.	Remember	Fact
	C. State the electronic governing system power source.		
1/15/6	A. State when the engine/propeller is in the ground (BETA) operating range.	Remember	Fact
	B. List the two selectable RPM's for ground (BETA) operating range.	Remember	Fact
	C. Name the (1) component which governs RPM when the power lever is in the ground (BETA) operating range and (2) control which governs blade angle in the BETA range.	Remember	Fact
	D. State the three reasons why low RPM is desirable for ground operations.	Remember	Fact

Table A-2

Sample of Training Objectives

Crew Position: Pilot

Number of Sample Objectives: 64

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
1/14/1	A. State the location of (1) fuel tanks one through four and (2) fuel tank five.	Remember	Fact
	B. List the two types of fuel used on the P-3.	Remember	Fact.
1/14/2	A. Given the two electrical system conditions, state (1) the tanks which may be fueled and (2) the method for fueling these tanks.	(1) Remember (2) Remember	Procedure Procedure
	B. List the (1) two methods of checking fuel quantity prior to flight, (2) the tanks on which each method is performed and (3) the unit of measurement for each method..	(1) Remember (2) Remember (3) Remember	Procedure Procedure Fact
	C. Given a list of flight conditions, state the maximum fuel differential between tank pairs for (1) tanks one and four, and (2) tanks two and three.	Remember	Fact
1/14/3	A. Given a diagram of the fuel management panel and a list of fuel management panel components, state the function of each component.	Remember	Fact
	B. State the (1) function and (2) run and control power sources of the boost pumps, main tank valves and fuel tank emergency shutoff valves.	Remember	Fact
1/14/4	A. List the two functions of the transfer system.	Remember	Fact
	B. State the (1) function and (2) run and control power sources of the transfer pumps and transfer valves.	Remember	Fact
1/14/5	A. State the function of the crossfeed system.	Remember	Fact
	B. State the crossfeed valve power source.	Remember	Fact

Table A-1

Summary of Training Objectives Classification

Crew Position: Pilot

Number of Sample Objectives: 64

CONTENT

BEHAVIOR	FACT Recall or recognize Names, Parts, Dates, Places, Etc.	CONCEPT Remember Characteristics, or Classify Objects, Events, or Ideas According to Characteristics	PROCEDURE Sequence of Steps Remembered or Used in a Single Situation or on a Single Piece of Equipment	RULE Remember or Use a Sequence of Steps which Apply Across Situations or Across Equipments
REMEMBER - Recall or Recognize Facts, Concept Definitions, Steps of Procedures or Rules	50	0	14	0
USE - Tasks which require classifying, performing a procedure, using a rule with job aids available or with no aids except memory		0	0	0

Objectives from Pilot Course

The B MOD/C Pilot course consists of the following units organized by phases in the Master Course Syllabus:

A. Unit 1--Equipment Hardware and Operation Familiarization

Unit 2--Normal Procedures

Unit 3--Normal Procedures

B. Unit 4--Malfunctions

Unit 5--Instrument Procedures

Unit 6--Safety/Survival Equipment/Emergencies and Preflight Inspections

Unit 7--Navigation/Mission Planning

C. Unit 8--Oceanography/Submarine Signatures

Unit 9--ASW Procedures and Tactics

Unit 10--LOFAR/DIFAR Techniques

Unit 11--Radar/ESM/IRDS/MAD

Unit 12--Active Tactics

Unit 13--Ordnance

Unit 14--TACCO Station

Unit 15--Communications Systems

D. Unit 16--Tactical Flight Scenario

Since Phase C contains mostly classified material, the analysis was confined to Phases A and B. Interviews with pilot instructors revealed that the problem areas in the curriculum were concentrated in Phase A, particularly Unit 1. The instructors indicated that the pilot requires more knowledge of how systems function in order to be able to respond to multiple emergencies or other conditions where routine procedures may not apply. On this basis, Lesson 14, which covers the fuel supply system, and Lessons 15 and 17, which deal with the propeller system components/normal operations and feathering/unfeathering, were included in the representative sample. Lesson 26, which covers operation of the PB-20N Autopilot system, was also included since it involves a mix of factual and procedural objectives which are representative of the pilot course.

APPENDIX A

SAMPLE OF OBJECTIVES

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* Referred to in Appendix B only.

media. Efforts made by TAEG, NAVPERSRANDCEN, and other research organizations are relevant sources for such data.

It should be noted, however, that much of the research on media in the past has confused the use of the media--that is, the instructional technology that can be utilized on the media--with the media hardware. It is of major importance to define the attributes of the medium that make it different enough to warrant selection of that medium over another. This is the technology versus media hardware distiction (Salomon, 1977). Research comparing television to lecture, CAI to textbook, or other media to each other is probably not meaningful and is, at best, difficult to interpret within the context of military training. Certainly, media selection methodology has not been helped by this type of research.

As exhibited during the sessions, the important questions surfacing are (1) what features does this medium have that we can use and (2) under what conditions are those features more effective? These are the basic data of media selection and, unfortunately, they are usually missing when media selection is carried out. In the absence of such data, one is forced to define assumptions and ground rules, and formalize biases as explicitly as possible. This is not to say that all of the algorithmic media selection procedures being used are totally incorrect. They are, in fact, the best that can be done at the present time. The use of such procedures should not be discontinued. However, their weaknesses should be recognized as such.

RECOMMENDATIONS

Until critical decision data are available from additional media selection research, any media selection technique used must include the rules and assumptions to be employed if the results are to be interpreted meaningfully.

Table 6

Ratings of Seven Instructional Objectives with Respect to the NASC-Provided Attributes, Using a Six-Point Scale

	Segment						
			C SS 1/2				B NFO
Criteria	Pilot 1/14/1	Pilot 1/26/4	4/4/6	4/4/7	4/4/8	8/5/3	2/8/13
Visual Representation:							
Pictorial	1	0	0	0	0	0	0
Graphic	5	4	5	5	5	5	3
Color	1	1	0	0	0	0	0
Text	5	5	5	0	0	5	5
Motion	0	2	0	0	0	0	0
Clarity	0	0	0	0	0	0	0
Format Flexibility	0	0	0	0	0	0	0
Sound (Voice)	3	3	3	0	0	3	3
Response:							
Verbalize	5	5	5	0	0	0	5
Select	0	0	0	0	0	0	0
Perform	0	0	0	5	5	5	0
Feedback:							
Immediate	4	4	4	4	4	5	4
Delayed	1	1	1	0	0	0	1
Feedback Context:							
Correct Answer Only	5	5	5	0	0	5	5
Elaborated Answer	0	0	0	5	5	0	0

CONCLUSIONS AND DISCUSSION

The obvious conclusion regarding the media selection exercise is that much more structure is required to accomplish successfully the media selection task, as evidenced by the attempted structuring that occurred during the session. However, it is doubtful that it was possible to develop a set of assumptions and ground rules that would have been acceptable to all members of the team. There would have been disagreements with some of the definitions even if much more time had been available. The remaining disagreements were a function of the team members' particular experiences and resulting biases.

The lack of consensus among team members and their constant questioning of each other is not so much a reflection on the capabilities of the participants as it is on the state of knowledge of differential media effectiveness and media selection itself. Continued efforts should be made to compile data on both media hardware and the use of

Table 5

Ratings of Media Applicability to the NASC-Provided Attributes

Criterion	Lecture	Programmed Text	Linear Text	Work-book	Programmed Film Strip	Sound Slide	Random-Access Slide	Video-Tape	Video-Disc	TICCIT CAI	PLATO CAI	GETS CAI	Random Access: Micro-fiche	Random Access: Microfiche with Micro Control
Visual Representation:														
Pictorial	5	5	5	5	5	5	5	5	5	5	0	5	5	5
Graphic	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Color	5	5	5	5	5	5	5	5	5	5	0	5	5	5
Text	1	5	5	5	2	2	2	1	1	3	3	3	5	5
Motion	0	0	0	0	5	0	0	5	5	5	0	5	0	0
Clarity (Resolution)	0	4	4	4	5	5	5	2	2	2	1	1	5	5
Format Flexibility	3	1	0	3	0	0	4	0	5	4	4	4	4	5
Sound	5	0	0	0	5	5	0	5	5	5	0	0	0	0
Response:														
Verbalize	5	5	0	5	0	0	0	0	4	4	4	4	0	4
Select	3	5	0	5	3	0	0	0	5	5	5	5	0	5
Perform	1	5	0	5	0	0	0	0	5	5	5	5	0	5
Feedback:														
Immediate	1	5	0	5	5	0	0	0	5	5	5	5	0	5
Delayed	5	0	0	NA	NA	0	0	0	NA	NA	NA	NA	0	NA
Feedback Context:														
Correct Answer Only	5	5	0	5	5	0	0	0	5	5	5	5	0	5
Elaborated Answer	3	5	0	5	0	0	0	0	5	5	5	5	0	5

Table 4

Six-Point Scaling Systems Developed to
Assist in Judging Media Attributes

System	Scale Alternatives
Applicability of Media Attributes	0 - Not Applicable 1 - Of Minimum Help 2 - Of Some Help 3 - Moderately Helpful 4 - Very Helpful 5 - Essential
Capability of Media	0 - None 1 - Minimal Capability 2 - Some Capability 3 - Substantial Capability 4 - Some Limits 5 - Complete

The procedure that evolved was to rate each of the listed media on one of the six-point scales with respect to its capability to handle each of the media attributes provided by NASC. These ratings are shown in Table 5. Following this, an attempt was made to rate each of the chosen instructional objectives, using a six-point scale, with respect to the importance of the media attributes. Although Table 6 shows the results of the ratings for the seven objectives completed, there were numerous examples of disagreement that are not shown in the table. Although the intent was to match the ratings of available media with those of the sample objectives, it became evident that the evolved procedures had shortcomings and that the desired results were not being achieved within the time available for the process. Because of this, and as a result of the disagreement about the results shown in Tables 5 and 6, the process was terminated.

The list of candidate media was determined to be insufficient in detail. While the team members were willing to work with this particular media pool, the lack of information about, or definition of, the media was troublesome. For example, a PLATO CAI system may have several configurations with different capabilities. Since the configuration was not defined, assumptions had to be made as to which capabilities would exist. Much additional discussion centered on the design technology of the mediated instruction as opposed to the media hardware. That is, does one assume that a lecture would be well designed and instructor implemented, provide interaction with students, elicit questions, provide feedback, provide demonstrations, allow for individual differences, provide feedback to the instructor on student progress, or be supported by quality learning materials? All of these are certainly possible with a lecture, but it became necessary for the media selection team to define such items and make assumptions. Biases about the capability of technology or quality of the media also became apparent during these discussions. Some participants believed that high quality could be obtained with one media form and not with another or, at least, that more difficulty in standardization of quality might be inherent in the media. Such expert opinion is, of course, actually biased. As the biases toward technology and media surfaced, the discussions became more intense, requiring more definitions and assumptions, and, to some extent, compromising of individual positions. Although members reached agreement in some areas, they never achieved total consensus.

The learning objectives were also subject to controversy. Team members raised questions concerning the completeness of the objectives, since some did not have satisfactory standards or sufficient descriptions of conditions. They constantly referred questions to the "P-3 expert" concerning the requirements of learning tasks in accomplishing the objective. The grouping of objectives by learning classification also posed a problem for two of the members who were unfamiliar with the system utilized. Although this system is part of the Instructional Quality Inventory (IQI) (Wulfeck et al., 1978) and is utilized in several naval air training programs, agreement as to the specific classification of each objective was sometimes difficult. In addition, the implications of the classification for media selection were often not evident.

The media attributes also caused concern. During the course of the session, the list of attributes was restructured and several attributes were redefined to achieve consensus among team members. They added such items as feedback (with various explicit forms), graphics, and specific response (verbalize, select, perform) to the list. The team members also decided that voice and sound should be two separate attributes for evaluation. In addition, flexibility was redefined to mean flexibility in format as to how the courseware could be structured on that media. Some items, such as reliability and maintainability, were questioned as being appropriate for an evaluation of training effectiveness. Furthermore, judgment was difficult to make as to the reliability or maintainability of particular media. Although participants had explicit experience with some of the media forms, it was felt that there is not enough unbiased data with which to judge many media candidates.

During the session, team members discovered that they could judge media attributes only on the basis of some form of scaling system. Therefore, scaling systems were developed. Several six-point scales evolved because a particular scale did not always seem to fit all attributes. Two such scales are shown in Table 4.

inherent in the media selection process. During the course of the 9-hour session, a number of discussions were held that revealed a deep divergence of views among members of the group, all of whom are respected, experienced professionals in the field. The team evaluated only seven objectives for media selection during the session and never reached total agreement even on those seven. The seven objectives and their characteristics are shown in Table 3. The following paragraphs describe some of the major problems encountered.

Table 3

Characteristics of Learning Objectives Evaluated

Crew Position	Unit/ Lesson/ Segment	Training Segment	Classification	
			Behavior	Content
Pilot	1/14/1	State the location of (1) fuel tanks one through four and (2) fuel tank five.	Remember	Fact
Pilot	1/26/4	List the four procedural steps for engaging the AFCS.	Remember	Procedure
C SS1/2	4/4/6	State the four distinctive signature characteristics for the Soviet type 1 diesel submarine.	Remember	Concept
C SS1/2	4/4/7	Given multipoint dividers, frequency scales and lofargrams with calibration marks, classify signatures of Soviet type 1 diesel submarines.	Use	Concept
NBFO	2/8/13	Given an LTN-72 INS data sheet and the necessary information, complete the form.	Use	Procedure
C SS1/2	4/4/8	Given the HP-67 calculator, the Fleet Mission Program Library VP Inflight Manual, and VP program cards, analyze signatures for Soviet type 1 diesel submarines.	Use	Rule
C SS1/2	8/5/3	List the four steps to determine layer depth and sea surface temperature.	Remember	Rule

Table A-2 (Continued)

Sample of Training Objectives

Crew Position: Pilot

Number of Sample Objectives: 64

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
1/26/3	A. State where the AFCS receives (1) attitude information, (2) heading information, (3) pilot and (4) static information.	Remember	Fact
	B. State which hydraulic system the AFCS requires for control booster operation.	Remember	Fact
	C. State the power sources for the AFCS.	Remember	Fact
1/26/4	A. List the four procedural steps for engaging the AFCS.	Remember	Procedure
	B. State the three methods of normal AFCS disconnect.	Remember	Procedure
	C. State the conditions and procedures for engagement and disengagement of the (1) PRE-SEL HDG, (2) RADAR ALT HOLD and (3) BAR ALT HOLD functions.	Remember	Procedure
	D. State the functional priority of the pitch-and-roll commands.	Remember	Procedure
1/26/5	A. State the aircraft pitch-and-roll response upon AFCS engagement.	Remember	Fact
	B. List the AFCS warnings associated with (1) low altitude flight, (2) operation of the emergency disconnect handle and (3) steep angles of bank.	Remember	Procedure
	C. State the (1) recommendation concerning AFCS ALT HOLD during turbulent air penetration and (2) list the two methods of controlling altitude when using the AFCS in turbulent air.	Remember	Procedure
	D. List the two evolutions when the AFCS should not be used.	Remember	Procedure
	E. List the (1) two indications of an abnormal disengagement and (2) five conditions which will cause abnormal disengagement.	Remember	Fact
	F. List the two procedural steps to follow when AFCS abnormal disengagement occurs.	Remember	Procedure
	G. State the condition which will illuminate only the red glareshield lights.	Remember	Fact

Objectives from Flight Engineer Course

The B MOD/C Flight Engineer (FE) course consists of the following units:

Unit 1--Aircraft Familiarization

Unit 2--Operation of PT Computer

Unit 3--Aircraft Performance

Unit 4--Normal Procedures

Unit 5--Malfunction and Emergency Procedures

Unit 6--Weight and Balance

Unit 7--Aircraft Servicing

Unit 8--Aircraft Inspection

Unit 9--Survival Equipment

Unit 10--Flights

Unit 11--Flight Procedures and Planning

Unit 12--TAC and Nav Extended Flights

The lessons chosen from Unit 5, emergency shutdown procedures, engine malfunctions, and propeller malfunctions, exhibit a mix of factual and procedural objectives which are representative of the FE course.

Table A-3

Summary of Training Objectives Classification

Crew Position: FE

Number of Sample Objectives: 29

BEHAVIOR	CONTENT: FACT Recall or recognize Names, Parts, Dates, Places, Etc.	CONCEPT Remember Characteristics, or Classify Objects, Events, or Ideas According to Characteristics	PROCEDURE Sequence of Steps Remembered or Used in a Single Situation or on a Single Piece of Equipment	RULE Remember or Use a Sequence of Steps which Apply Across Situations or Across Equipments
REMEMBER - Recall or Recognize Facts, Concept Definitions, Steps of Procedures or Rules	12	0	17	0
USE - Tasks which require classifying, performing a procedure, using a rule with job aids available or with no aids except memory		0	0	0

Table A-4

Sample of Training Objectives

Crew Position: FE

Number of Sample Objectives: 29

Unit/Lesson/Segment	Training Objective	Classification: Behavior	Classification: Content
5/2/1	A. List the Flight Engineer memory items on the Emergency Shutdown Checklist and state the condition for when they are to be performed.	Remember	Procedure
	B. Given the Emergency Shutdown Checklist challenges state the Flight Engineer actions and responses, and the related warning.	Remember	Procedure
	C. State the two actions to be taken by the Flight Engineer if an Engine fire is not extinguished with one HRD bottle.	Remember	Procedure
5/3/1	Given a list of engine fuel system indications, (1) name the malfunctions and (2) state the corrective actions and related cautions.	(1) Remember (2) Remember	Fact Procedure
5/3/2	Given a list of engine fuel system indications, (1) name the malfunctions and (2) state the corrective actions.	(1) Remember (2) Remember	Fact Procedure
5/3/3	Given a list of oil system indications, (1) name the malfunctions and (2) state the corrective actions.	(1) Remember (2) Remember	Fact Procedure
5/3/4	Given a list of engine gage indications, (1) name the malfunctions and (2) state the corrective actions.	(1) Remember (2) Remember	Fact Procedure
5/3/5	Given a list of TIT indications, (1) name the malfunctions and (2) state the corrective actions.	(1) Remember (2) Remember	Fact Procedure
5/3/6	Given a list of mechanical indications, (1) name the malfunctions and (2) state the corrective actions.	(1) Remember (2) Remember	Fact Procedure
5/4/1	A. List the eight procedural steps and the associated warning for the propeller fails to feather malfunction.	Remember	Procedure
	B. State when the Flight Engineer is to perform the propeller fails to feather completely procedure.	Remember	Procedure

Table A-4 (Continued)

Sample of Training Objectives

Crew Position: FE

Number of Sample Objectives: 29

Unit/Lesson/Segment	Training Objective		Classification: Behavior	Classification: Content
5/4/2	Given a list of abnormal condition indications, (1) name the malfunctions and (2) state the corrective actions associated with emergency shutdown procedures.		Remember	Fact
5/4/3	Given a list of RPM indications, (1) name the malfunctions and (2) state the corrective actions.	(1) (2)	Remember Remember	Fact Procedure
5/4/4	Given a list of propeller pump light indications, (1) name the malfunctions and (2) state the corrective actions and the corresponding warning.	(1) (2)	Remember Remember	Fact Procedure
5/4/5	A. List (1) the indications of a pitchlocked propeller and (2) the procedural steps for pitchlocked propeller operation.	(1) (2)	Remember Remember	Fact Procedure
	B. State (1) the RPM and airspeed limitations and (2) the corrective action when these limitations cannot be maintained.	(1) (2)	Remember Remember	Fact Procedure
5/4/6	Given the no beta light on landing indication, (1) name the malfunctions and (2) state the corrective actions.	(1) (2)	Remember Remember	Fact Procedure

Objectives from Naval Flight Officer Course

The Naval Flight Officer (NFO) course consists of the following units organized by phases in the Master Course Syllabus:

A. Unit 1--Aircraft Familiarization

Unit 2--Equipment--Hardware and Operation

Unit 3--Flight Procedures/Weather/Maintenance Logs

B. Unit 4--Survival/Emergency Equipment and Procedures

Unit 5--NAV-1 Flight/NATOPS Review

Unit 6--Oceanography/Submarine Signatures

Unit 7--TAC Hardware and Procedures

Unit 8--Tactics/DRT/LOFAR

C. Unit 9--DIFAR/LOFAR Procedures and Techniques

Unit 10--Radar/ESM/MAD

Unit 11--Active Tactics

Unit 12--Ordnance

Unit 13--2F69 Trainer Device Sessions

Unit 15--Tactics and Tactical Communication

D. Unit 16--2F69 Device Sessions/Emergencies

Unit 17--Submarine Signatures

The objectives selected for the BNFO course come from two lessons, the LTN-72 Inertial Navigation System (Unit 2/Lesson 8) and ASN-124 Tactical Hardware (Unit 7/Lesson 3). Both the LTN-72 and the ASN-124 lessons involve memorization of complex pieces of equipment and associated procedures. Basically this involves memorization of tables detailing components and their functions, power sources, circuit breakers, and locations; the effects of different switch settings, buttons, keyboard inputs, etc; the meaning of display mnemonics and symbology; signal flow; and procedural steps involved in using the equipment.

These lessons are representative of the materials in Phase A, which emphasizes familiarization with equipment and procedures prior to device sessions in the trainers and aircraft. The lessons in Phases B and C are related to tactics and involve some classified materials, so they were not included in the sample.

Table A-5

Summary of Training Objectives Classification

Crew Position: BNFO

Number of Sample Objectives: 84

CONTENT

BEHAVIOR	FACT Recall or recognize Names, Parts, Dates, Places, Etc.	CONCEPT Remember Characteristics, or Classify Objects, Events, or Ideas According to Characteristics	PROCEDURE Sequence of Steps Remembered or Used in a Single Situation or on a Single Piece of Equipment	RULE Remember or Use a Sequence of Steps which Apply Across Situations or Across Equipments
REMEMBER - Recall or Recognize Facts, Concept Definitions, Steps of Procedures or Rules	54	3	25	0
USE - Tasks which require classifying, performing a procedure, using a rule with job aids available or with no aids except memory		0	1	1

Table A-6

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/8/2	A. Given a table of LTN-72 INS components, fill in the function, power source, and component and circuit breaker locations for each.	Remember	Fact
	B. Given a table of the inertial compass system components, fill in the function, power source, and component and circuit breaker locations for each.	Remember	Fact
2/8/3	Given a list of the four INU subcomponents and a scrambled list of their functions, match each function to its correct subcomponent.	Remember	Fact
2/8/4	Given a labeled diagram of the MSU and a list of the corresponding controls/indicators, match each contro/indicator to its function.	Remember	Fact
2/8/5	Given a labeled diagram of the CDU and a list of the corresponding controls/indicators, match each control/indicator to its function.	Remember	Fact
2/8/6	Given a diagram of the CDU display selector switch and a list of the corresponding switch positions, match each switch position to its function.	Remember	Fact
2/8/7	A. State the approximate length of time a fully charged BU will provide operating power to the INS in the event the primary power is lost.	Remember	Fact
	B. State the effect on the INS when the BU falls below usable power level with the INS operating on (1) primary power and (2) the BU.	Remember	Fact
	C. Given a table of the INS power source operation, the CDU and MSU BATT (battery) annunciators, and the CDU INS WARN annunciator, list the appropriate CDU and MSU indications for system operation with each power source.	Remember	Fact
2/8/8	Given a numbered diagram and a table of the inertial compass system controller, fill in the function for each control/indicator.	Remember	Fact

Table A-6 (Continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/8/9	A. State the LTN-72 INS input signal and its use.	Remember	Fact
	B. List the LTN-72 INS output signals and their uses.	Remember	Fact
2/8/10	Given partially labeled signal flow block diagrams for the (1) INS NAV and (2) ATT REF operating modes, indicate the signal flow and use of each mode.	Remember	Fact.
2/8/11	Given partially labeled signal flow block diagrams of the inertial compass system controller for the slave, free and compass operating modes, indicate the signal flow and use of each mode.	Remember	Fact
2/8/12	State the two most probable failures of the INS and list their indications, effects and corrective actions, as applicable for the NAV and ATT REF modes.	Remember	Fact/ Procedure
2/8/13	A. State the use of the LTN-72 INS data sheet.	Remember	Fact
	B. Given an LTN-72 INS data sheet and the necessary information, complete the form.	Use	Procedure
2/8/14	A. Given the procedure for aligning the INS for NAV mode operation, list the steps in proper order.	Remember	Procedure
	B. Given the procedure for entering the aircraft's present position for INS alignment, list the steps in proper order.	Remember	Procedure
	C. State the item required to be recorded in the navigation flight log and on the INS data sheet.	Remember	Fact
2/8/15	A. State the purpose of the INS integrity monitoring and warning capability.	Remember	Fact
	B. State the two annunciator indications of abnormal system operation.	Remember	Fact

Table A-6 (Continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/8/15	C. State the procedure for displaying action/malfunction codes following an abnormal indication.	Remember	Procedure
	D. List the three items that are required to be recorded in the flight log and on the INS data sheet following an abnormal indication.	Remember	Fact
	E. State the corrective action to be taken following an abnormal indication.	Remember	Procedure
2/8/16	A. State the purpose of the selectable Z slew alignment.	Remember	Fact
	B. State when the selectable Z slew alignment should be performed.	Remember	Fact
	C. Given the procedure for performing a selectable Z slew alignment, list the steps in proper order.	Remember	Procedure
2/8/17	A. State when the ATT REF mode is used.	Remember	Fact
	B. Given the procedure for the ATT REF alignment, list the steps in proper order.	Remember	Procedure
2/8/18	A. State the purpose of the manual wind blanking entry.	Remember	Fact
	B. Given the procedure for the manual wind blanking entry, list the steps in proper order.	Remember	Procedure
2/8/19	A. Briefly describe the (1) use and (2) definition of LTN-72 INS waypoints.	Remember	Concept
	B. State the procedure for manually entering waypoint coordinates.	Remember	Procedure
	C. List and briefly describe the two methods of transferring the LTN-72 waypoint coordinates to the ASN-124 waypoint coordinates.	Remember	Procedure
	D. State the precaution regarding the use of LTN-72 waypoint data to the ASN-124.	Remember	Concept
	E. State (1) the use of waypoint zero and (2) the reference for its coordinates.	Remember	Concept

Table A-6 (Continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/8/20	A. State the procedure for selection of initial track.	Remember	Procedure
	B. List and briefly describe the two methods of track leg switching.	Remember	Procedure
2/8/21	A. List the three indications that occur during automatic track leg switching.	Remember	Fact
	B. List the two indications that occur during manual track leg switching.	Remember	Fact
	C. State the procedure for manual track leg change.	Remember	Procedure
2/8/22	State the procedure for a track leg change from the aircraft's present position.	Remember	Procedure
2/8/23	A. List the two methods by which waypoints can be bypassed.	Remember	Procedure
	B. List the two reasons for changing the coordinates of waypoints while in flight.	Remember	Fact
2/8/24	A. State the maximum number of arc minutes the latitude/longitude may be updated per position update.	Remember	Fact
	B. State the procedure for performing a position update.	Remember	Procedure
	C. State the procedure for performing a position check following a position update.	Remember	Procedure
	D. State what occurs in the ASN-124 system when an INS position update is performed.	Remember	Fact
2/8/25	A. State the use of the RMT selection system when the AUTO/MAN/RMT switch is positioned to RMT.	Remember	Fact
	B. List and briefly describe the information that can be obtained when RMT is selected.	Remember	Fact
	C. State how navigation guidance occurs when RMT is selected.	Remember	Fact

Table A-6 (Continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/8/26	A. State the procedure for remote direct ranging between waypoints.	Remember	Procedure
	B. State the procedure for remote ranging along the flight route.	Remember	Procedure
	C. State the procedure for remote direct ranging from the present position.	Remember	Procedure
2/8/27	A. State the purpose of an update flush.	Remember	Fact
	B. State the procedure for performing an update flush.	Remember	Procedure
2/8/28	A. List the four postflight INS data items required to be recorded on the INS data sheet following an update flush.	Rememeber	Procedure
	B. State the procedure for obtaining navigation acuracy data.	Remember	Procedure
	C. List the system error tolerances that radial error rate and ground speed must exceed before an INS discrepancy should be written up for (1) single and (2) consecutive flight performances.	Remember	Fact
2/8/29	A. List the three conditions which must exist for the INS to be left in the NAV mode following a flight.	Remember	Fact
	B. List the three situations which require the INS to be turned off.	Remember	Fact
	C. State the procedure for performing an INS shutdown.	Remember	Procedure
	D. State when the INS will shut down.	Remember	Fact

Table A-6 (Continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
7/3/1	A. List the names and functions of the three main ASN-124 tactical hardware components.	Remember	Fact
	B. State (1) the power source and (2) circuit breaker location for both the TACCO and Pilot ASA-66.	Remember	Fact.
	C. State (1) which components of the ASN-124 tactical hardware compose the ITADS (Integrated Tactical Display System), (2) the power source for the ITADS and (3) the ITADS circuit breaker location.	Remember	Fact
	D. State the function of the ITADS light control panel.	Remember	Fact
7/3/2	Given a diagram of the CI and a table listing several of the CI controls/switches, state the function of each.	Remember	Fact
7/3/3	A. Given a diagram of the CI, state the function(s) of the gram/ trace display windows.	Remember	Fact
	B. Given a diagram of the CI, and the sonobuoy (RF) channel numbers and types, properly interpret the displayed information.	Use	Rule
7/3/4	Given a diagram of the CI and a table listing several of the CI pushbutton switches, state the results of pushing each.	Remember	Fact
7/3/5	Given a diagram of the CI and a table listing several of the CI switches/indicators, state the function(s) of each.	Remember	Fact
7/3/6	Given a diagram of the TDC tray and a list of several TDC switches/ indicators, state the function of each.	Remember	Fact
7/3/7	Given a diagram of the TDC tray and a list of several TDC switches, state the function(s) of each.	Remember	Fact

Table A-6 (continued)

Sample of Training Objectives

Crew Position: BNFO

Number of Sample Objectives: 84

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
7/3/8	Given a diagram of the TDC tray and a list of several TDC switches, state the function of each.	Remember	Fact
7/3/9	Given a diagram of the TDC tray and a list of several TDC controls/ indicators, state the function(s) of each.	Remember	Fact
7/3/10	Given a diagram of the TDC tray and a list of several TDC switches/ indicators, state the functions of each.	Remember	Fact
7/3/11	Given a diagram of the TDC tray and a list of several TDC switches, state the function(s) of each.	Remember	Fact
7/3/12	Given a diagram of the TDC tray and a list of several TDC switches, state the function(s) of each.	Remember	Fact
7/3/13	Given a diagram of the TDC tray and a list of several switches, state the function(s) of each.	Remember	Fact
7/3/14	Given a diagram of the ASA-66 and a list of several ASA-66 controls/switches, state the function of each.	Remember	Fact
7/3/15	Given a list of symbols that may appear on the ASA-66, state the meaning of each.	Remember	Fact

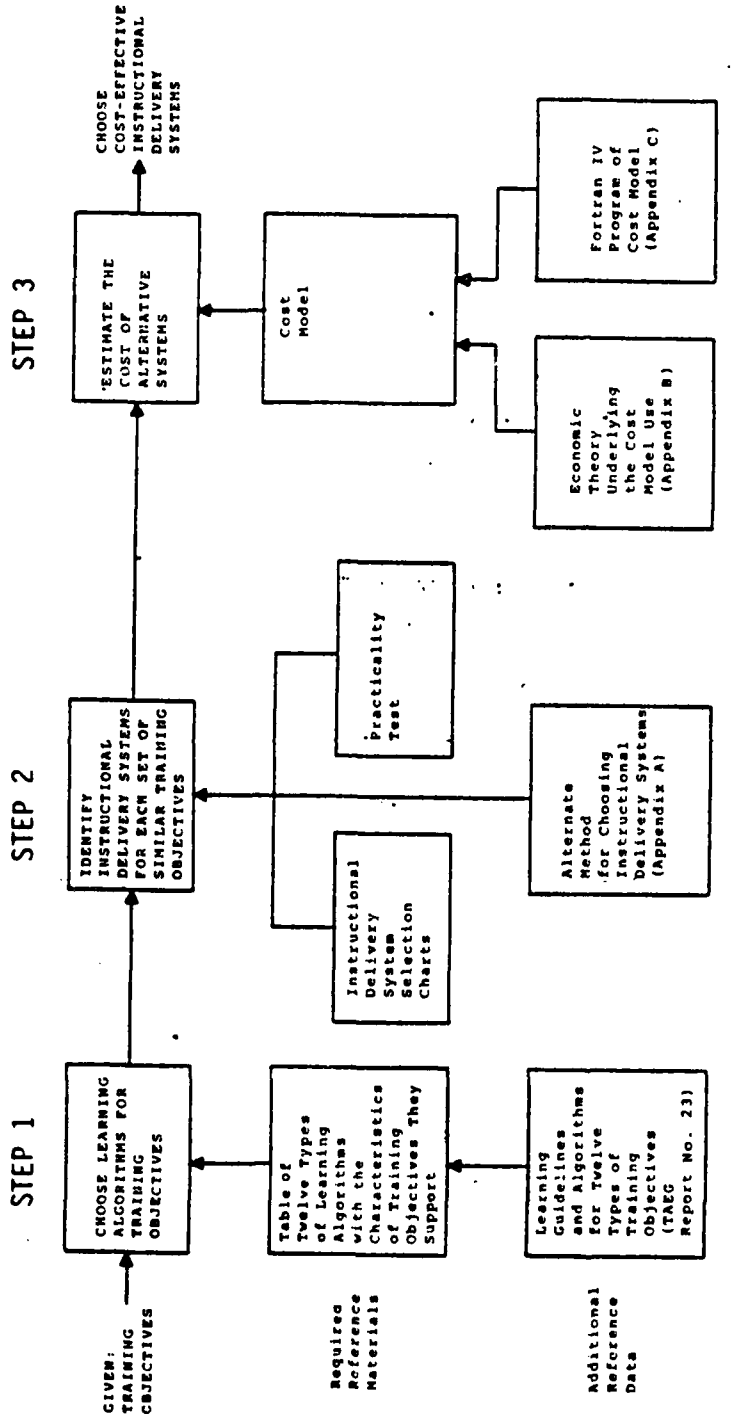

Figure B-1. TECEP Media Selection Process

MEDIA SELECTION METHODOLOGIES

aining Effectiveness and Cost Effectiveness Prediction (TECEP) Technique

The TECEP technique (Braby, Henry, Parrish, & Swope, 1975) was developed by the aining Analysis and Evaluation Group (TAEG) to provide learning principles appropriate Navy job tasks and a method for selecting cost-effective instructional delivery systems at support the use of these learning principles. Aagard and Braby (1976) state that the ECEP technique uses learning guidelines, based in part on those used by Willis and eterson (1961) and Gagne (1965), and learning algorithms developed to combine and quence the guidelines. As defined by Braby et al. (1975), "a learning algorithm is a step-/-step prescription for a student to follow in learning any specific task in a class of arning tasks. . ."

The TECEP technique was designed as a three-step job aid to be used by training stem designers in the media selection process. Figure B-1, taken from TAEG Report o. 16, provides a detailed picture of the three steps in the process. However, only Steps and 2 are described herein since Step 3, cost considerations, was beyond the scope of is study. A discussion of modifications to enhance NAVAIR use of the TECEP technique also provided.

Step 1

The initial step is to classify and group the training objectives according to the type f learning algorithm required to accomplish the objective. This involves matching each aining objective in a proposed training system with the name of the learning algorithm ppropriate for achieving the objective. The learning guidelines and associated algorithms re defined as follows:

1. Recalling bodies of knowledge.
2. Using verbal information.
3. Rule learning and using.
4. Decision making.
5. Detecting.
6. Classifying.
7. Identifying symbols.
8. Voice communicating.
9. Recalling procedures and positioning movement.
10. Steering and guiding, continuous movement.
11. Performing gross motor skills.
12. Attitude learning.

As shown in Figure B-1, Step 1 requires using a table describing the 12 types of earning algorithms and the characteristics of the training objectives that they support. igure B-2, taken from TAEG Report No. 16, is an example of the table used. The haracteristics of the training objective are compared with the action verbs, behavioral ttributes, and examples of objectives that can be achieved with the algorithm to verify he classification. Training objectives that are classified alike are grouped into sets for nalysis in Step 2.

Step 2

The second step is to identify the instructional delivery systems that will support the se of the learning algorithm required for each set of training objectives. As shown in

APPENDIX B

MEDIA SELECTION METHODOLOGIES

Table A-10 (Continued)

Sample of Training Objectives

Crew Position: C SS3

Number of Sample Objectives: 34

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
3/13/4	Using figures of off-line RADAR displays with range rings, determine the contact's range.	Use	Rule
3/13/5	A. Using a diagram of a north stabilized off-line RADAR display, determine the contact's true bearing.	Use	Rule.
	B. Using a diagram of a heading stabilized off-line RADAR display, determine the contact's relative bearing.	Use	Rule
3/13/6	State the procedures for performing off-line RADAR run-ins.	Remember	Procedure

Table A-10 (Continued)

Sample of Training Objectives

Crew Position: C SS3 Number of Sample Objectives: 34

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
3/9/5	A. State the functions of the CLEAR POINT DATA, DIS CLRD DATA, SKIP and AMPLIFY keys.	Remember	Fact
	B. State the limitations for displaying RADAR contacts tracks and reference marks.	Remember	Concept
3/9/6	State the procedure for point-fixing.	Remember	Procedure
3/10/1	A. State the procedure for performing a surface plot.	Remember	Procedure
	B. State the procedure for obtaining a RADAR track.	Remember	Procedure
	C. State the procedure for determining contact speed.	Remember	Procedure
	D. State the procedure for determining contact course.	Remember	Procedure
3/10/2	A. State the procedure for performing an intercept run-in.	Remember	Procedure
	B. State the procedure for performing a port-side, off-set run-in.	Remember	Procedure
3/10/3	State the procedure for verifying an area is clear for buoy drops.	Remember	Procedure
3/13/1	A. State the two circumstances for using off-line RADAR operation.	Remember	Fact
	B. State the three indications requiring off-line RADAR operation.	Remember	Fact
	C. State the correct position of each control used for off-line RADAR initialization.	Remember	Fact
	D. State the limitations of off-line RADAR operation.	Remember	Concept ?
3/13/2	A. State the procedure for selecting off-line RADAR display scales.	Remember	Procedure
	B. State the procedures for displaying RADAR range rings.	Remember	Procedure
3/13/3	State the number of rings and the distance between rings for each of the five display scales.	Remember	Fact

Table A-10

Sample of Training Objectives

Crew Position: C SS3 Number of Sample Objectives: 34

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
3/2/1	List the six ICS components located at SS-3.	Remember	Fact
3/2/2	State the functions of the controls/selections on the SS-3 ICS control box.	Remember	Fact
3/2/3	State the procedure for using the ICS.	Remember	Procedure
3/8/1	Given RADAR scope display, recognize landmass, surface contacts, weather and airborne contacts.	Remember	Concept
3/9/1	A. Given a geographical position by latitude and longitude, locate the position on a chart.	Use	Rule
	B. Given a position on a chart, determine its latitude and longitude.	Use	Rule
3/9/2	A. Given a geographical point on a chart, determine its range from a given reference point.	Use	Rule
	B. Given a geographical point on a chart, determine its bearing from a given reference point.	Use	Rule
	C. Given the range and bearing from a reference point, determine the geographical position on the indicated point.	Use	Rule
3/9/3	A. Given a diagram of the RADAR matrix readout keys, state the functions of the keys pertaining to RADAR navigation.	Remember	Fact
	B. Given a diagram of the track matrix readout keys, state the functions of the keys pertaining to RADAR navigation.	Remember	Fact
3/9/4	Given a diagram of the numeric readout keys, state the functions of the keys pertaining to communication with the computer.	Remember	Fact

Table A-9

Summary of Training Objectives Classification

Crew Position: C SS3

Number of Sample Objectives: 34

BEHAVIOR	CONTENT: FACT Recall or recognize Names, Parts, Dates, Places, Etc.	CONCEPT Remember Characteristics, or Classify Objects, Events, or Ideas According to Characteristics	PROCEDURE Sequence of Steps Remembered or Used in a Single Situation or on a Single Piece of Equipment	RULE Remember or Use a Sequence of Steps which Apply Across Situations or Across Equipments
REMEMBER - Recall or Recognize Facts, Concept Definitions, Steps of Procedures or Rules	10	3	13	0
USE - Tasks which require classifying, performing a procedure, using a rule with job aids available or with no aids except memory		0	0	8

Objectives from Sensor Station Operator 3 Course

The Sensor Station Operator 3 (C.SS 3) course consists of the following units organized by phases in the Master Course Syllabus:

B. Unit 1--Aircraft Familiarization

Unit 2--Data Processing System

Unit 3--Radar/IFF

C. Unit 4--Emergency Equipment

Unit 5--MAD

Unit 6--ESM

D. Unit 7--Tactics

Objectives from five lessons in Unit 3, ICS components and voice procedures, scope interpretation, radar operations--parts 1 and 2, and radar off-line operation, were selected as representative of the tasks taught in the SS 3 course.

Table A-8 (Continued)

Sample of Training Objectives

Crew Position: C SS1/2

Number of Sample Objectives: 43

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
8/5/1	List the three steps in the BT-buoy-monitoring equipment setup.	Remember	Procedure
8/5/2	A. State the formula for computing temperature.	Remember	Rule
	B. Given any frequency being received from BT buoy, use the BT formula and the stated procedure to compute the associated temperature.	Use	Rule
8/5/3	List the four steps to determine layer depth and sea surface temperature.	Remember	Rule
8/5/4	A. List the BT information (1) given to the TACCO and (2) annotated on the gram.	Remember	Concept
	B. Given a gram showing a BT trace and an overlay, properly analyze the gram for depth and temperature.	Use	Rule

Table A-8 (Continued)

Sample of Training Objectives

Crew Position: C SS1/2 Number of Sample Objectives: 43

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
7/6/1	Provide the required information on how the BITE system is used in determining the probable cause of malfunctions.	Remember	Procedure
7/6/2	State the six steps in the procedure for using the CSMM for troubleshooting.	Remember	Procedure
7/6/3	Given the CSMM Sono System BITE table, answer questions regarding that table.	Remember	Fact
7/6/5	Given the CSMM DIFAR BITE Pattern table, answer questions regarding that table.	Remember	Fact
8/1/1	Given a scenario requiring SETAD transmission and an illustration of the SETAD converter control panel, indicate the proper equipment settings for transmission of acoustic data.	Remember	Procedure
8/1/2	A. Given a simulated gram showing the first 15 seconds of the TONE ID codes and a TONE ID job aid, determine the (1) CODER, (2) CLK RATE and (3) FILTER switch/indicator settings required to properly receive SETAD information.	Use	Procedure
	B. Given a simulated gram showing the second 15 seconds of the TONE ID codes and a TONE ID job aid, determine the required BANDSHIFTER setting to properly receive SETAD information.	Use	Procedure
8/1/3	Given a scenario for receiving SETAD and the illustration of the converter control panel, indicate the proper equipment settings required for receiving acoustic data.	Remember	Procedure
8/1/4	Given a scenario requiring the looping of acoustic information and an illustration of the SETAD converter control panel, state the proper equipment settings for looping acoustic data.	Remember	Procedure
8/1/5	State the gram annotation requirements for SETAD when using the (1) receive, (2) transmit and (3) loop modes.	Remember	Concept

Table A-8 (Continued)

Sample of Training Objectives

Crew Position: C SS1/2

Number of Sample Objectives: 43

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
4/4/4	List (1) the two drive modes mainly utilized by Soviet type 1 diesel submarines, and (2) their operating mode combinations.	Remember	Fact
4/4/5	List the three main auxiliaries detected with Soviet type 1 diesel submarines and their associated ratios to the engine crankshaft.	Remember	Fact
4/4/6	State the four distinctive signature characteristics for the Soviet type 1 diesel submarine.	Remember	Concept
4/4/7	Given multipoint dividers, frequency scales and LOFAR grams with calibration marks, classify signatures of Soviet type 1 diesel submarines.	Use	Rule
4/4/8	Given the HP-67 calculator, the Fleet Mission Program Library VP Inflight manual and VP program cards, analyze signatures for Soviet type 1 diesel submarines.	Use	Rule
5/4/1	Given a list of initialization or procedural steps for station lighting checks, and a CSMM, state the purpose of each step.	Remember	Procedure
5/4/2	Given a list of initialization or procedural steps for the AN/AQA-7 (V) 1 preflight, and a CSMM, state the purpose for these steps.	Remember	Fact
5/4/3	Given the CSMM, provide the required information regarding the Preflight Checklist.	Remember	Procedure
6/3/1	A. State the definition of comparative LOFAR fixing.	Remember	Concept
	B. State the requirement for its use.	Remember	Fact
6/3/2	Given various gram signatures, and a list of strength values and their characteristics, determine the signal strength values of the signatures.	Use	Rule
6/3/3	List the steps of the procedure for performing a CLF.	Remember	Procedure
6/3/4	Given the actions performed with each switch/indicator during the entering of comparative LOFAR readings into the computer, state the associated indications.	Remember	Procedure

Table A-8

Sample of Training Objectives

Crew Position: C SS1/2 Number of Sample Objectives: 43

Unit/Lesson/Segment	Training Objective	Classification	
		Behavior	Content
2/3/1	A. List the indicators represented by dark, green or amber light conditions for the AQA-7.	Remember	Fact
	B. Given a drawing of the SDR (Signal Data Recorder) and its controls, list the function of each master control/indicator.	Remember	Fact
2/3/2	Given a drawing of the SDR and its controls, list the function of each gram control/indicator.	Remember	Fact
2/3/3	Given a drawing of the BFC (Bearing Frequency Control) panel and its controls, list the function of each control/indicator.	Remember	Fact
2/3/4	Given a drawing of the BFI (Bearing Frequency Indicator) and its controls/indicators, list the functions of each.	Remember	Fact
2/3/5	A. Given a drawing of the SDR and its controls, list the seven controls on the SDR that affect the BFI.	Remember	Fact
	B. Given the BFI display modes, list the SDR controls affecting them.	Remember	Fact
2/3/6	Given drawings of the DL control, state the function of each.	Remember	Fact
3/1/1	Given LOFAR grams, identify each primary harmonic family by the use of visual cues.	Use	Rule
3/1/2	Given a set of multipoint dividers and LOFAR grams with calibration marks, mechanically group and label the harmonic family.	Use	Rule
3/1/3	Given a set of multipoint dividers and LOFAR grams with calibration marks, group and label the primary and secondary harmonic families.	Use	Rule
4/4/1	List the blade parameters for the Soviet type 1 diesel submarine.	Remember	Fact
4/4/2	List the engine parameters for the Soviet type 1 diesel submarine.	Remember	Fact
4/4/3	State the classes of Soviet type 1 diesel submarines by the number of engines and shafts.	Remember	Fact

Table A-7

Summary of Training Objectives Classification

Crew Position: C SS 1/2

Number of Sample Objectives: 43

CONTENT

BEHAVIOR	FACT Recall or recognize Names, Parts, Dates, Places, Etc.	CONCEPT Remember Characteristics, or Classify Objects, Events, or Ideas According to Characteristics	PROCEDURE Sequence of Steps Remembered or Used in a Single Situation or on a Single Piece of Equipment	RULE Remember or Use a Sequence of Steps which Apply Across Situations or Across Equipments
REMEMBER - Recall or Recognize Facts, Concept Definitions, Steps of Procedures or Rules	17	4	10	2
USE - Tasks which require classifying, performing a procedure, using a rule with job aids available or with no aids except memory		0	2	8

Objectives from Sensor Station Operator 1/2 Course

The Sensor Station Operator 1/2 (C SS 1/2) course consists of the following units organized by phases in the Master Course Syllabus:

A. Unit 1--Aircraft Familiarization

Unit 2--AQA-7 DIFAR System Controls

B. Unit 3--Harmonic Families

Unit 4--Surface Vessel Classification

Unit 5--Associated Equipment and Function

C. Unit 6--Classification, Detection, Localization

Unit 7--Equipment Malfunctions

Unit 8--Analysis and Monitoring

D. Unit 9--Tactics

The representative sample of objectives for the SS 1/2 course includes lessons from each unit in Phases A, B, and C. Units 2, 5, and 7 focus on equipment function, procedures, malfunction identification, and preflights through the use of workbooks, videotapes, and aircraft device sessions. Units 3, 4, and 6 focus on gram analysis procedures.

TABLE 2. TWELVE TYPES OF LEARNING ALGORITHMS WITH THE CHARACTERISTICS OF TRAINING OBJECTIVES THEY SUPPORT
(See TAEG Report 23 for actual algorithms)

NAMES OF LEARNING ALGORITHMS	CHARACTERISTICS OF TRAINING OBJECTIVES THAT CAN BE ACHIEVED WITH SPECIFIC ALGORITHMS		
	ACTION VERBS	BEHAVIORAL ATTRIBUTES	EXAMPLES
1. RECALLING BODIES OF KNOWLEDGE	Answer Define Express Inform Select	1. Concerns verbal or symbolic learning. 2. Concerns acquisition and long-term maintenance of knowledge so that it can be recalled.	1. Recalling equipment nomenclature or functions. 2. Recalling system functions, such as the complex relations between system input and output. 3. Recalling physical laws, such as Ohm's law. 4. Recalling specific radio frequencies and other discrete facts.
2. USING VERBAL INFORMATION	Apply Arrange Choose Compare Determine	1. Concerns the practical application of information. 2. Generally follows the initial learning of information through the use of the guidelines for Recalling Bodies of Knowledge. 3. Limited uncertainty of outcome. 4. Usually little thought of other alternatives.	1. Based on academic knowledge, determine which equipment to use for a specific real world task. 2. Based on an academic knowledge of the system, compare alternative modes of operation of a piece of equipment and determine the appropriate mode for a specific real world situation. 3. Based on memorized knowledge of radio frequencies, choose the correct frequency in a specific real world situation.
3. RULE LEARNING AND USING	Choose Conclude Deduce Predict Propose Select Specify	1. Choosing a course of action based on applying known rules. 2. Frequently involves "If...Then" situations. 3. The rules are not questioned, the decision focuses on whether the correct rule is being applied.	1. Apply the "rules of the road." 2. Solve mathematical equations (both choosing correct equation and the mechanics of solving the equation). 3. Carrying out military protocol. 4. Selection of proper fire extinguisher for different type fires. 5. Using correct grammar in novel situations, covered by rules.
4. MAKING DECISIONS	Choose Design Diagnose Develop Evaluate Forecast Formulate Organize Select	1. Choosing a course of action when alternatives are unspecified or unknown. 2. A successful course of action is not readily apparent. 3. The penalties for unsuccessful courses of action are not readily apparent. 4. The relative value of possible decisions must be considered - including possible trade-offs. 5. Frequently involves forced decisions made in a short period of time with soft information.	1. Choosing frequencies to search in an ECM search plan. 2. Choosing torpedo settings during a torpedo attack. 3. Threat evaluation and weapon assignment. 4. Choice of tactics in combat - wide range of options. 5. Choosing a diagnostic strategy in dealing with a malfunction in a complex piece of equipment. 6. Choosing to abort or commit oneself to land upon reaching the critical point in the glidepath.

Figure B-2. Example of TECEP Learning Algorithms

Figure B-1, Step 2 consists of two substeps--identification of instructional delivery systems and practicality tests--with two alternatives provided for accomplishing the first substep.

In the first substep, the instructional delivery systems with the stimulus, response, and feedback capabilities required to support the events in the learning algorithm are identified. Instructional delivery system selection charts were developed for each of the 12 learning algorithms to serve as job aids for training system designers to complete this task. As shown in the example in Figure B-3, a comprehensive list of instructional delivery systems is provided across the top of the chart, while special selection criteria are listed on the side with an "X" placed in the cells of systems that meet the special criteria. The training system designer can easily identify candidate instructional delivery systems by specifying the relevant selection criteria on the left side and looking for "Xs" in those rows.

An alternate approach to this substep is provided to allow experienced training system designers to consider instructional delivery systems not included in the charts. Two job aids are provided: (1) a list of 55 generic media characteristics that includes stimulus, response, and feedback and (2) a list describing 89 general types of instructional media that can be incorporated into instructional delivery systems. Examples from each list are provided in Figures B-4 and B-5 respectively. From these, the generic media characteristics required to implement the learning algorithms can be specified and the media containing these characteristics can be identified. This approach requires expert knowledge of media, the learning algorithms, and the subject matter.

The second substep is testing the candidate instructional delivery systems for practicality. Each delivery system should be evaluated in terms of the following 11 criteria so the impractical delivery system candidates are eliminated before the costing exercise in Step 3.

1. Marginal technical solution.
2. State-of-the-art system.
3. Size of the system.
4. Interface with existing programs.
5. Long lead time to produce the system.
6. Budget cycle constraints.
7. User acceptance of innovations.
8. Resources for courseware development.
9. High cost system alternative.
10. Learning style of trainees.
11. Any other applicable constraints.

Enhancements

The use of training tasks and training stages provides a method to identify the learning algorithms required to support the training when training objectives are not available at the time media selection decisions must be made. Figure B-6, taken from TAEG Report No. 1, is an example of this method. To test the feasibility of the TECEP model, it was applied to the TA-4 aircraft training program (Braby, Micheli, Morris, & Okraski, 1972). As shown in Figure B-6, the stages of training for each task and specific tasks within each stage of training were matched with primary task categories, which roughly correspond to the learning algorithms currently used in Step 1.

TABLE 3. INSTRUCTIONAL DELIVERY SYSTEM CHART FOR THE ALGORITHM

RECALLING BODIES OF KNOWLEDGE

Directions:

To choose a delivery system:

1. Place a "✓" (light pencil) in boxes representing criteria (rows) that must be met.

2. Select the delivery systems (columns) that have an "X" in each row designated by a "✓". These are the candidate delivery systems.

Criteria for Selecting Instructional Delivery Systems

	Alternative Instructional Delivery Systems								
	Delivery Approaches Permitting the Application of All Learning Guidelines and Algorithm					Delivery Approaches NOT Permitting Complete Application of Learning Guidelines and Algorithm			
	CAI	Teaching Machine - Branching	Microfiche with Self-Scoring Tests	Programmed Text - Branching with Self-Scoring Tests	Audio Visual Carrel with Program Texts, AV Modules and Self-Scoring Tests	Traditional Classroom with Instructor, Overhead Projector, Texts, and Paper and Pencil Tests	Independent Study Using Textbooks, Handbooks, Tests and Workbooks	Instructional Television Broadcast or CCTV Without Feedback, Tests	Programmed Text - Linear with Instructor Scored Criterion Test
Stimulus Criteria									
● Visual Movement									
Limited	X	X			X			X	
Full	X				X			X	
● Visual Spectrum									
Full Color	X	X	X		X	X	X	X	
● Audio									
Voice Sound Range	X	X			X	X		X	
Full Sound Range					X				
Training Setting Criteria									
● Individual Trainees at Fixed Location	X	X	X	X	X	X		X	X
● Individual Trainees with Simultaneous Instruction at Many Locations								X	
● Individual Trainees with Independent Instruction at Any Location			X	X			X		X
● Small Group						X		X	
● Large Group at a Single Location						X		X	
● Team Setting									
Administrative Criteria									
● Site of Courseware and Special Hardware Development									
Local			X	X	X	X	X		X
Central	X	X	X	X	X		X	X	X
● Magnitude of Acquisition Cost									
Low			X	X		X	X		X
High	X	X			X			X	

Figure B-3. Example of TECEP Instructional Delivery System Selection Chart

TABLE 15. GENERIC CHARACTERISTICS OF TRAINING MEDIA

STIMULUS CAPABILITIES

Visual Form

1. Visual Alphanumeric - words, numbers and other symbols presented graphically.
2. Visual Pictorial, Plane - a two-dimensional image, a representation in the form of a photograph or drawing.
3. Visual Line Construction, Plane - a two-dimensional figure made of lines, such as a mathematical curve or graph.
4. Visual Object, Solid - a three-dimensional image or reality that is viewed from exterior perspectives.
5. Visual Environment - A three-dimensional image or reality that is viewed from inside.

Visual Movement

6. Visual Still - a static visual field, as with a still photograph, drawing, or printed page.
7. Visual Limited Movement - a basically static visual field with elements that can be made to move, as with an animated transparency or simple panel with switches that move.
8. Visual Full Movement - a visual field in which all elements can move, as with a motion picture, flight simulator, or operational aircraft.
9. Visual Cyclic Movement - a visual field which moves through a fixed sequence and then repeats the sequence in a repetitive manner, as with a film loop.

Visual Spectrum

10. Black and White - a visual field composed of either black or white elements, as with the printed page or line drawings.
11. Gray Scale - a visual field composed of black, white and continuous gradations of gray, as with a black and white photograph or television picture.
12. Color - a visual field composed of various segments of the visual spectrum, as with color television or motion pictures.

Scale

13. Exact Scale - actual visual field or a one-to-one replication of that field as with a full-sized mock-up, simulator, or operational system.
14. Proportional Scale - a representation of reality in other than full scale, such as a scaled model map or photograph.

Audio

15. Voice Sound Range - a limited quality of sound which enables spoken words to be used as the medium of communications, but not suited to more demanding tasks, such as music or sound recognition exercises.
16. Full Sound Range - a quality of sound reproduction that contains all the significant elements of the sound and is suited to the demanding task of sound recognition exercises.
17. Ambient Sounds - a complex sound environment with sounds emanating from various sources and from various directions, including background noise and task significant sounds.

Other

18. Tactile Cues - signals received through the sense of touch, including sensations related to texture, size or shape.
19. Internal Stimulus Motion Cues - the sensations felt by a person when he moves his arm, leg, fingers, etc.
20. External Stimulus Motion Cues - the sensations felt by a person when he is moved by some outside force in such a way that his body experiences roll, pitch, yaw, heave, sway and/or surge.

TRAINEE RESPONSE MODES

21. Covert Response - a response which the trainee creates in his mind but does not express in an observable manner.
22. Multiple Choice - a response mode in which a trainee selects a response from a limited set of responses.
23. Pre-programmed Verbal Performance - a response mode in which a trainee creates a short answer to a question having a limited set of correct answers.
24. Free-Style Written Performance - a response mode in which a trainee writes a response in his own words.
25. Decision Indicator - a verbal or perceptual motor response in which the trainee indicates that he has made a divergent type decision.
26. Voice Performance - a response mode in which a trainee speaks, including conversation.
27. Fine Movement Manipulative Acts - a response mode in which a trainee makes discrete and small movements of dials, switches, keys or makes sensitive adjustments to instruments. Act may involve use of small instruments.
28. Broad Movement Manipulative Acts - a response mode in which a trainee makes large movements of levers or wheels on large pieces of equipment or by the use of hand held tools.
29. Tracking - a response mode in which a trainee continuously controls a constantly changing system, such as steering an automobile or holding a compass bearing in steering a ship.
30. Procedural Manipulative Acts - a response mode in which a trainee performs the sequence of steps in a procedure, such as in the carrying out of the items on the checklist for pre-flighting an aircraft or turning on a radar system.

Figure B-4. Example of TECEP Generic Media Characteristics

TABLE 16. MEDIA POOL

PRINT MATERIALS

CASE STUDY FOLDER - A folder of detailed background information on a problem requiring a decision or plan of action; to be read by the trainee prior to his (1) making a decision on how to resolve the issue and (2) participating in a critique on various solutions. Various forms of folders are used in support of such methods of instruction as the Case Study, Incident and In-Basket methods of management and leadership training.

FLASH CARDS - A set of cards designed to be used by an instructor in front of a group of trainees to drill the group in the recall of memory type information.

PRINTED MATERIALS - HANDOUTS - Handouts are a class of printed materials issued to a student for his use and retention to augment regular instructional materials. They are usually instructor prepared, machine copied materials of one or two pages highlighting specific topics or updating existing materials.

PRINTED MATERIALS - PERFORMANCE AIDS - Performance aids are a class of printed materials that aid in job performance by providing data that should not be committed to memory. They include checklist routines, conversion tables, equipment test tolerance matrices and the like.

PRINTED MATERIALS - REFERENCE BOOKS - Reference books are a class of printed materials used to identify certain facts or for background information such as dictionaries, encyclopedias or technical publications.

PRINTED MATERIALS - REFERENCE CHARTS - Reference charts are a class of printed material pictorially displaying data used to identify certain facts or for background information. Included are data charts, schematic diagrams, topographical maps and the like.

PRINTED MATERIALS - SELF-SCORING EXERCISES - Self-scoring materials include exercises and quizzes used in conjunction with standard curriculum, or programmed instruction. The class includes electrographic or mark sense materials scored by keys or computer, punch mark and other mechanical score indicating equipments, chemically scored materials, etc., that have the capability of providing near immediate student feedback without the use of prolonged scoring procedures.

Figure B-5. Example of TECEP Media Pool

Table 2

Categorization of Tasks in the Familiarization Stage in the TA-4J Advanced Jet Navy Undergraduate Pilot Training Program.

Stage	Tasks Within Stage	Primary Task Categories
Familiarization	Cockpit Procedures	Recalling Procedures Non-Verbal Identification Positioning & Serial Movement
	Preflight Inspection	Recalling Procedures Non-Verbal Identification Making Decisions
	Normal Operating Procedures	Recalling Procedures Non-Verbal Identification Continuous Movement Positioning and Serial Movement
	Nosewheel Steering and Taxi Procedures	Recalling Procedures Non-Verbal Identification Continuous Movement Oral Verbalization
	Take-Off/Climb/Level Off	Recalling Procedures Non-Verbal Identification Continuous Movement Positioning and Serial Movement Oral Verbalization
	Aerobatics	Recalling Procedures Non-Verbal Identification Continuous Movement
	Landing	Recalling Procedures Non-Verbal Identification Continuous Movement Positioning and Serial Movement Oral Verbalization

Figure B-6. Example of Using Training Stage and Training Tasks

Figure B-7, taken from TAEG Report No. 1, illustrates the format for the media selection matrices developed for each primary task category. The matrix shows a direct relationship between the characteristics of the task, the learning guidelines, the implications for media selections, and the media options available from the pool. These matrices, with modifications to ensure they are accurate and aviation training specific, may be more useful in identifying media candidates than the job aids provided in Step 2.

Automated Instructional Media Selection (AIMs) Model

The AIMs Model was developed by Instructional Science and Development, Inc. under contract N61339-79-C-0104 to the Navy Training Equipment Center. The model was designed and implemented as part of an automated system to facilitate the instructional systems development (ISD) process, although it is fully capable of operating in a stand-alone mode. The AIMS model provides rapid access to a media pool containing up to 99 media and 99 instructional attributes. The media pool is completely user-definable. Media pools are changeable and updatable. All functions of the system allow the user total access to all capabilities without the need for computer science or programming expertise.

Operation

As stated by Simpson and Kribs (1980), the most unique feature of the AIMS model is that the user can begin by using either a predetermined media pool or by creating an entirely new pool. Creation of a media pool is a three-step process. The first step is to determine the media to be considered. The user should make a list of all the media, or combinations of media, to be included in the pool. It is advisable to allow for a wide range of alternatives. If need be, the pool can easily be narrowed if a shorter version is desired for a given project. Figure B-8 shows a sample media listing that includes both cognitive and hands-on type media.

The second step is to determine the instructional characteristics, or "attributes," that can be a difficult task. Figure B-9 presents a sample list of attributes. Note how the attributes are clustered into groups of similar characteristics: (1) display characteristics, (2) response mode, (3) evaluation mode, (4) feedback, and (5) special requirements. Breaking the attributes into small categories like this simplifies the task of creating the media pool and helps make the table itself a bit more legible.

The third step is to cross-reference media and their attributes. For each medium listed, it is necessary to weight its ability to deliver each instructional characteristic. The weighting is made with a single number between 0 and 5. A "0" weighting indicates that the medium is not capable of delivering an instructional attribute. A "5" indicates that the medium is very capable of handling a particular characteristic. Note in Figure B-10 that the medium "audio-tape" is ranked "5" under the attribute "audio-voice," indicating the strong relationship between the two. "Workbook," of course, is ranked "0" under the audio-voice capability, since it is not able to deliver this characteristic.

Once the media pool has been created, it is entered into the computer as a data base. The AIMS system provides programs to allow easy entering of these data. After that task is complete, the user creates selection worksheets for matching instructional characteristics to objectives. The system provides for automatic generation of such a worksheet. The worksheet, of course, is directly tailored to the media pool from which it was created. Figure B-11 is a sample selection worksheet produced by the computer. The instructional designers/developers use the worksheets to indicate the instructional characteristics required for effective and efficient delivery of instruction. Since this is a

Sample Page from Media Selection Matrix

NON-VERBAL DETECTION

TASK CATEGORIES	TASK ELEMENTS	LEARNING GUIDELINES	IMPLICATIONS FOR MEDIA SELECTION	MEDIA OPTIONS: CCTV w/of	PI(L)	PI(B)	SRS(T/S)	SRS(AV)	PIA	CAI/MM	LCD(AV)	VTR	LECT/TEXT	PA	CARREL/MOCKUP	SIM	SIM/AA	PROC TNR	PROC TNR AA	M PROC TNR	C GAMING	OP/SYS	OP/SYS & SIM
a. Common behavior attributes: 1. Vigilance - detect a few cues embedded in a large block of time. 2. Low threshold detections - early detection of very small cues. 3. Scan for wide range of possible cues. b. Common Examples: 1. Detect targets in background noise on radar/ sonar scopes. 2. Visually detect submarine periscope at sea (snorkeling) 3. Detect status and change in status of an operating system - a bearing starting to burn out. 4. Instrument scanning in an aircraft cockpit.	Stimulus	Transfer increased as the difference between reference and generalization stimulus decreases.	Provide signal-to-noise ratios required in the operational setting.													F	F					F	F
		Decrease signal to noise ratio as student achieves success at a given difficulty level.	Control over signal-to-noise ratio													F	F	F	F				F
			Logic for adjusting signal-to-noise ratio													M	F	M	F				M
	Response	To enable reinforcement of performance, the student, upon detecting a signal should respond so that what is detected, and time of detection can be recorded.	(While response is in-the-head, overt action is required) Record and evaluate student performance in detecting signals.													M	F	M	F			M	M
	Feedback	Feedback omission schedule programmed according to stage of training: high feedback during initial stages, decreased to equivalent to operational setting or lower. 2	Logic for adjusting feedback schedule													M	F	M	F			M	M
			Provide feedback, as per logic, in terms of a description of student performance/criterion performance.													M	F	M	F			M	M
	Personal Environment	Vigilance training through extended duration practice with provisions to overcome fatigue & boredom. 3	Capability for extended duration practice (one complete watch). Control over number of targets to be presented.													F	F	F	F			F	F
		NOTE: "M" medium enables instructor or student to manually carry out the intent of the guideline.	NOTE: "F" medium automatically facilitates the application of the guideline.																				

Figure B-7. Sample Page from Media Selection Matrix

MEDIA LISTED ON THE FILE : pool

1. CAI
2. Random Access Slides
3. Motion Picture/ Videotape
4. Slides/Audio
5. Audio/Tape
6. Slides
7. Lecture
8. Demonstration
9. Group Discussion
10. Workbook
11. Teaching Machine
12. OP. Equip./OP. Environment
13. OP. Equip./Lab
14. Team Trainer
15. Procedural Trainer
16. Part Task Trainer
17. 3-D Mock-up
18. 2-D Mock-up
19. TICCIT + Videodisc
20. PLATO + Videodisc
21. GETS
22. Besseler Cue-See

Figure B-8. A sample media listing.

ATTRIBUTES LISTED ON THE FILE : pool

* I. DISPLAY CHARACTERISTICS
1. Audio (voice)
2. Audio (ambient)
3. Tactile cues
4. Kinesthetic cues
5. Verbal/text
6. Pictorial
7. Drawings/diagrams
8. Motion
9. Color
* II. RESPONSE MODE
10. Verbal/written
11. Point-touch-mark
12. Manipulate
13. Multiple choice
* III. EVALUATION
14. Instructor
15. Automated
16. Peer
17. Intrinsic
* IV. FEEDBACK
18. Immediate response
19. Immediate error
20. Periodic
21. Post session
* SPECIAL REQUIREMENTS
22. Crew/team interaction
23. Environmental condition
24. Physical motion
25. Time variability

Figure B-9. A sample listing of instructional characteristics.

Attributes ➔ / Media ▼	Display Characteristics	1. Audio (voice)	2. Audio (ambient)	3. Tactile	4. Kinesthetic	5. Verbal/TEXT	6. Pictorial	7. Diagrams/Drawings	8. Motion	9. Color	* RESPONSE	10. Verbal/written	11. Point-Touch-Mark	12. Manipulate	13. Multiple Choice	* EVALUATION	14. Instructor	15. Automated	16. Peer	17. Intrinsic	* FEEDBACK	18. Immediate Response	19. Immediate Error	20. Periodic	21. Post Session	*SPECIAL REQUIREMENTS	22. Crew/team Interaction	23. Environmental Condition	24. Physical Motion	25. Time Variability
1. CAI		4	1	0	0	5	4	4	2	5		3	4	4	5		3	5	0	4		5	5	5	3		3	0	0	5
2. Random-Access						4	5	5	0	5		3	0	0	3		4	0	0	5		4	0	4	3		3			5
3. Motion Pic/VT		4	3			1	5	5	5	5		3	0	0	3		5	0	0	5		0	0	5	3		3			5
4. Slides/Audio		5	3			3	4	4	5	5		3	0	0	3		5	0	0	5		0	0	5	3		3			5
5. Audio Tape		5	5									3					4	1		4				4	4		3	0	0	5
6. Slides						3	5	5	0	5		3			3		4		3	4		0	0	5	5		3			5
7. Lecture		5	0	0	0	5	3	4	2	2		3	0	0	3		5	0	5	5		5	5	5	5		4	3	0	5
8. Demonstration		5	0	4	1	5	3	4	2	2		4	0	0	4		4	1	1	1		5	5	5	5		2	2	1	5
9. Group Discuss.		5	0	0	0	0	0	0	0	0		5	0	0	0		5	0	5	5		5	5	5	5		5	0	0	5
10. Workbook						5	5	5	0	3		5	0	0	5		5	2	0	2		3	3	3	2		0	0	0	0
11. Teaching Machine						5	4	3	1	1		1	4	4	5		0	5	0	1		5	5	5	5		1	0	0	1
12. OP.EQUIP/OP.ENV		5	5	5	5	3	3	4	5	5		0	0	5	0		5	0	5	1		0	5	3	5		5	5	5	0
13. OP. EQUIP/LAB		5	0	5	3	0	3	3	0	5		4	4	5	0		5	0	0	1		3	3	2	2		5	2	2	0
14. Team Trainer		5	4	5	3	0	0	3	4	4		0	3	5	0		5	4	3	1		5	3	0	1		5	2	1	0
15. Proced. Trainer				5	5								5	3			5	5	4	1		0	3	0	3		5	0	0	1
16. Part Task Train.		3	3	3	0	3	0	1	3	4		0	5	3	0		5	5	1	1		0	0	5	0		5	0	0	1
17. 3-D Mock Up		0	0	5	1	4	5	5	0	5		0	0	5	0		5	0	1	4		0	0	5	3		2	0	0	1
18. 2-D Mock Up				3			3	3						0													2			5
* Potential CAI *																														
19. TICCIT & VDISC		4	5			5	4	3	5	5		3	4				3	5	0	1		5	5	4	4		3			3
20. PLATO & VDISC		4	5			5	3	3	2	5		5	4				3	5	0	1		5	5	5	5		4			5
21. GETS		4	5			5	3	3	2	5		3	4	5	1		3	5	0	1		5	5	5	3		3			5
:Also Possible:																														
22. Besseler Cue-See		3	4			4	4	4	0	4		3	2	0	0		3	2	0	1		4	3	5	5		0	0	0	5

Figure B-10. A sample completed media pool with each medium's ability to deliver each characteristic rated on a 0-to-5 scale.

SELECTION WORKSHEET FOR USE WITH THE FILE : pool

OBJECTIVE NUMBER : _____

OBJECTIVE:

Put a check in the boxes next to required attributes.

* I. DISPLAY CHARACTERISTICS
- |__| 1. Audio (voice)
- |__| 2. Audio (ambient)
- |__| 3. Tactile cues
- |__| 4. Kinesthetic cues
- |__| 5. Verbal/text
- |__| 6. Pictorial
- |__| 7. Drawings/diagrams
- |__| 8. Motion
- |__| 9. Color

* II. RESPONSE MODE
- |__| 10. Verbal/written
- |__| 11. Point-touch-mark
- |__| 12. Manipulate
- |__| 13. Multiple choice

* III. EVALUATION
- |__| 14. Instructor
- |__| 15. Automated
- |__| 16. Peer
- |__| 17. Intrinsic

* IV. FEEDBACK
- |__| 18. Immediate response
- |__| 19. Immediate error
- |__| 20. Periodic
- |__| 21. Post session

* SPECIAL REQUIREMENTS
- |__| 22. Crew/team interaction
- |__| 23. Environmental condition
- |__| 24. Physical motion
- |__| 25. Time variability

Figure B-11. A sample selection worksheet from a media pool entitled "POOL."

nental task, the worksheets allow designers to work "off-line," not consuming cessary computer time at this stage.

Once all of the instructional characteristics for a given group of objectives have been rmined, these data need to be entered into the computer. Basically, the person :ting data types in the objective number and the numbers of the instructional butes checked off on the worksheet for that objective. The computer then goes to : in several ways:

1. Determines media that have the required characteristics.
2. Determines how well each medium handles required characteristics.
3. Rank orders media as to their appropriateness for the given objective.
4. Records how many times each medium is selected.
5. Stores objectives with selected media on data base of objectives.

Figure B-12 shows a sample media selection made by the AIMS model. Note that the ia are ranked according to specific rating. This is a rating of how well this medium les the characteristics specific to the objective. The general rating is the average of uality ratings assigned to all of the instructional characteristics for that medium.

Goals

Simpson and Kribs (1980) state that the AIMS model was designed to meet five major s. These goals, and how they were met, are described below:

1. Maximize the use of information pertinent to media selection. Some models mpt simplification of the media selection process on the grounds that it is unwieldy, cult for those without extensive media expertise, time consuming, or too soft a nology. The AIMS model approaches this process, first by providing computerized ss to the media pool. The media pool can theoretically be of any size without easing the human labor involved in the selection task. Second, a media pool can be ted by a single person, or small group of personnel, with extensive media expertise. maximizes the use of their time and knowledge. Matching training objectives to uctional characteristics is a task that can be performed by subject-matter experts or instructional development personnel. There is no need for these persons to have ific media expertise at this point, thus making full use of the time and knowledge of e personnel. Clerical personnel can then input data into the computer, and it can ct the appropriate media, rank order, record, and file them. The bulk of the labor, , actually falls on the computer. The computer performs these tasks at a mere tion of the time required of a human, and virtually makes no mistakes.

2. Provide flexibility in modifying the model to reflect specific problems and ging technology of media or media guidelines. The recurring problem with current ia selection models is the broadness of media selections and the rigidity of media s. The possibility of creating a universal media pool seems nil. Media pools are going ary in the media to be considered, relevant instructional characteristics, and level of ificity of media and characteristics. They are going to have to change with changing nologies, also. The AIMS model provides for this. Without any special programming rtise, a user may add media, delete media, add attributes, or create entirely new ia pools, without compromising the selection process itself.

3. Allow greater, more detailed selection of training devices, beyond the classroom learning center type media. Since each user is the author of his own media pool, nsive listings of simulators, realia, and other "hands-on" type media and their

MEDIUM	SPECIFIC RATING	GENERAL RATING
OP. Equip./OP. Environment	5.00	4.48
OP. Equip./Lab	4.33	4.85
Procedural Trainer	4.33	4.83
Part task trainer	3.67	4.18
3D Mock - up	3.67	4.36
2D Mock-up	1.33	3.36

Figure B-12. A sample media selection made by the AIMS model.

attributes are fully permissible. Fidelity requirements can be included as instructional characteristics, thereby directly bearing on the media selected. The bias toward "cognitive"-type media apparent in earlier models is eliminated.

4. Provide consideration of stage of learning. To take stage of learning into consideration, one needs simply to incorporate this as an instructional characteristic for the computer to select.

5. Allow for variations in the stage of front-end analysis. The conventional thinking behind media selection models is that they are used by a combination of instructional designers and people with media expertise during instructional development. Usually included in the "use" scenario is the asumption that a job/task analysis has been performed with objectives defined and arranged in a fashion indicating instructional sequence. . . . Media selections may be as general or as specific as available knowledge about potential instructional characteristics permits. (pp. 63-64)

Delphi Technique

The Delphi technique is a set of procedures for eliciting and refining the opinions of a panel of experts. The objective of the technique is to obtain a consensus of expert opinion on the topic under consideration. This requires determining the items on which the experts are in agreement. If the responses of the experts are randomly distributed among several alternatives for a given topic, then no agreement exists. A statistical definition is required to specify precisely what is meant by the term consensus of opinion. Some users of the Delphi technique have concluded that consensus exists if 50 percent of the experts agree, while other users have employed measures of variability and other sophisticated measures. Two variables are crucial in defining consensus: the number of experts on the panel and the number of alternatives available for a given topic. If the distribution of the responses is likely to occur by chance, then consensus of opinion cannot be said to exist (Herrick, Wright, & Bromberger, 1977).

This approach is considered superior to the panel discussion for achieving consensus (Helmer, 1966). The procedures are designed to minimize (1) the effect of a dominant (but not necessarily more expert) individual, (2) the "bandwagon" effect, (3) the hesitancy to abandon a publicly expressed position once it has been refuted, and (4) the pressure that exists to renounce an unpopular position (Keller & Koen, 1976). The procedures also offer the advantage of providing the expert with the opportunity to leisurely examine the opinions of other experts and benefit from the exposure to opinions from other experts with different orientations and biases.

The Delphi technique is based on a series of carefully designed questionnaires (typically three to five) interspersed with information and opinion feedback from the previous iterations. The first questionnaire consists of general questions designed to evoke discussion of the selected topics by the experts. In their responses, they identify the areas of relevance and importance, describe their knowledge, provide examples and experiences to support their opinions, suggest problems and offer solutions. The responses to the first questionnaire are summarized, statistically analyzed, organized, and converted into individual items for the second round questions. Thus, the experts determine the content of the second and subsequent rounds (Herrick et al., 1977). The iterations or rounds allow the panel to reconsider factors they might have inadvertantly neglected and to give weight to those they may have initially dismissed as unimportant.

In summary, the Delphi technique is characterized by (1) the anonymity of responses through the use of mailed questionnaires, (2) the respondents' expertise, (3) requirement of

multiple rounds to obtain consensus, and (4) controlled feedback on responses from previous rounds (Armstrong, 1978).

In general, these characteristics may be considered relevant and useful to the media selection process. However, some refinements and guidelines are required to make the technique operational. Specifically, the Delphi technique is too time-consuming a process for making media selection decisions within most ISD development efforts. The traditional use of several rounds of mailed questionaires with the associated analysis and determination of consensus on items may take weeks or months. The statistical definition of consensus of opinion for items may present a problem in media selection. There are the issues of defining consensus to permit identification of one or more candidate media from the available pool, and to ensure that agreement is reached so that candidate media can be selected for each training objective.

For these reasons, the E-T-E (estimate-talk-estimate) method, which is similar to the Delphi technique, is suggested for media selection. The general characteristics of E-T-E, as well as the specific requirements for use in selecting media, are provided below.

Estimate-Talk-Estimate (E-T-E)

E-T-E is a method to structure group discussions for decision-making purposes. It possesses the four general characteristics of the Delphi technique: (1) anonymity of responses is emphasized, (2) the respondents are experts, (3) more than one round is required to obtain consensus for making decisions, and (4) controlled feedback from previous rounds is provided. The primary advantage of E-T-E over Delphi designs is speed of responses. The process can be completed in hours or days rather than weeks or months (Armstrong, 1978). Also, the considerations associated with statistically defining consensus are less involved, since the emphasis is placed on making specific decisions rather than achieving consensus or agreement on items.

E-T-E procedures call for independent and anonymous estimates, then a face-to-face group discussion (rather than mailed questionnaires), and, finally, another round of individual estimates. Usually, both estimate periods are made anonymously, and participants are also encouraged not to reveal or argue their own positions during the talk period. The initial estimate period approximates the first round in the Delphi. It is structured to evoke a set of parameters and discussion of the selected topics by the panel of experts. The responses to the estimate period are summarized, organized, and converted into discussion points for the talk period. There are two methods for conducting the group discussion: the nominal group meeting, in which control is exerted over the discussion, and the general discussion, in which experts may argue for their own positions. Likewise, there are two methods for conducting the last estimate period: the pooled estimate of anonymous experts to reach a decision, or a group decision.

Given these general characteristics of the E-T-E method, the following subsection provides considerations and guidelines for its use as a media selection technique in military technical training settings.

Media Selection Using E-T-E

One of the most important considerations in using the E-T-E method as a media selection tool is to establish selection criteria for the panel of experts. Since media selection decisions have operational and cost implications for a number of activities in Navy training commands, it is suggested that the panel of experts be representative of these activities. Guidelines for selecting panel should specify at least one expert from each of the following personnel types:

1. Program management personnel concerned with planning, programming, and budgeting for the training program under consideration.

2. School adminstration personnel concerned with operation and maintenance of the training program.

3. Subject-matter experts in the content areas to be trained.

4. Experienced training system designers.

5. A media specialist.

The five variables listed below are considered essential to any media selection technique:

1. Practical factors and training program constraints.
2. Trainee characteristics.
3. Training task requirements.
4. Instructional characteristics (stimulus, response, feedback requirements).
5. Media attributes.

These variables must be addressed in the three rounds prescribed in the E-T-E method. The first estimate period includes all five of the variables since it establishes the parameters for selecting media for the specific training program under consideration. The talk period provides an opportunity to analyze the match of instructional characteristics required to support the training tasks with the media attributes of the candidates available in the media pool. The last estimate period focuses on trade-offs and practical factors in order to make the media selection decisions required for the training program. The considerations for each of these rounds are described in more detail below.

The first round is critical in using E-T-E for media selection. Any training program constraints or significant practical factors that may impact the media decisions should be identified early in the process. These may include such things as command policy, phase in the weapon system and training program life cycle (i.e., conceptual or operational), and training resources availability (i.e., facilities, funding, instructional staff, or support personnel). These will establish the parameters for defining the remaining four variables. The trainee characteristics should be reviewed to identify entry level behaviors, student throughout and attrition rates, and any other pertinent factors. The candidates included in the media pool should be examined for relevancy and adequacy to meet the training requirements of the program under consideration. The media attributes of the candidates to be included in the media pool should be thoroughly defined. The format for the training task requirements (i.e., training objectives, or stages of training and tasks) should also be determined. In addition, the procedures for matching the instructional characteristics of these training requirements to the attributes first estimate period.

The procedures for conducting the first round might be as follows:

1. Each expert on the panel receives a list of preliminary definitions for each of the five media selection variables for review and critique.

2. The panel makes detailed definitions for each variable and returns them to the coordinator.

3. The coordinator analyzes and summarizes the responses to determine agreement on the definitions of the variables.

Sufficient agreement must be achieved during the first estimate period in order to perform the match of instructional characteristics against media attributes. In fact, it may be advantageous in some cases to include a second pass during the initial round to accomplish this task prior to the group meeting, especially if there are time constraints on the panel of experts.

The results of the first round are then used to structure the face-to-face group meeting. The meeting may be conducted in either one of the two ways described earlier. The primary purpose of the face-to-face meeting is to identify one or more candidate media for each training objective or training task within a training stage. Sufficient agreement must be achieved during the group discussion to accomplish this goal. If the match of instructional characteristics to media attributes was performed as a second pass in the first round, this should be a review process. If it is to be performed as a group, ample time must be allowed for discussion.

The results of the second round are then used to make trade-offs, reconsider initial constraints, and identify any other constraints or practical factors that might impact the final selection. Once again, the final round may be conducted in a group mode or as a pooled estimate of individual expert responses. This depends upon the nature of the decisions to be made, and the time constraints on the panel of experts and coordinator. The desired end product of the three E-T-E rounds is the selection of an optimal and usable media mix to meet the requirements of the training program under consideration.

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