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ABSTRACT

This document is the second in a series of 11 subvolumes of a handbook providing training for educational research and development personnel in the development of instructional materials. This subvolume deals with the task of collecting and analyzing data about criterion behavior. The document content is divided into the following five steps for completing the task: (a) collect description of critical elements of criterion behavior from job holders; (b) plan the sequence for collecting from individual performance experts or knowledge domain experts the types of information needed to perform the various required types of analysis of criterion behavior; (c) collect task description information about criterion behavior; (d) collect task analysis, learning analysis, and competency analysis information about criterion behavior; and (e) collect information necessary to perform a mode analysis of inputs, actions, and outputs for each criterion behavior. More specific substeps are listed for performing the steps. (PD)

A Technology For Developing Instructional Materials

3 HANDBOOK

A. PLAN STUDY OF CRITERION BEHAVIORS

B. COLLECT AND ANALYZE DATA ABOUT CRITERION BEHAVIORS

C. SEQUENCE AND GROUP CRITERION BEHAVIORS

D. STATE CRITERION AND PREPARATORY OBJECTIVES

E. PLAN SIMULATION BASED ON INSTRUCTIONAL AND LOGISTICAL NEEDS

F. DEVELOP DIAGNOSTIC AND EVALUATIVE TESTS

G. FORMULATE INSTRUCTIONAL STRATEGIES

H. PLAN ACCOMMODATION OF INDIVIDUAL DIFFERENCES

I. DEVELOP INSTRUCTIONAL MATERIALS

J. EVALUATE INSTRUCTIONAL MATERIALS

X. INDEX

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VOLUMES IN THIS SERIES

1. USER'S MANUAL
2. ORIENTATION
3. HANDBOOK
   (eleven sub-volumes)
4. WORKBOOK
5. FINAL EXERCISES

FOREWORD

This is one of a series of eleven HANDBOOK sub-volumes which has been prepared to provide training for educational R&D personnel in the development of instructional materials.

The USER'S MANUAL, which accompanies the series, describes the role each volume is designed to play and the sequence recommended for its use in the training process. The user is, therefore, urged to read the instructions in the USER'S MANUAL before using this or any other separate volume.

ACKNOWLEDGMENTS

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U.S.O.E. sponsorship does not in any way imply official endorsement of the views expressed in this volume.

The author is indebted: to Dr. Robert Fitzpatrick for reviewing portions of the series of volumes and for informal discussions concerning several training issues; to Mrs. Zita Glasgow for the first and critical use of this volume; and, not least, to Miss Kathleen Gubala for her tireless preparation of the complex manuscript required by this HANDBOOK.

George L. Gropper
March 1973

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STEP B.1 *

B.1 Collect description of critical elements of criterion behavior from (or about) many job holders.**

**With the completion of Sub-STEP B.1.5 (below), additional analyses of criterion behavior are performed as per the steps beginning with Step B.3.3.

B.1.1 Determine how many individual descriptions of criterion behavior are required and how many informants should be sampled to provide them.

B.1.2 Identify the type(s) of informants to use and the methods for obtaining information from them.

B.1.3 Collect and perform preliminary analysis of critical incidents.

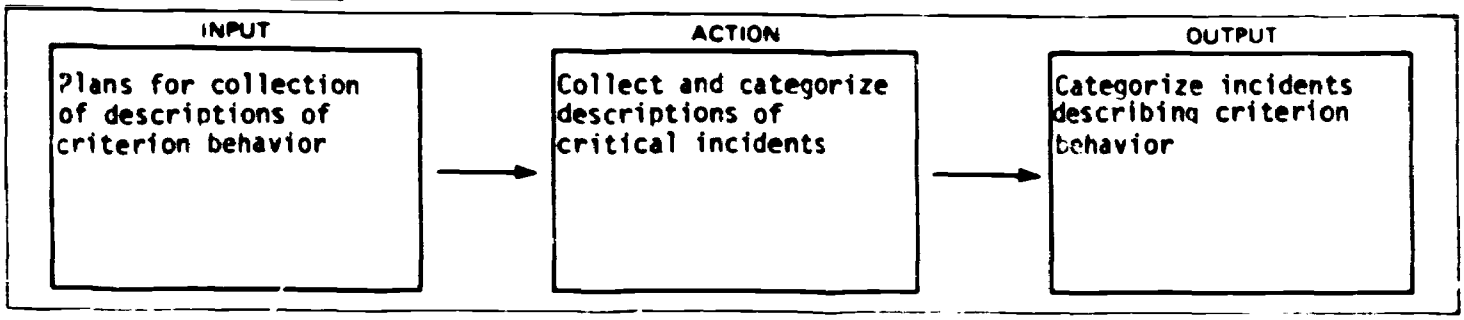
B.1.4 Categorize and (when appropriate) sequence critical incidents.

B.1.5 Assess the reliability of the categorization of incidents and revise the categories when necessary.

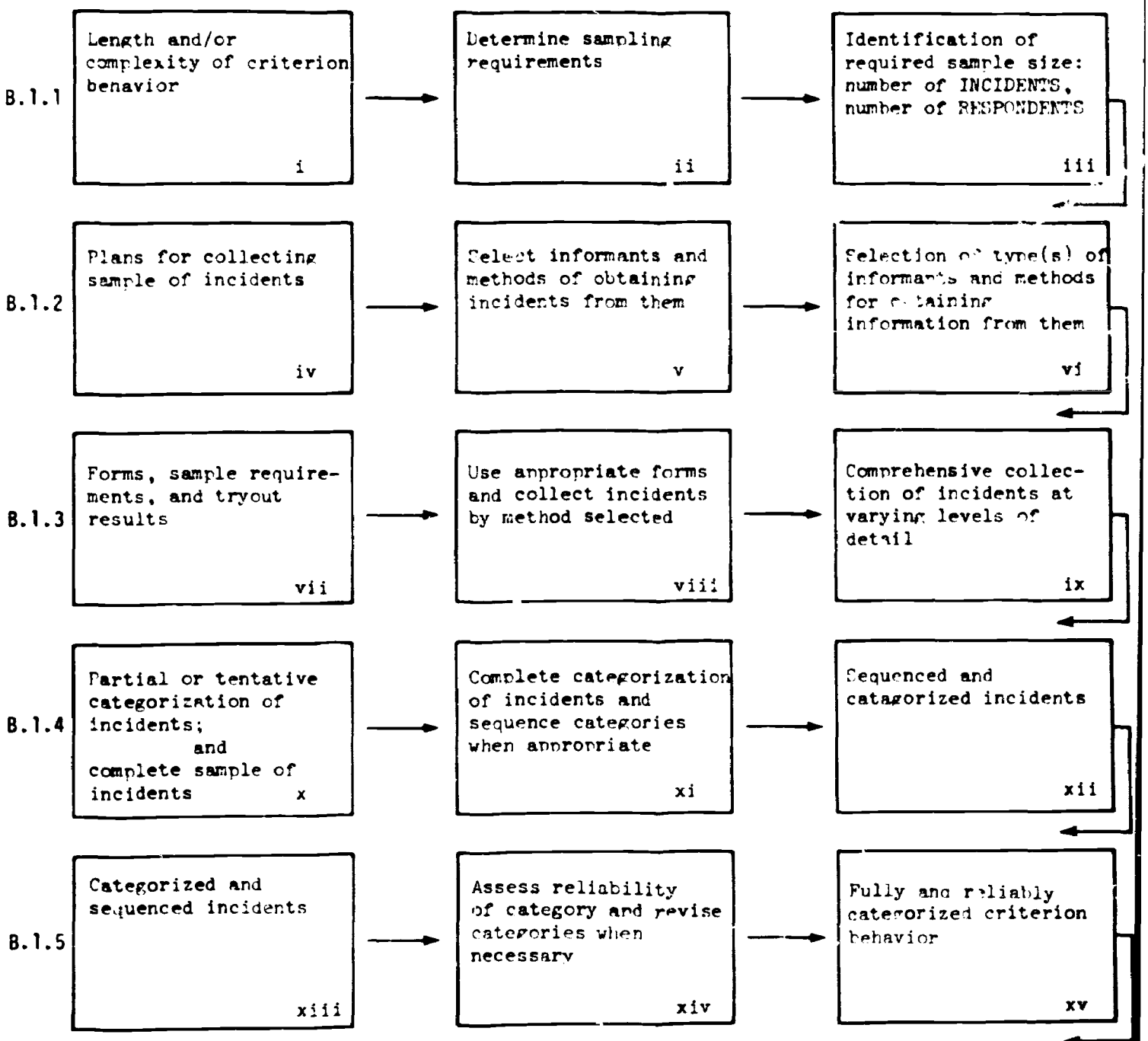
*Step B.1 is not performed if it is planned to do Step B.2

STEP B.1

OVERVIEW



Sub-STEPS



STEP B.1

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PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A decision about: (a) how many "incidents" are needed adequately to describe the criterion behavior under study; and (b) how many informants are needed to provide the descriptions.*
WHAT YOU WILL WORK FROM	(1) Identification of the length and/or complexity of the criterion behavior.
WHAT YOU WILL DO	(1) Determine how many incidents describing the criterion behavior to collect and how many respondents (informants) to use in collecting them.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.1.1

INPUT	ACTION	OUTPUT
Length and/or complexity of criterion behavior i	Determine sampling requirements ii	Identification of required sample size: number of INCIDENTS, number of RESPONDENTS iii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
	-MATRIX: Number of incidents required . . . . 8 -MATRIX: Number of respondents required 9		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Decision about complexity or difficulty of performance	A.5.2 (c)			

Sub-STEP B.1.1

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Length and/or complexity of criterion behavior — i	Determine sampling requirements — ii	Identification of required sample size: number of INCIDENTS, number of RESPONDENTS — iii

	INPUT	*Decision*	*Identification*
I	Relatively SHORT and/or SIMPLE criterion behavior — i.a	Plan to collect a small sample of criterion behavior descriptions — ii.a	Number of required incidents describing terminal behavior: several hundred — iii.a
	Relatively LONG and/or COMPLEX criterion behavior — i.b	Plan to collect a large sample of criterion behavior descriptions — ii.b	Number of required incidents describing terminal behavior: a few thousand — iii.b
II	Number of incidents required for adequate description of criterion behavior in the thousands — i.a	Plan to use very large number of respondents — ii.a	Number of respondents required: several hundred — iii.a
	Number of incidents required for adequate description of criterion behavior in the hundreds — i.b	Plan to use moderately large number of respondents — ii.b	Number of respondents required: a few hundred — iii.b

BACKGROUND INFORMATION

B.1.1

DETERMINING HOW MANY CRITICAL INCIDENTS DESCRIBING CRITERION BEHAVIOR WILL BE NEEDED

DECISION MATRIX

CONDITIONS	Criterion behavior is relatively LONG and/or COMPLEX	Criterion behavior is relatively SHORT and/or SIMPLE
ACTION TO TAKE	*Plan to collect a <u>few</u> to <u>several thousand</u> incident* *The longer or more complex the criterion behavior, the more incidents will be required*	*Plan to collect a <u>few</u> to <u>several hundred</u> incidents* *The shorter or simpler the criterion behavior, the fewer incidents will be required*

EXAMPLES	Examples of Terminal Behavior: Which Might Require A Few or Several *Thousand* Incidents	Examples of Terminal Behavior: Which Might Require A Few or Several *Hundred* Incidents
	-Developing a science curriculum -Developing a computer program -Flying an airplane -Carrying out a research project -Deriving a statistical formula	-Drawing maps -Cataloguing books

B.1.1

DETERMINING HOW MANY RESPONDENTS SHOULD BE USED TO PROVIDE CRITICAL INCIDENTS

DECISION MATRIX

CONDITIONS	Number of incidents required: in the <u>thousands</u>	Number of incidents required: in the <u>hundreds</u>
ACTION TO TAKE	*(1) Require each respondent to provide no more than <u>ten</u> incidents* *(2) Divide number of incidents per respondent into <u>total</u> number required incidents to get number of required <u>respondents</u>*	*(1) Require each respondent to provide no more than <u>six</u> incidents* *(2) Divide number of incidents per respondent into <u>total</u> number required incidents to get number of required <u>respondents</u>*
EXAMPLE	(a) Required: 4000 <u>incidents</u> (b) Obtain from <u>each</u> respondent: 8 incidents (c) Sample of respondents required: 500 <u>people</u>	(a) Required: 400 <u>incidents</u> (b) Obtain from <u>each</u> respondent: 5 incidents (c) Sample of respondents required: 80 <u>people</u>

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	--*Identification of the type(s) of informant to use: (a) job holders; (b) peers; (c) superiors or subordinates.* --*Identification of methods to use in collecting incidents from informants: (a) interviews; (b) questionnaires; or (c) observations.*
WHAT YOU WILL WORK FROM	(1) Plans for sample of incidents to collect and for the number of informants to provide incident descriptions.
WHAT YOU WILL DO	(1) Identify the type of informant needed to describe the criterion behavior under study. (2) Identify the method(s) for collecting the incidents from the informants.
FORMS YOU WILL USE	

DESCRIPTION OF Sub-STEP	B.1.2

INPUT	ACTION	OUTPUT
Plans for collecting sample of incidents iv	Select informants and methods of obtaining incidents from them v	Selection of type(s) of informants and methods for obtaining information from them vi

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Acceptability of informants . . . 14 -MATRIX: Selecting description methods 16	-MATRIX: When to use non-job holders 15		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of required sample size	B.1.1			

Sub-STEP B.1.2

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Plans for collecting sample of incidents — iv	Select informants and methods of obtaining incidents from them — v	Selection of type(s) of informants and methods for obtaining information from them — vi

I

Persons with firsthand experience with the criterion behavior and its goals — iv.a	Select as informants — v.a	Selection of: JOB HOLDERS, PEERS, SUPERIORS, SUBORDINATES — vi.a
Persons with inadequate experience with the criterion behavior and its goals — iv.b	Do not select as informants — v.b	Avoidance of those insufficiently familiar with the criterion behavior — vi.b

II

A small sample of incidents is required; and it is important to be able to probe for more information — iv.a	Select appropriate method of collecting critical incidents — v.a	Method selected: INTERVIEWS — vi.a
A large sample of incidents and informants is required — iv.b	Select appropriate method of collecting critical incidents — v.b	Method selected: QUESTIONNAIRES — vi.b
Reliance on memory is undesirable — iv.c	Select appropriate method of collecting critical incidents — v.c	Method selected: DIRECT OBSERVATION — vi.c

BACKGROUND INFORMATION

B.1.2

GENERAL CRITERIA FOR DETERMINING THE ACCEPTABILITY OF RESPONDENTS/INFORMANTS

IDENTIFICATION MATRIX

CRITERIA	-Are familiar with the criterion behavior -Are familiar with the goals of the criterion behavior -Have had opportunities to observe criterion behavior AND -Have had opportunities to observe the outcome of the criterion behavior	-Are unfamiliar with the criterion behavior -Are unfamiliar with the goals of the criterion behavior -Have not had opportunities to observe criterion behavior AND -Have not had opportunities to observe the outcome of the criterion behavior
JUDGMENT OF ACCEPTABILITY	ACCEPTABLE as informants	UNACCEPTABLE as informants
EXAMPLES	-Job holders -Peers -Subordinates -Superiors	-Peers, subordinates, or superiors who have not had the above opportunities -Instructional technologist unfamiliar with the behavior

B.1.2

CRITERIA FOR DETERMINING WHEN TO USE OTHER INFORMANTS IN ADDITION TO OR INSTEAD OF JOB HOLDERS

DECISION MATRIX

CRITERIA	*(1) Total population of job holders is small* *AND* *A large number of incidents is required to describe criterion behavior* *OR* *(2) A point of view other than that of the job holder is required*	*(1) Total population of job holders is large* *AND* *A large number of incidents is required to describe criterion behavior* *OR* *(2) A point of view other than that of the job holder is not required*
ACTION TO TAKE	In addition to job holder use: PEERS SUBORDINATES SUPERIORS EXPERTS IMPARTIAL OBSERVERS	USE JOB HOLDER
EXAMPLES	Example of point of view: -The "reporting" behavior of a job holder can be better described by his superior -The "reinforcing" or "punishing" behavior of a teacher can be better described by: -Pupils -Reinforcement experts -Observers	Example of point of view: -The job holder's description of incidents covering problems with others from his own point of view is under study

B.1.2

IDENTIFICATION MATRIX

CRITERIA FOR ASSESSING THE ADVANTAGES AND DISADVANTAGES OF THREE METHODS OF OBTAINING DESCRIPTIONS OF CRITICAL INCIDENTS

METHODS	INTERVIEWS about <u>past</u> incidents	QUESTIONNAIRE about <u>past</u> incidents	OBSERVATION about <u>current</u> incidents
CRITERIA	*(1) -Subject to memory distortion* *(2) -Costly and time-consuming when large sample of informants is required* *(3) +Can monitor quality and completeness of answers and do further probing when necessary*	*(1) -Subject to memory distortion* *(2) +Inexpensive and efficient way to collect large sample* *(3) -Cannot follow up questions when answers are deficient*	*(1) +<u>Not</u> subject to memory distortion* *(2) -Time-consuming waiting for a sufficient number of incidents to occur*
POSSIBLE WAYS TO OVERCOME DISADVANTAGES	(1) Memory distortion can be overcome by asking for <u>recent</u> incidents ("The last time you did something . . .") (2) If possible, ask for <u>more</u> incidents from each informant	(1) Memory distortion can be overcome by asking for recent incidents ("The last time you did something . . .") (3) Pretesting of questionnaire wording can assure acceptable answers	(2) Not possible to overcome this disadvantage without increasing number of observers and number of those observed

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A comprehensive collection of critical incidents -- tentatively categorized.*
WHAT YOU WILL WORK FROM	1. Sample of personnel. 2. FORMS to use in collecting incidents.
WHAT YOU WILL DO	(1) Try out the FORMS to determine their capacity to elicit appropriate incident descriptions. (2) Use FORMS (revised if necessary) to collect incidents. (3) Assess sample for adequacy and continue collection if needed. (4) Perform categorization of incidents.
FORMS YOU WILL USE	FORMS A.5(1)-(3); FORMS A.5(15) or A.5(16) for collecting critical incidents.

DESCRIPTION OF Sub-STEP	B.1.3

INPUT	ACTION	OUTPUT
Forms, sample requirements, and tryout results vii	Use appropriate forms and collect incidents by method selected viii	Comprehensive collection of incidents at varying levels of detail ix

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Judging similarity among incidents . . . 31 -MATRIX: Judging adequacy of sample of incidents . . . 36	MATRICES -Soliciting specific vs. random responses . . . . 23 -Selection of forms . . . . . 24 -Assignments to informants . . . 26 -Order in categorizing incidents . . . . 32 -Determining need for additional incidents 37	-MATRIX: Desirable properties of incident descriptions . . 28, 29 -MATRIX: Acceptability of categorization . 33, 34	-FORMS: A.5(1)-(3) -FORMS: A.5(15) or A.5(16)

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Tried out and revised questions and forms	A.5.3			A.5(1)-(3) A.5(15) or A.5(16)
Identification of sampling requirements	B.1.1			A.5(1)-(3) A.5(15) or A.5(16)
Selected method of collecting incidents	B.1.2			

Sub-STEP B.1.3

JOB DIAGRAM I

	INPUT	ACTION	OUTPUT
	Forms, sample requirements, and tryout results vii	Use appropriate forms and collect incidents by method selected viii	Comprehensive collection of incidents at varying levels of detail ix

Sub-Sub-STEPS

1	Results of tryout of questions and forms vii.1	Decide on which forms to use and on the order in which different levels of detail will be obtained viii.1	Selection of forms and a plan for the order of information collection ix.1
2	Plans for collecting incidents vii.2	Collect preliminary sample; develop major categories and assign informants to different categories viii.2	Assignment of portions of informant sample to different categories (i.e., different levels of detail) ix.2
3	Assignments to informants vii.3	Collect and periodically assess adequacy of incidents reported viii.3	Collection of adequately reported incidents ix.3
4	Early returns of incidents vii.4	Begin summary and categorization of incidents viii.4	Preliminary category system and assignment of incidents ix.4
5	Collection of planned number of incidents and their assignment to preliminary category system vii.5	Assess the adequacy of the size of the sample of incidents (continue collecting until judged adequate) viii.5	Adequate sample of incidents ix.5

BACKGROUND INFORMATION

Sub-Sub-STEP B.1.3.1

JOB DIAGRAM II

	INPUT	ACTION	OUTPUT
1	Results of tryout of questions and forms vii.1	Decide on which forms to use and on the order in which different levels of detail will be obtained viii.1	Comprehensive collection of incidents at varying levels of detail ix.1

	INPUT	ACTION	OUTPUT
I	One or more broad levels of detail supplied during tryout of questions and forms vii.1.a	First ask for descriptions of broad levels of detail, then for specific lower levels viii.1.a	Plan for order of collecting description of incidents ix.1.a
	One or more broad levels of detail NOT supplied during tryout of questions and forms vii.1.b	First, collect descriptions at specific levels, and then categorize into higher, broader levels viii.1.b	Plan for order of collecting description of incidents ix.1.b
II	Informants relatively expert AND Tryout results show they can verbalize about fine details of performance vii.1.a	Select from forms appropriate to fine detail viii.1.a	Selection of FORM A.5(15) ix.1.a
	Informants relatively inexpert AND tryout results show they cannot easily verbalize about fine details of performance vii.1.b	Select from forms appropriate to broader detail viii.1.b	Selection of ALTERNATIVE FORM A.5(16 ix.1.b

B.1.3.1

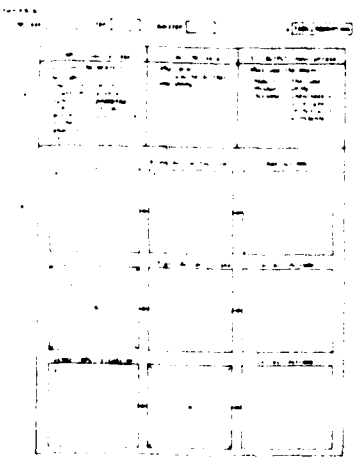
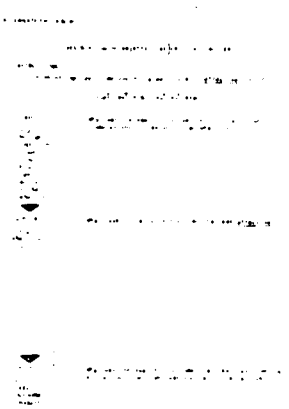
DETERMINING WHEN TO DIRECT ATTENTION OF INFORMANTS TO SPECIFIC AREAS OF CRITERION BEHAVIOR AND WHEN TO SOLICIT RANDOM RESPONSES

DECISION MATRIX

CONDITIONS	In Sub-STEP A.5.3 during pretest of forms A.5(1)-A.5(3), informants were able to provide descriptions at one or more broad levels of detail: i.e., at TASK level i.e., at STEP level, or i.e., at Sub-STEP level	In Sub-STEP A.5.3 during pretest of forms A.5(1)-A.5(3), informants were NOT able to provide descriptions at one or more broad levels of detail
ACTION TO TAKE	(1) *First, ask a small percentage of informants (e.g., 5%) to provide a description of criterion behavior at broad levels of detail* *USE FORMS A.5(1)-A.5(3)* (2) *Second, directing attention of portions of the sample of informants to each level obtained (e.g., to each sub-STEP identified), ask for descriptions of incidents within that level* *USE FORMS A.5(15) or A.5(16)* (3) *Third, assure that all levels are assigned some portion of the total number of informants*	(1) *First, ask a moderate-sized sample of informants (e.g., 10-20% of total) to provide descriptions of incidents at random (i.e., from any portion of the terminal behavior)* (2) *Second, summarize incidents by creating broad categories (levels) (See Sub-STEP B.1.4 for procedures for summarizing incidents)* (3) *Third, direct attention of remainder of sample of informants to each broad category or level you have just obtained (as per instruction #2 in the lefthand column)*
EXAMPLE: "PERFORMING RESEARCH"	(1) Broad category levels obtained via the means described in either column: A. *FORMULATING PROBLEMS AND HYPOTHESES* B. *PLANNING AND DESIGNING THE INVESTIGATION* C. *CONDUCTING THE INVESTIGATION* D. *INTERPRETING RESEARCH RESULTS* E. *PREPARING REPORTS*	(2) and (3) Assign some portion of the sample of informants to each of the five broad categories and ask for incidents concerning a particular category: e.g., *"Think of the last time you were interpreting research results and you did something that was particularly effective. What did you do?" Etc.*

B.1.3.3 | DETERMINING WHETHER TO USE FORM A.5(15) OR A.5(16)

DECISION MATRIX

CONDITIONS	-Informants at a relatively high level of expertise AND -Can verbalize accurately about fine details of performance (as shown during tryout of forms) SEE Sub-Sub-STEP B.1.3.3 FOR STANDARDS MATRIX	-Informants at a moderate level of expertise AND/OR -Cannot easily verbalize accurately about fine details of performance (as shown during tryout of forms) SEE Sub-Sub-STEP B.1.3.3 FOR STANDARDS MATRIX
ACTION TO TAKE	*Use FORM A.5(15)* *See Sub-STEP A.5.2(c)*	*Use ALTERNATE FORM A.5(16)* *See Sub-STEP A.5.2(c)*
ILLUSTRATION		

Sub-Sub-STEP B.1.3.2

JOB DIAGRAM III

	INPUT	ACTION	OUTPUT
2	Plans for collecting incidents vii.2	Collect preliminary sample; develop major categories and assign informants to different categories viii.2	Assignment of portions of informant sample to different categories (i.e., different levels of detail) ix.2

Level of detail obtained is BROAD i.e., at TASK level vii.2.a.1

Level of detail obtained is SPECIFIC i.e., at sub-step or sub-sub-step level AND the number of specific levels per broad level is roughly equal vii.2.a.2

→ Assign equal number of informants to each broad level or categories viii.2.a → Increased likelihood of comprehensive sampling of incidents per major level ix.2.a

Level of detail obtained is SPECIFIC i.e., at sub-step or sub-sub-step level AND the number of specific levels per broad level is roughly disproportionate vii.2.b

→ Assign informants to broad levels (categories) in proportion to number of sub-divisions within the category viii.2.b → Increased likelihood of comprehensive sampling of incidents per major level ix.2.b

B.1.3.2

DIVIDING THE TOTAL NUMBER OF INFORMANTS AMONG THE MAJOR CATEGORIES OF TERMINAL BEHAVIOR

DECISION MATRIX

CONDITIONS	-The level of detail obtained is broad or high; i.e., at TASK level rather than at sub-STEP or sub-sub-STEP levels	-In addition to broad levels, the level of detail obtained is specific; i.e., at the sub-STEP or sub-sub-STEP levels AND -The number of specific levels per broad levels is roughly equal	-In addition to broad levels, the level of detail obtained is specific; i.e., at the sub-STEP or sub-sub-STEP levels AND -The number of specific levels per broad levels is disproportionate
ACTION TO TAKE	*Divide informants equally among the major levels*	*Divide informants equally among the major levels*	*Assign more informants to the major levels having more sub-divisions (i.e., having more sub-steps)*
EXAMPLES	Descriptions obtained only at the TASK level PERFORMING AS AN ORTHOPEDIC SURGEON A. *Gathers clinical information* B. *Uses special diagnostic information* C. *Develops a diagnosis* D. *Decides on appropriate care* E. *Implements treatment* F. *Provides continuing care* Assign an equal number of informants to each TASK (to provide incidents about a particular task)	Descriptions obtained at the STEP level -The number of STEPS reported for each of the TASKS (in the column to the left) is roughly equal -Assign an equal number of informants to describe each TASK: A-F e.g., total number of informants = 100; assign 16 to provide critical incidents about each task	-The number of STEPS reported for each of the TASKS (in the columns to the left) is roughly disproportionate -Assign informants to each task in proportion to the number of STEPS obtained e.g., if A has 5 STEPS and E only 1, assign informants in the same proportions

b-Sub-STEP B.1.3.3

JOB DIAGRAM IV

INPUT	ACTION	OUTPUT
Assignments to informants vii.3	Collect and periodically assess adequacy of incidents reported viii.3	Collection of adequately reported incidents ix.3

3

Need to describe INPUTS vii.3.a	Only accept incidents which meet standards for describing inputs viii.3.a	Description which is: -Objective and concrete -Something which has been observed ix.3.a
AND		
Need to describe ACTIONS vii.3.b	Only accept incidents which meet standards for describing actions viii.3.b	Description of: -Something someone did -Something that actually happened -Something done that was critical ix.3.b
AND		
Need to describe OUTPUTS vii.3.c	Only accept incidents which meet standards for describing outputs viii.3.c	Description which is: -Objective and concrete -Something which has been observed ix.3.c

B.1.3.3

FOUR DESIRABLE PROPERTIES OF A CRITICAL INCIDENT [EITHER FORM A.5(15) OR A.5(16)]

STANDARDS MATRIX

DESIRABLE PROPERTIES	*Is a report of SOMETHING THAT ACTUALLY HAPPENED*	*Includes a description of all three:* *-An INPUT* *-An ACTION, and* *-An OUTPUT*	*The description is objective, and not an interpretation:* *-Input is OBSERVABLE and CONCRETELY described* *-Action is what someone DID* *-Output is OBSERVABLE and CONCRETE*
POSITIVE EXAMPLE EXAMPLE OF PRESENCE OF PROPERTIES IN DESCRIPTIONS OF INCIDENTS	Description of an actual occurrence that proved effective or ineffective VS.	Nursing Care INPUT -Usual time for administering medicine -Many patients to deal with, leading to time pressure ACTION -Administered medicine without checking patient's condition OUTPUT -Patient developed reaction to administration of medicine VS.	Conference Leadership INPUT -A participant badgered a speaker three times in 30 minutes ACTION -The chairman requested that the speaker be allowed to finish his presentation OUTPUT -Discussion of all the facts was completed VS.
NEGATIVE EXAMPLE EXAMPLE OF ABSENCE OF PROPERTIES IN DESCRIPTION OF INCIDENTS	A hypothesis about what is effective or ineffective, or about what should be done	INPUT -Usual time for administering medicine -Many patients to deal with, leading to time pressure ACTION -Administered medicine without checking patient's condition *No OUTPUT reported*	INPUT -One participant was particularly hostile to the speaker ACTION -The chairman was conciliatory toward the hostile participant OUTPUT -The discussion was more fruitful

B.1.3.3

DESIRABLE PROPERTIES OF INCIDENTS PROVIDING FINE DETAIL ON FORM A.5(16)

STANDARDS MATRIX

DESIRABLE PROPERTIES	INPUT	ACTION	OUTPUT
	(1) *Two input situations in cells a and d are identified:* *-Identifies two inputs that must be discriminated before the correct action can be taken*	(1) *Wrong action in cell b is either:* *-A simple omission of the correct action OR (preferably)* *-An action that should be taken under other input conditions* (2) *Actions in rows B and C are reported:* *-Identifies which action is associated with which input*	(1) *Description of the outcome resulting from taking one action (rather than another) when faced with a particular input situation*
EXAMPLE		Wrong Action You Took	Bad Outcome
A	a. *In an experiment, predicted there would be a difference between treatments X and Y (but did not specify which treatment would be better)*	b. *Analyzed the obtained difference in results using a one-tailed t-test of statistical significance*	c. *A misleading estimate of the statistical significance of the difference between the treatments*
		Right Action to Take	Correct Outcome
B	[X]	Should have used a two-tailed t-test of statistical significance	Would have doubled the probability figure, but it would be a more accurate estimate
	Other INPUT Situation		Correct Outcome
C	d. Prediction that treatment X would be better than Y	[X]	Correct assessment of probability of obtaining a difference of the kind predicted by chance above

Sub-Sub-STEP B.1.3.4

JOB DIAGRAM V

INPUT	ACTION	OUTPUT
4 Early returns of incidents vii.4	Begin summary and categorization of incidents viii.4	Preliminary category system and assignment of incidents ix.4

Identification *Decision*

Functionally similar incidents vii.4.a	Group together in same category viii.4.a	Incidents grouped into categories at varying levels of detail ix.4.a
Functionally dissimilar incidents vii.4.b	Group in different categories viii.4.b	Incidents grouped into categories at varying levels of detail ix.4.b

B.1.3.4

IDENTIFICATION MATRIX

THREE CRITERIA TAKEN SINGLY OR JOINTLY FOR DETERMINING FUNCTIONAL SIMILARITY OF INCIDENTS

CRITERIA	*INPUTS in incidents are identical or highly similar*	*ACTIONS taken (and reported in incidents) are identical or highly similar*	*OUTPUTS in incidents are identical or highly similar*
FUNCTIONAL SIMILARITY OF INCIDENTS	The incident describes behavior aimed at dealing with an identical or comparable situation, condition, or problem	Nearly identical actions (when accompanied by highly similar inputs or outputs) suggest functional similarity	The incident describes a behavior that leads to comparable outputs (results, conclusions, solutions)
EXAMPLES*	(1) *"Stopped argument between two patients over checker rules; explained the rules and told them to start game over, agreeing on rules beforehand."* (2) *"Stayed with two patients who had been fighting over their toys until they finally calmed down and began playing together more cooperatively."* (a) In both incidents, a ward attendant is dealing with comparable input situations, i.e., quarreling patients	(1) *"Stayed with upset patient; comforted and reassured him while rocking and cuddling him."* (2) *"Spent a great deal of time with an unhappy patient, playing with him and making him feel wanted."* (a) The comparable action is "spending time with the patient" (b) The comparable input is "an upset patient" (c) The comparable output is "a calmed patient"	(1) *"Talked calmly to disturbed patient for half an hour, allowing him to talk and yell until he became calm."* (2) *"Patient was upset over having been rebuffed by another attendant; calmly listened until he quieted down."* (a) The comparable output was the quieting down of the patient

*All these are examples of "calming, reassuring, or supporting misbehaving patients."

B.1.3.4

ORDER OF EVENTS IN GROUPING, CATEGORIZING, AND LABELING CATEGORIES OF INCIDENTS

DECISION MATRIX	FIRST	SECOND	THIRD
CONDITIONS	Sample of ungrouped incidents	Labeled categories at Level I	Labeled categories at Level II
ACTION TO TAKE	(a) Group raw incidents according to functional similarity (b) Strive for a large number of groupings (c) Create a category label--for each of these groupings, resulting in Level I categories	(d) Group Level I categories according to functional similarity (e) Strive to create a considerably smaller number of groupings than obtained at Level I (f) Create a category label for each of these new groupings, resulting in Level II categories	(g) Group Level II categories according to functional similarity (h) Strive to create a number of groupings even smaller than the number of Level II groupings (i) Create a category label for each of these new groupings, resulting in Level III categories
EXAMPLE from "Performing Research"	114 groupings at Level I (1) Investigated chance findings, unexpected results or difficulties encountered in work or mentioned significance of such findings (2) Chose for investigation a problem for which solution was urgently needed (3) Suggested a new problem which could be studied with an already successful technique (4) Proposed an entirely new problem or line of research (5) Used materials that had recently been made available to study previously unsolved problem (6) Conducted preliminary investigation to see whether phenomena merited experimental study or to furnish essential basic data . . . (114) Heightened interest in report and stimulated thought by skillful manner of presentation	36 groupings at Level II (1) Identify Problems (2) Define the Problem (3) Set Up Hypotheses (4) Collect Information (5) Set Up Assumptions (6) Control Important Variables (7) Develop Systematic Plans (8) Plan Use of Equipment (9) Anticipate Difficulties (10) Determine Number of Observations (11) Develop Methods (12) Apply Methods (13) Modify Procedures (14) Apply Theory (15) Attend to Details (16) Analyze Data (17) Evaluate Findings (18) Point Out Implications of Data (19) Describe Work (20) Substantiate Findings (21) Organize Report (22) Use Appropriate Report Style (23) Select Personnel (24) Deal with Subordinates (25) Coordinate Work of Groups (26) Make Administrative Decisions (27) Work with Other Groups (28) Perform Own Work (29) Assist in the Work of Others (30) Subordinate Personal Interests (31) Accept Supervision (32) Adapt to Associates (33) Adapt to Job Demands (34) Meet Personnal Commitments (35) Being Fair and Ethical (36) Show Interest in Work	8 groupings at Level III (A) FORMULATING PROBLEMS AND HYPOTHESES (B) PLANNING AND DESIGNING THE INVESTIGATION (C) CONDUCTING THE INVESTIGATION (D) INTERPRETING RESEARCH RESULTS (E) PREPARING REPORTS (F) ADMINISTERING RESEARCH PROJECTS (G) ACCEPTING ORGANIZATIONAL RESPONSIBILITY (H) ACCEPTING PERSONAL RESPONSIBILITY

B.1.3.4

CRITERIA FOR DETERMINING ACCEPTABILITY OF CATEGORIES AND THEIR LABELS OR TITLES

STANDARDS MATRIX

CRITERIA	*-Categories and their labels are at a level of generality just <u>one</u> step removed from the material in the category* *• Raw incidents are grouped and labeled at Level I* *• Level I labels are grouped and labeled at Level II* *• Level II labels are grouped and labeled at Level III*	*-Categories and their labels are at a level of generality <u>two</u> or <u>more</u> steps removed from the material in the category* *• Raw incidents are directly grouped into a small number of Level III categories without intermediate levels*
ACCEPTABILITY OF LABELING	ACCEPTABLE GROUPINGS AND LABELING	LESS ACCEPTABLE GROUPINGS AND LABELING
RATIONALE	CATEGORIZATION PROCESS REMAINS EMPIRICAL AND SYSTEMATICALLY INDUCTIVE	CATEGORIZATION PROCESS BECOMES TOO JUDGMENTAL AND INTERPRETIVE

EXAMPLES	(1) *"Stopped argument between two patients over checker rules; explained the rules and told them to start game over, agreeing on rules beforehand."* (2) *"Stayed with two patients who had been fighting over their toys until they finally calmed down and began playing together more cooperatively."* <u>Category Label at Level I is:</u> *"Calming, reassuring, or supporting misbehaving patient."* The level of generality of the summarizing statement is not far removed from the incidents themselves. (See opposite)	The same two incidents (to the left) should not be categorized at Levels II or III All the Level I categories (e.g., *calming, reassuring, or supporting misbehaving patient*) should provide the basis for creating Level II categories e.g., "USES SUPPORTIVE TECHNIQUES AND VERBAL PERSUASTION" A higher level (i.e., III) (e.g., "CONTROLS RELUCTANT OR UNDESIRABLE BEHAVIOR") is better derived from an intermediate level (Level II) rather than directly from the lowest level (Level I)

B.1.3.4

STANDARDS MATRIX

PROBABLE PROPERTIES OF DIFFERENT LEVELS OF CATEGORIES AND THEIR LABELS

PROPERTIES	-Describes general goals OR -Describes conditions at highest level of generality -Describes behavior at highest level of generality	-Describes conditions at intermediate levels of generality OR -Describes behavior at intermediate levels of generality	-Describes behavior at lowest level of generality (close to the behavior itself)
LEVELS	Level III	Level II	Level I
"GOAL" EXAMPLES e.g., "nursing behavior"	-Preventing injury to patient -Preventing injury to self and other staff members -Contributing to effective ward management -Maintaining ethical, moral, and professional behavior		
"CONDITION" EXAMPLES e.g., "driving behavior"	TASKS RELATED TO: -Traffic conditions -Roadway characteristics -The environment -The car Etc.	-Intersections -Hills -Curves -Lanes -Obstructions -Turnabouts -Crossings, bridges Etc.	
"BEHAVIOR" EXAMPLES e.g., "conducting research"	(A) FORMULATING PROBLEMS AND HYPOTHESES (B) PLANNING AND DESIGNING THE INVESTIGATION (C) CONDUCTING THE INVESTIGATION (D) INTERPRETING RESEARCH RESULTS (E) PREPARING REPORTS (F) ADMINISTERING RESEARCH PROJECTS (G) ACCEPTING ORGANIZATIONAL RESPONSIBILITY (H) ACCEPTING PERSONAL RESPONSIBILITY	(11) Develop Methods (12) Apply Methods (13) Modify Procedures (14) Apply Theory (15) Attend to Details (16) Analyze Data	(1) Developed unique solution using mathematical analysis (2) Transformed problem so that it could be solved by mathematical analysis (3) Explained phenomenon by analyzing procedures used (4) Solved a problem by applying textbook principles (5) Provided answers to technical question (6) Correctly interpreted theory in applying it to a problem

Sub-Sub-STEP 8.1.3.5

JOB DIAGRAM VI

INPUT	ACTION	OUTPUT
Collection of planned number of incidents and their assignment to preliminary category system vii.5	Assess the adequacy of the size of the sample of incidents (continue collecting until judged adequate) viii.5	Adequate sample of incidents ix.5

Identification → *Decision*

Collection of 100 incidents in addition to the planned number of incidents results in an increase of more than 2% in the number of lowest level categories vii.5.a	Continue collecting additional incidents until the 2% figure is reached viii.5.a	Comprehensive collection of critical incidents ix.5.a
Collection of 100 incidents in addition to the planned number of incidents results in an increase of less than 2% in the number of lowest level categories vii.5.b	Stop collecting additional incidents viii.5.b	Comprehensive collection of critical incidents ix.5.b

B.1.3.5

CRITERIA FOR DETERMINING THE ADEQUACY OF THE SIZE OF THE SAMPLE OF INCIDENTS

IDENTIFICATION MATRIX

CRITERIA	*After the planned number of incidents has been collected and categorized (to the lowest category level planned on),* *the addition of 100 incidents yields* *LESS THAN 2 PERCENT* *new, lowest level categories*	*After the planned number of incidents has been collected and categorized (to the lowest category level planned on),* *the addition of 100 incidents yields* *MORE THAN 2 PERCENT* *new, lowest level categories*
ADEQUACY OF SAMPLE SIZE	ADEQUATE NUMBER OF INCIDENTS COLLECTED	INADEQUATE NUMBER OF INCIDENTS COLLECTED
EXAMPLES	(a) 2000 incidents have been categorized into TASKS, STEPS, and Sub-STEPS, resulting in: 10 TASKS 50 STEPS 225 Sub-STEPS (b) The addition of 100 incidents results in only 3 new Sub-STEPS (c) $\frac{\text{3 new Sub-STEPS}}{\text{225 existing Sub-STEPS}}$ is less than a 2 percent increase	(a) 2000 incidents have been categorized into TASKS, STEPS, and Sub-STEPS, resulting in: 15 TASKS 90 STEPS (b) The addition of 100 incidents results in 11 new STEPS (c) $\frac{\text{11 new STEPS}}{\text{90 existing STEPS}}$ is more than a 2 percent increase

B.1.3.5 DETERMINING WHEN IT IS NECESSARY TO COLLECT ADDITIONAL INCIDENTS IN ORDER TO ASSURE AN ADEQUATE SAMPLE

DECISION MATRIX

CONDITIONS	SAMPLE OF COLLECTED INCIDENTS IS ADEQUATE	SAMPLE OF COLLECTED INCIDENTS IS INADEQUATE
ACTION TO TAKE	*Stop collecting additional incidents*	*Continue collecting additional sample of 100 new incidents until the percentage of new, lowest-level categories in a given sample drops to 10% or less*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A category system embodying levels of detail appropriate to the criterion behavior under study -- and categories of incidents sequenced if contingencies exist among the categories.*
WHAT YOU WILL WORK FROM	(1) Complete sample of incidents. (2) Preliminary systems of categories for clarifying the incidents.
WHAT YOU WILL DO	(1) Complete categorization systems. (2) Sequence categories whenever appropriate.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.1.4

INPUT	ACTION	OUTPUT
Partial or tentative categorization of incidents; and complete sample of incidents x	Complete categorization of incidents and sequence categories when appropriate xi	Sequenced and categorized incidents xii

Job Aid Contents

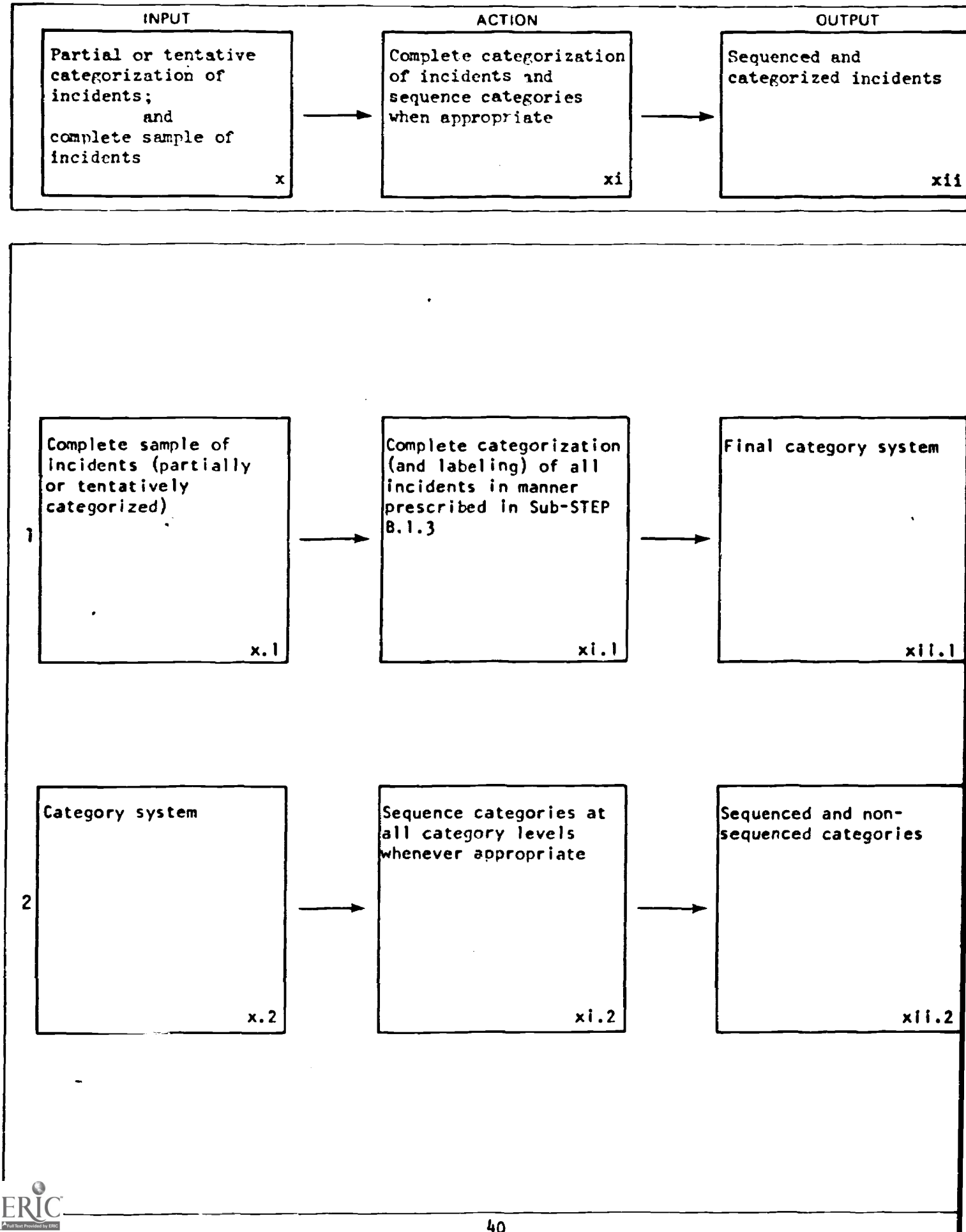
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: What are contingent behaviors . . . 44	-MATRIX: Sequencing contingent behaviors . . . 45		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Collected and partially categorized incidents	B.1.3	FORMS: A.5(1)-(3) FORMS: A.5(15) or (16)	B.1.3	

Sub-STEP B.1.4

JOB DIAGRAM I



INPUT	ACTION	OUTPUT
Category system x.2	Sequence categories at all category levels whenever appropriate xi.2	Sequenced and non-sequenced categories xii.2

Categories summarize contingent behaviors x.2.a	Sequence categories according to contingencies xi.2.a	Categories sequenced at Levels I, II, and III xii.2.a
Categories summarize non-contingent behaviors x.2.b	Do not sequence categories xi.2.b	Non-sequenced categories at whatever level xii.2.b

JOB PROCEDURES

B.1.4.2

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING CONTINGENT AND NON-CONTINGENT BEHAVIOR (AT EITHER THE TASK, STEP, OR SUB-STEP LEVELS)

CRITERIA	*The OUTPUT of a behavior becomes the INPUT of the next behavior in a sequence of behaviors* *i.e., the OUTPUT of one task becomes the INPUT for the next task, or* *i.e., the OUTPUT of one step becomes the INPUT for the next step, or* *i.e., the OUTPUT of one sub-step becomes the INPUT for the next sub-step*	*The OUTPUT of a behavior does NOT become the INPUT of the next behavior in a sequence of behaviors* *It is a self-contained, separate behavior* *i.e., the OUTPUT of a task marks the end of the behavior; it does not become the input for another task* *i.e., the OUTPUT of a step marks the end of the behavior; it does not become the INPUT for another step* *i.e., the OUTPUT of a sub-step marks the end of the behavior; it does not become the input for another sub-step*
TYPE OF BEHAVIOR	CONTINGENT BEHAVIORS	NON-CONTINGENT BEHAVIORS
"TASK" EXAMPLE	CONTINGENT TASKS e.g., from the instructional development process: -IDENTIFY OBJECTIVES -FORMULATE INSTRUCTIONAL STRATEGIES -DEVELOP INSTRUCTIONAL MATERIALS -TRY OUT INSTRUCTIONAL MATERIALS -REVISE MATERIALS Etc. *The performance of each of these tasks is contingent on the output of a preceding task*	NON-CONTINGENT TASKS e.g., from performance of hospital attendants for mentally retarded patients: -CHECKING AND OBSERVING -TRAINING THE PATIENT FOR SELF-CARE -CONTROLLING RELUCTANT OR UNDESIRABLE BEHAVIOR -RECOGNIZING AND RESPONDING TO EMOTIONAL NEEDS -PREVENTING INJURY TO PATIENT Etc. *The performance of each of these tasks is not contingent on the output of a preceding task*
"STEP" EXAMPLE	CONTINGENT STEPS (within the same task) TASK: TRY OUT INSTRUCTIONAL MATERIALS STEPS: -Reproduces sufficient copies of materials for tryout population -Administers materials and tests to population -Collects data on tryout -Analyzes data *The performance of each of these steps is contingent on the output of a preceding step*	NON-CONTINGENT STEPS (within the same task) TASK: RECOGNIZING AND RESPONDING TO EMOTIONAL NEEDS STEPS: -Considers patient's feelings -Considers patient's preferences whenever possible -Maintains a calm, positive and supportive attitude -Shows impartiality and consistency in patient care *The performance of each of these steps is not contingent on the output of a preceding step*

B.1.4.2

DETERMINING WHETHER TO SEQUENCE CATEGORIES OF INCIDENTS AT WHATEVER LEVEL OF GENERALITY

DECISION MATRIX

CONDITIONS	Categories summarize CONTINGENT Behavior	Categories summarize NON-CONTINGENT Behavior
ACTION TO TAKE	*Sequence categories according to the contingency*	*Do not sequence categories*

EXAMPLES	-If any Level III categories (highest level of generality) are contingent, sequence them according to the contingency	-If any Level III categories (highest level of generality) are not contingent, do not sequence them
	-If any Level II categories within a Level III category are contingent, sequence them according to the contingency	-If any Level II categories within a Level III category are not contingent, do not sequence them
	-If any Level I categories within a Level II category are contingent, sequence them according to the contingency	-If any Level I categories within a Level II category are not contingent, do not sequence them

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A reliable category system for classifying the collected critical incidents.*
WHAT YOU WILL WORK FROM	(1) A category system.
WHAT YOU WILL DO	(1) Have independent judges using the category system categorize a sample of approximately 100 incidents. (2) Assess the reliability (inter-judge agreement) of the categorizations. (3) Revise the category system if the category system is used unreliably.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.1.5

INPUT	ACTION	OUTPUT
Categorized and sequenced incidents xiii	Assess reliability of categorization and revise categories when necessary xiv	Fully and reliably categorized criterion behavior xv

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: When categorization can be judged reliable . . . . 53 -MATRIX: Which incidents to analyze for contingency . . 54 -MATRIX: Which wrong categorizations to analyze 55	-MATRIX: Categorizing incidents using general category scheme . . . . . 51 -MATRIX: What confusing contingencies to look for 56	-MATRIX: Adequacy of category headings 56	

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Categorized and sequenced incidents	B.1.4			

Sub-STEP B.1.5

JOB DIAGRAM I

INPUT	ACTION	OUTPUT
Categorized and sequenced incidents — xiii	Assess reliability of category and revise categories when necessary — xiv	Fully and reliably categorized criterion behavior — xv

Sub-STEPS

1	Sample of 100 incidents and final category system — xiii.1	Have approximately 10 informants assign each of the 100 incidents to one of the categories — xiv.1	10 individual categorizations of 100 incidents — xv.1
2	Results of the 10 individual categorizations — xiii.2	Compute the degree of agreement of the 10 informants with the final categorization of incidents — xiv.2	Estimate of the reliability of use of the category system — xv.2
3	(If) the categorization is unreliable — xiii.3	Revise the category system to remove sources of unreliability — xiv.3	Revised category system — xv.3

JOB PROCEDURES

Sub-Sub-STEP R.1.5.1

JOB DIAGRAM II

INPUT	ACTION	OUTPUT
1 Sample of 100 incidents and final category system — xiii.1	Have approximately 10 informants assign each of the 100 incidents to one of the categories — xiv.1	10 individual categorizations of 100 incidents — xv.1

Incidents categorized at one level of detail — xiii.1.a

Incidents categorized at two levels of detail — xiii.1.b

Incidents categorized at three levels of detail — xiii.1.c

→ Have informants categorize a sample of incidents at the lowest level of detail obtained — xiv.1 → Sample of 100 incidents categorized using the most detailed set of categories — xv.1

B.1.5.1

DETERMINING AT WHICH CATEGORY LEVEL TO REQUIRE INFORMANTS TO CATEGORIZE THE SAMPLE OF 100 INCIDENTS

DECISION MATRIX

CONDITIONS	Criterion behavior summarized by Level I categories	Criterion behavior summarized by Level I and II categories	Criterion behavior summarized by Level I, II, and III categories
ACTION TO TAKE	*Have informants assign <u>each</u> of the 100 incidents to one of the Level I categories (the <u>lowest</u> level obtained)*	*Have informants assign <u>each</u> of the 100 incidents to one of the Level I categories (the <u>lowest</u> level obtained)*	*Have informants assign <u>each</u> of the 100 incidents to one of the Level I categories (the <u>lowest</u> level obtained)*

Sub-Sub-STEP B.1.5.2

JOB DIAGRAM III

INPUT	ACTION	OUTPUT
Results of the 10 individual categorizations xiii.1	Compute the degree of agreement among the 10 informants on the categorization of incidents xiv.1	Estimate of the reliability of use of the category system xv.1

2

70% of informants agree on categorization of 70% of the incidents xiii.2.a	Judge category scheme to be RELIABLE xiv.2.a	Judgment of category reliability xv.2.a
70% of informants agree on categorization of less than 70% of the incidents xiii.2.b	Judge category scheme to be UNRELIABLE xiv.2.b	Judgment of category unreliability xv.2.b

B.1.5.2

CRITERIA FOR IDENTIFYING THE RELIABILITY (I.E., CONSISTENCY OR AGREEMENT AMONG INFORMANTS) OF THE CATEGORY SYSTEM

IDENTIFICATION MATRIX

CRITERIA	*-For an incident,* *a minimum of 7/10 (70%) of the informants* *categorize it the same way as the developer of the category system* *PLUS* *-This kind of agreement should be obtained for* *approximately 70/100 (70%) of the incidents*	*-This kind of agreement is obtained for* *less than 70/100 of the incidents*
JUDGMENT OF RELIABILITY	Category system is relatively RELIABLE	Category system is relatively UNRELIABLE
ACCEPTABILITY OF THE CATEGORIES	Need not be revised	Needs to be revised

Sub-Sub-STEP B.1.5.3

INPUT	ACTION	OUTPUT
3 (If) the categorization is unreliable xiii.3	Revise the category system to remove sources of unreliability xiv.3	Revised category system xv.3

High agreement among informants about an incorrectly categorized incident xiii.3.a	Analyze for primary identification of source of confusion xiv.3.a	Primary source of information about remedy for category system xv.3.a
Low agreement among informants about an incorrectly categorized incident xiii.3.b	Analyze for secondary identification of confusion xiv.3.b	A secondary, less useful source of information about remedy for category system xv.3.b

B.1.5.3

CRITERIA FOR DETERMINING WHICH WRONGLY CATEGORIZED INCIDENTS SHOULD BE ANALYZED FOR SOURCES OF CONFUSION

IDENTIFICATION MATRIX

CRITERIA	-*Incidents which are wrongly categorized by* *the largest number of informants* *PLUS* -*There is high agreement among those who wrongly categorized the incident* *i.e., they assign it to the same, wrong category* *(the confusion is systematic)*	-*Incidents which are wrongly categorized by* *the smallest number of informants* *OR* -*Even if a large number of informants wrongly categorize it,* *there is low agreement among those who wrongly categorized the incident* *i.e., they assign it to various, wrong categories* *(the confusion is random)*
USEFULNESS IN ANALYZING CONFUSIONS	USEFUL	LESS USEFUL

EXAMPLES	-Incidents which six or more informants wrongly classify or categorize AND -The six or more informants tend to assign the same incident to the same, wrong category; (three or more of the six do this)	-Incidents which four or five informants wrongly classify or categorize OR -Even if six or more wrongly categorized it, no more than two informants assign it to the same, wrong category

B.1.5.3 | DETERMINING WHETHER AND HOW TO ANALYZE INCIDENTS WRONGLY CATEGORIZED

DECISION MATRIX

CONDITIONS	Incidents are wrongly categorized in a SYSTEMATIC way (are useful to analyze)	Incidents are wrongly categorized in a NON-SYSTEMATIC or random way (are more difficult to analyze)
ACTION TO TAKE	*(1) Inspect the two (or more) categories involved:* *i.e., the correct category and the wrong category which a large percentage of the informants agreed on* *(2) Look for overlap or similarity in wording as source of confusion* *(3) Make the category headings distinctly different*	*Inspect these incidents for less obvious sources of confusion*

B.1.5.3 | CRITERIA FOR DETERMINING ADEQUACY OF CATEGORY LABELS OR DESCRIPTIONS

STANDARDS MATRIX

ADEQUACY OF CATEGORY LABELS	ADEQUATE	INADEQUATE
CRITERIA	*-Categories comprehensively cover all behaviors* *-Category headings:* *••are mutually exclusive* *••are brief but complete* *••use verb phrases (when behavior is described)* *••require no qualification, e.g., "except for"*	*-Categories omit relevant behavior* *-Category headings:* *••overlap* *••are too long* *••use noun phrases when behavior is described* *••require qualification*

STEP B.1

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
B.1.1		-Determined required number of incidents and required number of informants		
B.1.2		-Selected informants and methods for obtaining information from them		
B.1.3	-Adequacy of sample size	-Collected incidents until sample size is judged adequate	-Preliminary categorization of incidents	-A.5(1)-(3) -A.5(15) or A.5(16)
B.1.4	-Contingent and non-contingent categories of behavior	-Sequenced contingent categories	-Complete categorization of incidents	
B.1.5		-Assessed reliability of categorization -Revised categories (when necessary)		

With the completion of Sub-STEP B.1.5, additional analyses of terminal behavior are performed as per the steps beginning with Step B.3.3.

STEP B.2 *

B.2 Plan the sequence for collecting from individual "performance" experts or "knowledge domain" experts the types of information needed to perform the various, required types of analysis of criterion behavior.

B.2.1 Schedule the simultaneous or successive collection of different types of information needed for the analysis of criterion behavior.

B.2.2 Plan the order in which information about the various constituent parts of criterion behavior will be collected.

B.2.3 Plan the elimination of redundant information collection and recording.

*Step B.2 is not performed if Step B.1 has been performed, and vice versa.

STEP B.2

OVERVIEW

INPUT	ACTION	OUTPUT
Nature of expertise of informant/expert and type of criterion behavior	Plan the sequence of information collection	Schedule order for collecting different types of information needed to analyze criterion behavior

Sub-STEPS

B.2.1	Nature of expertise of the informant/expert — i	Schedule the order of collecting different types of information — ii	Plans for simultaneous or successive collection of different types of information — iii
B.2.2	Nature of criterion behavior — iv	Schedule the order in which levels of information detail will be obtained — v	Plans for sequence in which broad and specific levels of information detail will be obtained — vi
B.2.3	Nature of criterion behavior — vii	Review the criterion behavior and plan the elimination of redundant information collection when possible — viii	Anticipated reduction in information processing and recording — ix

STEP B.2

PAGE INDEX

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*Plans to collect needed types of information about the criterion from one or more informants.*
WHAT YOU WILL WORK FROM	(1) Identification of the nature of the expertise possessed by an informant/expert.
WHAT YOU WILL DO	(1) Schedule the order in which types of information will be collected.
FORMS YOU WILL USE	None.

DESCRIPTION OF Sub-STEP	B.2.1

INPUT	ACTION	OUTPUT
Nature of expertise of the informant/expert i	Schedule the order of collecting different types of information ii	Plans for simultaneous or successive collection of different types of information iii

Job Aid Contents

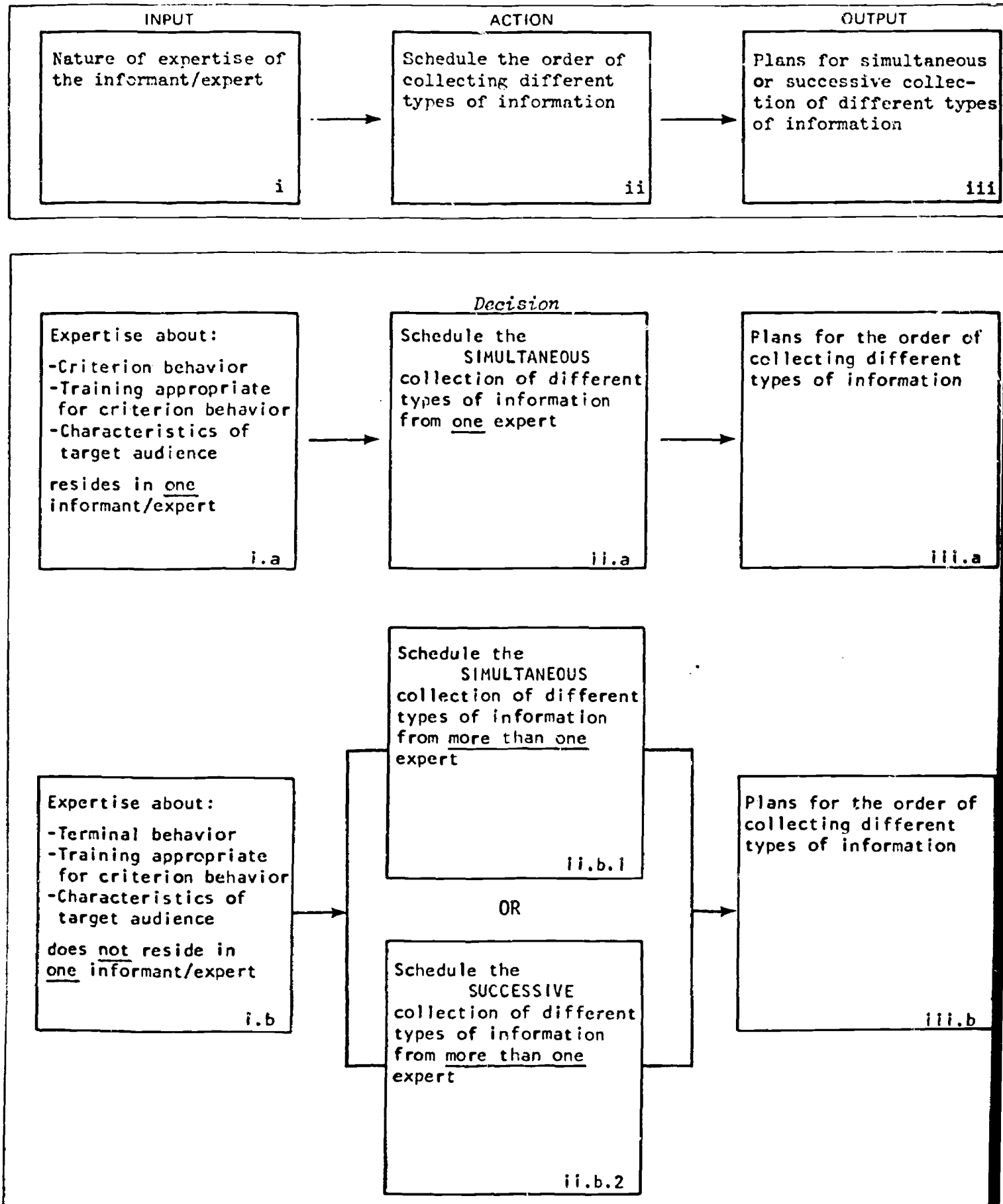
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Type of informant expertise . . . 62	-MATRIX: Scheduling collection of information from different sources 67		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of available experts	A.3.2			

Sub-STEP B.2.1

JOB DIAGRAM



JOB PROCEDURES

B.2.1

CRITERIA FOR DETERMINING WHETHER A PERFORMANCE OR KNOWLEDGE DOMAIN INFORMANT IS SUITABLE TO PROVIDE INFORMATION ABOUT TRAINING/INSTRUCTION REQUIREMENTS OR ABOUT THE TARGET AUDIENCE

IDENTIFICATION MATRIX

CRITERIA	*Informant has been responsible for training personnel for job performance* OR *Informant has been responsible for providing instruction in subject matter areas involving either "performance" or "knowledge domain"*	*Informant has NOT been responsible for training personnel for job performance* OR *Informant has NOT been responsible for providing instruction in subject matter areas involving either "performance" or "knowledge domain"*
SUITABILITY FOR PROVIDING INFORMATION NEEDED	SUITABLE	UNSUITABLE

"JOB" EXAMPLE	Training director who is also proficient at the criterion behavior	Supervisor, proficient at the criterion behavior, but who has never taught the criterion behavior
"SUBJECT MATTER" EXAMPLE	Biology teacher familiar with a particular grade level	Curriculum specialist in biology who has not taught (at all) or has not taught at a particular grade level

B.2.1

DECISION MATRIX

DETERMINING WHETHER TO COLLECT THE INFORMATION NEEDED FOR DIFFERENT TYPES OF ANALYSIS AT THE SAME TIME OR AT DIFFERENT TIMES

CONDITIONS	Informant who is expert about "performance" and/or about "knowledge domain" is <u>also</u> expert about: -training or instruction required -entering skills of the target population	Informant who is expert about "performance" and/or about "knowledge domain" is <u>NOT</u> expert about: -training or instruction required -entering skills of the target population
ACTION TO TAKE	*For <u>each</u> sub-STEP or sub-sub-STEP in a PERFORMANCE area (taking the lowest level obtained), or* *For <u>each</u> topic or sub-topic in a KNOWLEDGE DOMAIN (taking the lowest level obtained),* *Perform a Task Description* *AND* *<u>at the same time</u>* *Gather information for the following analyses:* *-a task analysis* *-a learning analysis* *-an audience analysis* *AND* *<u>at a later time</u>* *Do the following yourself:* *-a mode analysis*	*For <u>each</u> sub-STEP or sub-sub-STEP in a PERFORMANCE area (taking the lowest level obtained), or* *For <u>each</u> topic or sub-topic in a KNOWLEDGE DOMAIN (taking the lowest level obtained),* *Perform a Task Description* *AND* *<u>at a later time</u>* *Gather information from <u>other</u> informants for the following analyses:* *-a task analysis* *-a learning analysis* *-an audience analysis* *AND* *<u>at a later time</u>* *Do the following yourself:* *-a mode analysis*
DIAGRAM	same time ①: *from informant #1* task description + *from informant #1* task analysis, learning analysis, audience analysis later time ②: *(yourself)* mode analysis	①: *from informant #1* task description ②: *from informants #2, #3, etc.* task analysis, learning analysis, audience analysis ③: *(yourself)* mode analysis

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*Plans for the order in which information at varying levels of detail will be collected.*
WHAT YOU WILL WORK FROM	(1) Identification of the criterion behavior as being: ... complex/non-complex ... easy to summarize/difficult to summarize
WHAT YOU WILL DO	(1) Make scheduling plans about the order in which broad and then increasingly narrower descriptions of the criterion behavior will be obtained.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.2.2

INPUT	ACTION	OUTPUT
Nature of criterion behavior iv	Schedule the order in which levels of information detail will be obtained v	Plans for sequence in which broad and specific levels of information detail will be obtained vi

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Judging complexity of criterion behavior . . 72, 73 -MATRIX: When is criterion behavior contingent . . . 74	-MATRIX: Order of collecting information at different detail levels . . . 75-79		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of complexity of "performance"	A.5.2 (a)			
Identification of difficulty of summarizing "knowledge domain"				

Sub-STEP B.2.2

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Nature of criterion behavior iv	Schedule the order in which levels of information detail will be obtained v	Plans for sequence in which broad and specific levels of information detail will be obtained vi
-Complex performance -Knowledge domain difficult to summarize iv.a	Plan to organize information collection by starting at broad levels of detail--working down to more specific levels v.a	Plans for order of information collection vi.a
-Non-complex performance -Knowledge domain not difficult to summarize iv.b	Plan to organize information collection by starting at relatively specific levels of detail v.b	Plans for order of information collection vi.b

JOB PROCEDURES

B.2.2

CRITERIA FOR IDENTIFYING WHETHER PERFORMANCE IS LIKELY TO BE COMPLEX OR SIMPLE

IDENTIFICATION MATRIX

CRITERIA	*Performance consists of:* *-Long chains* *-Difficult discriminations or generalizations* *-Difficult associations*	*Performance consists of:* *-Short chains* *-Relatively easy discriminations or generalizations* *-Relatively easy associations*
JUDGMENT OF COMPLEXITY	Relatively COMPLEX Performance	Relatively SIMPLE Performance

EXAMPLES	-Developing a science curriculum -Developing a computer program -Flying an airplane -Carrying out a research project -Deriving a statistical formula	-Doing addition or subtraction -Drawing a map in geography -Bisecting an angle in geometry -Reciting a four line poem -Solving for an unknown in a statistical formula

B.2.2

CRITERIA FOR IDENTIFYING WHETHER KNOWLEDGE DOMAIN IS LIKELY TO BE DIFFICULT OR EASY TO SUMMARIZE

IDENTIFICATION MATRIX

CRITERIA	*-Involves a relatively large body of knowledge* *AND* *-Various parts in the body of knowledge are integrated or interrelated (i.e., terminal behavior involves one part dependent on terminal behavior in another)*	*-Involves a relatively small body of knowledge* *AND* *-Various parts in the body of knowledge are not integrated or related (i.e., terminal behavior does not involve one part dependent on terminal behavior in another)*
JUDGMENT OF DIFFICULTY	Knowledge domain is relatively DIFFICULT to summarize	Knowledge domain Is relatively EASY to summarize

EXAMPLES	-Physics -Chemistry -Psychology -Mathematics -Art appreciation -Philosophy -Economics -History	-Any small subdivision of the areas in the left-hand column -Rules for removing common types of household stains -Names of children in a teacher's homeroom -Description of properties of a single drug

6.2.2

CRITERIA FOR IDENTIFYING CONTINGENT AND NON-CONTINGENT BEHAVIOR (AT EITHER THE TASK, STEP, OR SUB-STEP LEVELS)

IDENTIFICATION MATRIX

CRITERIA	*The OUTPUT of a behavior becomes the INPUT of the next behavior in a sequence of behaviors* *i.e., the OUTPUT of one task becomes the INPUT for the next task, or* *i.e., the OUTPUT of one step becomes the INPUT for the next step, or* *i.e., the OUTPUT of one sub-step becomes the INPUT for the next sub-step*	*The OUTPUT of a behavior does NOT become the INPUT of the next behavior in a sequence of behaviors* *It is a self-contained, separate behavior* *i.e., the OUTPUT of a task marks the end of the behavior; it does not become the input for another task* *i.e., the OUTPUT of a step marks the end of the behavior; it does not become the INPUT for another step* *i.e., the OUTPUT of a sub-step marks the end of the behavior; it does not become the input for another sub-step*
TYPE OF BEHAVIOR	CONTINGENT BEHAVIORS	NON-CONTINGENT BEHAVIORS
"TASK" EXAMPLE	CONTINGENT TASKS e.g., from the instructional development process: -IDENTIFY OBJECTIVES -FORMULATE INSTRUCTIONAL STRATEGIES -DEVELOP INSTRUCTIONAL MATERIALS -TRY OUT INSTRUCTIONAL MATERIALS -REVISE MATERIALS Etc. *The performance of each of these tasks is contingent on the output of a preceding task*	NON-CONTINGENT TASKS e.g., from performance of hospital attendants for mentally retarded patients: -CHECKING AND OBSERVING -TRAINING THE PATIENT FOR SELF-CARE -CONTROLLING RELUCTANT OR UNDESIRABLE BEHAVIOR -RECOGNIZING AND RESPONDING TO EMOTIONAL NEEDS -PREVENTING INJURY TO PATIENT Etc. *The performance of each of these tasks is not contingent on the output of a preceding task*
"STEP" EXAMPLE	CONTINGENT STEPS (within the same task) TASK: *TRY OUT INSTRUCTIONAL MATERIALS* STEPS: *-Reproduces sufficient copies of materials for tryout population* *-Administers materials and tests to population* *-Collects data on tryout* *-Analyzes data* *The performance of each of these steps is contingent on the output of a preceding step*	NON-CONTINGENT STEPS (within the same task) TASK: *RECOGNIZING AND RESPONDING TO EMOTIONAL NEEDS* STEPS: *-Considers patient's feelings* *-Considers patient's preferences whenever possible* *-Maintains a calm, positive and supportive attitude* *-Shows impartiality and consistency in patient care* *The performance of each of these steps is not contingent on the output of a preceding step*

B.2.2

DECISION MATRIX

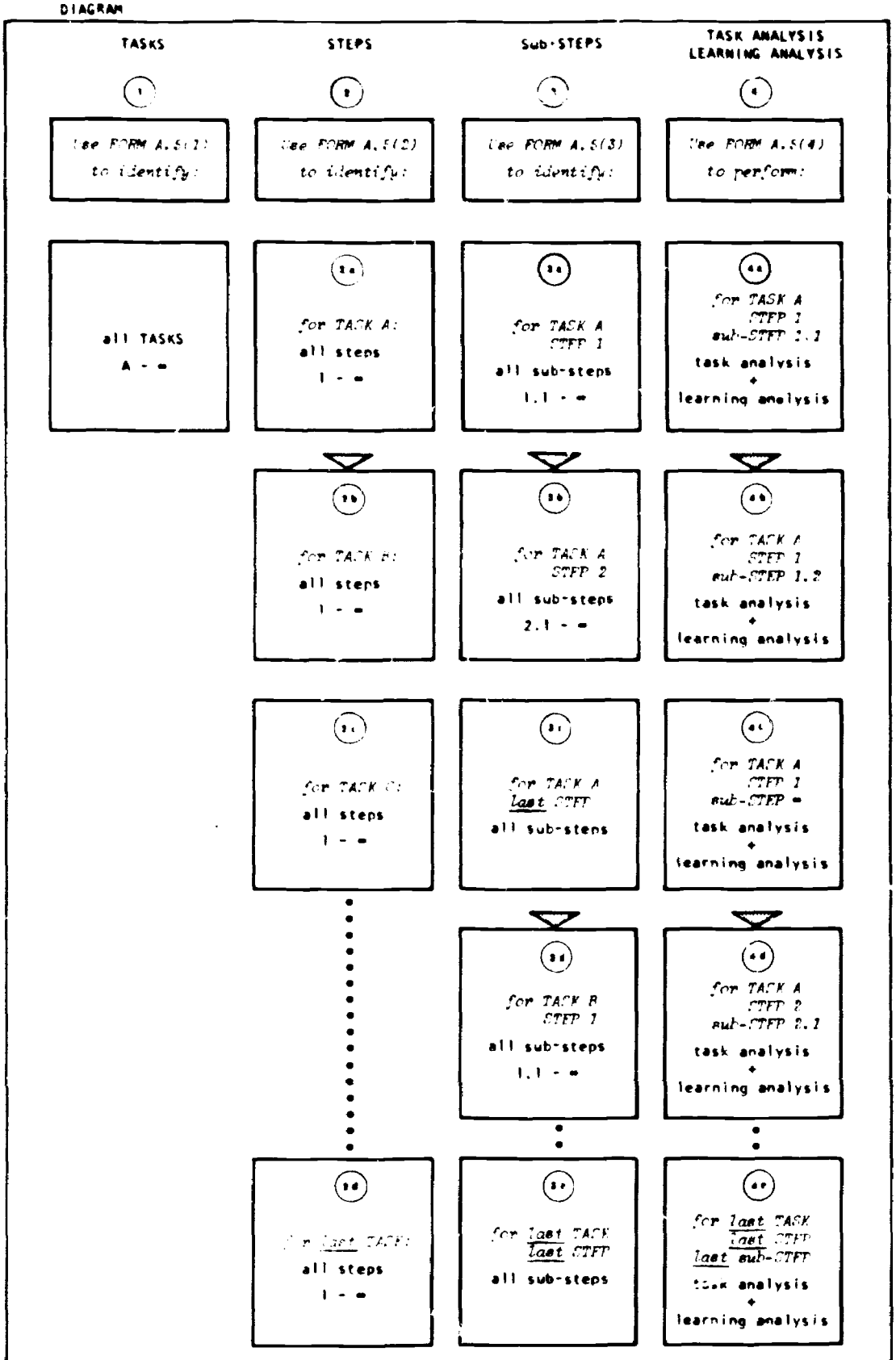
DETERMINING THE ORDER OF INFORMATION COLLECTION ABOUT "PERFORMANCE" THAT IS CONTINGENT

CONDITIONS	"Performance" under study is CONTINGENT and is relatively COMPLEX	"Performance" under study is CONTINGENT and is NOT COMPLEX
ACTION TO TAKE	*PLAN AS FOLLOWS:* (1) *First, have all the major tasks identified in the order of their contingency (i.e., in the proper sequence).* *USE FORM A.5(1)* (2) *Second, one task at a time, have all the steps within a task identified.* *Complete for all tasks* *USE FORM A.5(2)* (3) *Third, starting with the first step in the first task, have all the sub-steps identified* *Repeat for all other steps in the first task; and then, go on to the second task and continue the same process* *Complete for all steps in all tasks* *USE FORM A.5(3)* (4) *Fourth, starting with the first sub-step in the first step of the first task, perform a task analysis* *USE FORM A.5(4)* *Also, perform a learning analysis (if informant can provide the information)* *Repeat the process in (4) for the second sub-step* *Repeat for the sub-step after it and so on until all sub-steps in the first step have been completed* *Repeat for the next step and all the other steps until the first task has been completed.* *Repeat the process for the next task; and when that is completed, the next* *Complete for all tasks* SEE DIAGRAM ON OPPOSITE PAGE	*PLAN AS FOLLOWS:* (1) *First, have all the sub-steps identified starting with the first and proceeding sequentially* *USE FORM A.5(3)* (2) *Second, starting with the first sub-step, perform a task analysis* *USE FORM A.5(4)* *Also, perform a learning analysis (if the informant can provide the information).* (3) *Third, repeat this process for each sub-step in the sequence until all sub-steps have been analyzed*

B.2.2

ILLUSTRATION OF RECOMMENDED ORDER OF INFORMATION COLLECTION WHEN PERFORMANCE IS CONTINGENT AND RELATIVELY COMPLEX

DIAGRAM



B.2.2

DECISION MATRIX

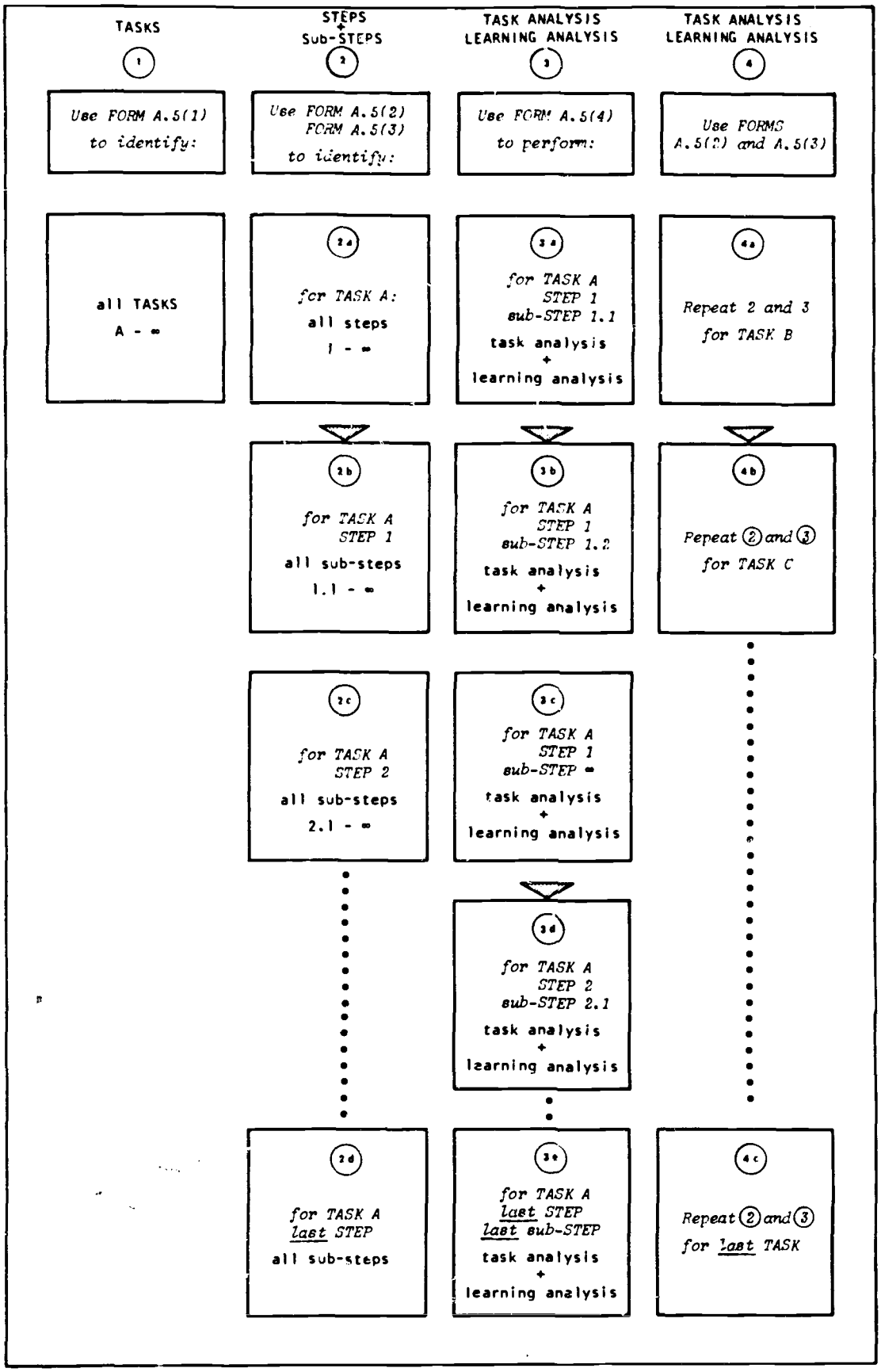
DETERMINING THE ORDER OF INFORMATION COLLECTION ABOUT "PERFORMANCE" THAT IS NON-CONTINGENT

CONDITIONS	"Performance" under study is NON-CONTINGENT and is relatively COMPLEX	"Performance" under study is NON-CONTINGENT and is NOT COMPLEX
ACTION TO TAKE	*PLAN AS FOLLOWS:* *(1) First, have all the major tasks identified.* *USE FORM A.5(1)* *(2) Have all the steps in the first task identified.* *USE FORM A.5(2)* *Have all the sub-steps in the first step (of the first task) identified.* *USE FORM A.5(3)* *Repeat for the second step, and then the third, and so on until all sub-sub-steps for all steps in the first task have been identified.* *(3) Perform a task analysis and a learning analysis for each sub-step in the first step (of the first task).* *Repeat for all sub-steps in the first step. Repeat for all the next steps until all steps have been completed for the first task.* *(4) Repeat (2) and (3) for all the other tasks, one task at a time.*	*PLAN AS FOLLOWS:* *(1) First, have all the self-contained and non-contingent sub-steps identified.* *USE FORM A.5(3)* *(2) Do a task analysis and a learning analysis (whenever possible) for each self-contained sub-step.* *USE FORM A.5(4)* *(3) Complete for each self-contained sub-step before moving on to another (Order in which the different sub-steps are treated is not relevant).*

B.2.2

ILLUSTRATION OF RECOMMENDED ORDER OF INFORMATION COLLECTION WHEN PERFORMANCE IS NON-CONTINGENT AND RELAT'VELY COMPLEX

DIAGRAM



B.2.2

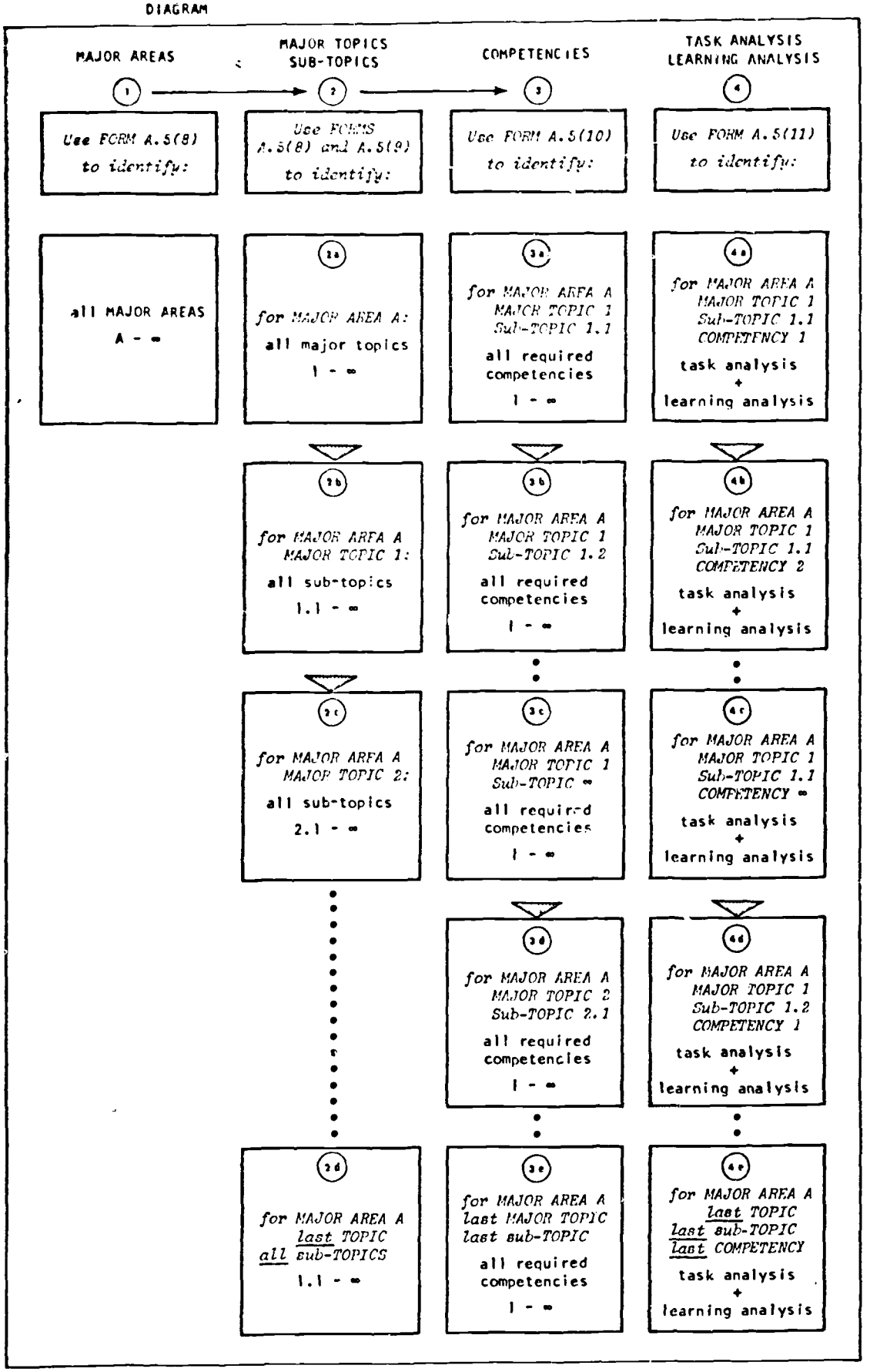
DETERMINING THE ORDER OF INFORMATION COLLECTION ABOUT "KNOWLEDGE DOMAINS" BASED ON THE DIFFICULTY IN SUMMARIZING THEM

DECISION MATRIX

CONDITIONS	"Knowledge domain" under study is relatively DIFFICULT to summarize	"Knowledge domain" under study is NOT DIFFICULT to summarize
ACTION TO TAKE	*PLAN AS FOLLOWS:* *(1) First, have all the major areas identified in the order in which they are currently taught.* *USE FORM A.5(8)* *(2) Second, complete all of the following for the first major area (before going on to the second):* *(a) Have all the major topics identified.* *USE FORM A.5(8)* *(b) Starting with the first major topic, have all the sub-topics and sub-sub-topics identified.* *USE FORM A.5(9)* *(c) Repeat (b) for all other major topics.* *(3) (d) Starting with the first sub-topic within the first major topic (or sub-sub-topic, if obtained), identify the types of competencies required.* *USE FORM A.5(10)* *(e) Repeat (d) for all other sub-topics within the first major topic.* *(f) Repeat (d) and (e) for the next major topic; then the next major topic, and so on.* *(4) Analyze skill elements for each competency identified, for every sub-topic proceeding from the first sub-topic within the first major topic to the last sub-topic within the last major topic.* *Also, perform a learning analysis at the same time (when possible).* *(5) Repeat procedures in (2), (3), and (4) for all other major areas, finishing all procedures for one area before moving on to the next.* SEE DIAGRAM ON OPPOSITE PAGE	*PLAN AS FOLLOWS:* *(1) First, have all the sub-topics identified.* *USE FORM A.5(9)* *(2) Second, starting with the first sub-topic, identify the types of competencies.* *USE FORM A.5(10)* *(3) Repeat (2) for all sub-topics.* *(4) Perform a skill analysis and a learning analysis together (whenever possible) for all terminal behaviors.* *USE FORM A.5(11)*

B.2.2 ILLUSTRATION OF RECOMMENDED ORDER FOR COLLECTING INFORMATION ABOUT DIFFICULT-TO-SUMMARIZE KNOWLEDGE DOMAIN

DIAGRAM



*Repeat all procedures in 2-4 for MAJOR AREA B; then for C, and so on until all major areas have been covered.

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*Plans to eliminate the collection of information about criterion behaviors which are repetitive - as a means of reducing the amount of information processing and recording.*
WHAT YOU WILL WORK FROM	(1) Identification of the criterion behavior to be studied as involving repetitive vs. non-repetitive elements.
WHAT YOU WILL DO	(1) Plan to eliminate redundant information collection.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.2.3

INPUT	ACTION	OUTPUT
Nature of criterion behavior vii	Review the criterion behavior and plan the elimination of redundant information collection when possible viii	Anticipated reduction in information processing and recording ix

Job Aid Contents

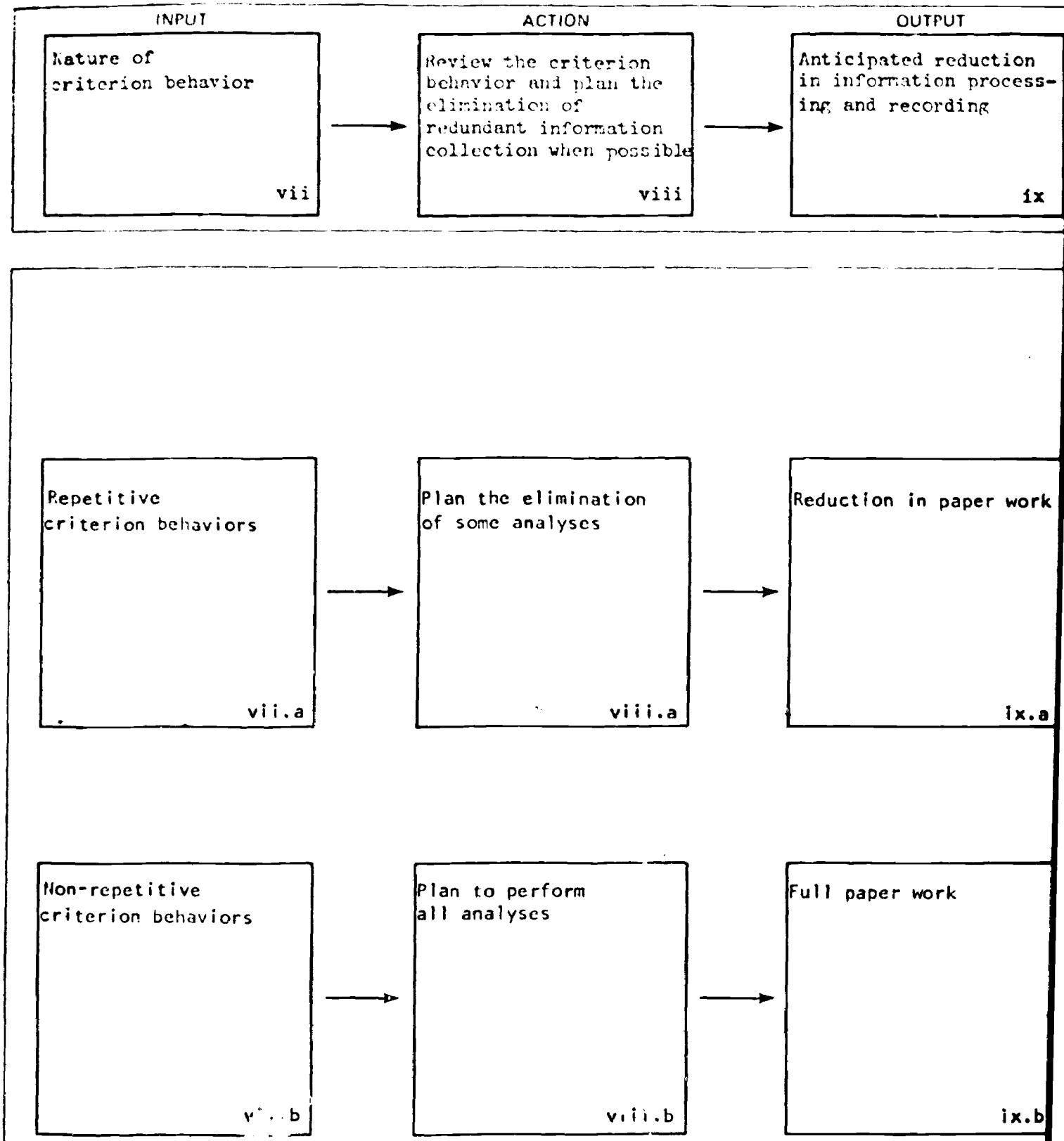
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Repetitiveness of criterion behaviors . . . 84 -MATRIX: Which analyses to eliminate or reduce 86	-MATRIX: Elimination of information processing or recording . . . 85		

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Review of type of criterion behavior	A.1			

Sub-STEP B.2.3

JOB DIAGRAM



JOB PROCEDURES

B.2.3

CRITERIA FOR IDENTIFYING TYPES OF CRITERION BEHAVIOR WHICH ARE REPEATED THROUGHOUT A CURRICULUM OR TRAINING PROGRAM

IDENTIFICATION MATRIX

CRITERIA	*Criterion behaviors involve one or more of the following:* *-Simple repetition of skill elements* *-Identical mode of input, action, or output throughout*	*Criterion behaviors involve one or more of the following:* *-Considerable variation in skill elements* *-Considerable variation in mode of input, action, or output*
DEGREE OF REPETITION	heavily REPETITIVE	NOT heavily REPETITIVE
EXAMPLES "Skill Elements"	e.g., learning to associate foreign language equivalents of English words (hundreds or thousands of words) e.g., criterion behavior consists largely of defining concepts	e.g., learning to implement the grammar rules of a foreign language e.g., criterion behavior consists of defining concepts, giving examples of concepts, comparing concepts to related concepts, etc.
EXAMPLES "Mode of Input, Action, or Output"	e.g., subject matter is solely or largely verbal (input, action, and output) -economics -history -philosophy -sociology e.g., performance is almost completely perceptual-motor -sports -driving -operating equipment	e.g., subject matter involves mixed modes - visual, verbal, and/or auditory -music -botany -chemistry -engineering e.g., performance involves multiple modes -troubleshooting equipment (visual, verbal) (perceptual, motor), etc.

B.2.3

DETERMINING WHETHER IT IS NECESSARY TO REPEAT ANALYSES

DECISION MATRIX

CONDITIONS	-One analysis provides all essential information -Virtually no new information is forthcoming by repeated analyses	-One short analysis provides key but incomplete information -While new information could be used and is desirable, it is not essential and may be eliminated for economic reasons	-One short analysis does NOT provide all essential information -New information is forthcoming and necessary from separate analysis of different elements of criterion behavior
ACTION TO TAKE	*UNNECESSARY TO REPEAT ANALYSES*	*DESIRABLE BUT UNECONOMICAL TO REPEAT ANALYSES*	*NECESSARY TO REPEAT ANALYSES*
EXAMPLES	-Mode of input, action, and/or output are identical throughout e.g., *in philosophy inputs and actions, terminal behavior is solely verbal* e.g., *it is also decided that "production" rather than "recognition" will be required* Therefore, it is necessary to perform a mode analysis only once.	-Skill elements are identical throughout e.g., *learning foreign language vocabulary* Having diagrammed the association problem once, it is unnecessary to repeat it. While a learning analysis for each word might be useful, it is uneconomical to do so.	-Skill elements vary throughout -Mode of input, action, or output varies throughout e.g., *highly complex performance, such as managing classroom behavior*

B.2.3

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING CONDITIONS UNDER WHICH EACH OF SIX TYPES OF ANALYSIS MIGHT BE SHORTENED

TYPES OF ANALYSIS	TASK DESCRIPTION	TASK ANALYSIS	LEARNING ANALYSIS	MODE ANALYSIS	COMPETENCY LEVEL ANALYSIS	AUDIENCE ANALYSIS
CRITERIA	*None*	*-Skill elements widely repeated and* *-Uneconomical to repeat*	*-Skill elements widely repeated* *-Uneconomical to repeat analysis*	*-Identical mode of input, action, or output* *heavily repeated*	*-Types of terminal behavior widely repeated* *-Uneconomical to repeat analysis*	*None*

STEP B.2

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
B.2.1	-Suitability of informant to provide information regarding learning and audience analysis	-Scheduled the use of one or more types of informants		
B.2.2		-Scheduled the order of information collection		
B.2.3	-Repetitive criterion behaviors	-Planned elimination of redundant information collection or recording		

STEP 9.3

B.3 Collect "task description" information about criterion behavior.#

#*For relatively non-complex "performance" start at B.3.3*

B.3.1 Collect description of criterion behavior at the highest level of generality: "performance" TASKS.

B.3.2 Collect description of criterion behavior at an intermediate level of generality: "performance" STEPS.

B.3.3 Collect description of criterion behavior at the lowest level of generality: "performance" Sub-STEPS (or Sub-Sub-STEPS).

//*Not a sequence*

B.3.4* Collect information organizing "knowledge domain" into units at varying levels of generality.

B.3.5* Collect descriptions of terminal behaviors indicating mastery in a "knowledge domain."

**For KNOWLEDGE DOMAINS only*

STEP B.3

OVERVIEW

INPUT	ACTION	OUTPUT
Expert informant and criterion behavior to be described	Ask questions designed to get description of criterion behavior at varying levels of detail	Description of PERFORMANCE at task, step, and sub-step levels

B.3.1	Expert informant and particular criterion behavior to be described (i)	Ask questions designed to get description of criterion behavior at highest level of generality (ii)	Listing of TASKS providing an overview of the total performance on Form A.5(1) (iii)
B.3.2	List of TASKS involved in "performance" (iv)	Ask informant for description of STEPS within each TASK (for all tasks) (v)	Listing of all STEPS in each TASK on FORM A.5(2): providing an overview of each TASK (vi)
B.3.3	List of STEPS involved in each TASK (vii)	Ask informant for description of Sub-STEPS within each STEP (for all steps and all tasks) (viii)	Listing of all Sub-STEPS within each STEP on Form A.5(3) providing a detailed and specific description of procedures to follow (ix)
B.3.4	Knowledge domain to be sub-divided into constituent units and units described (x)	Ask informant to sub-divide and describe knowledge domain into units at varying levels of generality (xi)	Listing of all: MAJOR AREAS MAJOR TOPICS Sub-TOPICS (Sub-Sub-TOPICS) on FORMS A.5(8) and (9) (xii)
B.3.5	Identification of specific Sub-TOPICS (or Sub-Sub-TOPICS): facts, concepts, principles, etc. (xiii)	Ask informant to describe criterion behavior involving the Sub-TOPIC (or Sub-Sub-TOPIC), and then record or classify it for required level of competency (xiv)	Description and cross-referencing of criterion behavior on FORM A.5(10) at competency level I, II, III, or IV (xv)

STEP B.3

PAGE INDEX

	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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B.3.3		-MATRIX: How to meet task description goals 116	-MATRIX: Completeness of task description . . 117 -MATRIX: Appropriate levels of generality . . . 118 -MATRIX: Performance requirements . . 119	FORM A.5(3) SUMMARY OF PROCEDURES . . 1[illegible]
B.3.4*	-MATRIX: Unit sizes in sub-dividing knowledge domains 127	-MATRIX: How to sub-divide total knowledge domains into units . . .128	-MATRIX: Adequacy of sub-division of knowledge domain . 126. 129	FORM A.5(8) FORM A.5(9) SUMMARY OF PROCEDURES . . 130
B.3.5*	-MATRIX: Specific vs. classes of inputs or [illegible]tions . . . . 136 -MATRIX: Old vs. new class examples . . . 137 -MATRIX: Recall vs. transfer requirements . 138 -MATRIX: Old/new and recall/ transfer . . . 139	-MATRIX: Classifying criterion behavior into competency levels . . . . . .142 -MATRIX: How to meet "description" goals . . . . . 143 -MATRIX: When to use a sample of examples vs. all examples 139	-MATRIX: Correct classification . . 142 -MATRIX: Objectivity of descriptions . . . 144 -MATRIX: Completeness of descriptions . . . 146 -MATRIX: Criterion behavior requirements . . . 147	FORM A.5(10) SUMMARY OF PROCEDURES . . 148

*For KNOWLEDGE DOMAIN only

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A listing of all the major TASKS reaching up the total criterion behavior recorded on FORM A.5(11).*
WHAT YOU WILL WORK FROM	(1) Informant expertise.
WHAT YOU WILL DO	(1) Ask questions of informant (and record results) designed to get descriptions of broad chunks of the criterion behavior.
FORMS YOU WILL USE	FORM A.5(1) for recording of the list of the broad tasks as involved in the total performance.

DESCRIPTION OF Sub-STEP	B.3.1

INPUT	ACTION	OUTPUT
Expert informant and particular criterion behavior to be described i	Ask questions designed to get description of criterion behavior at highest level of generality ii	Listing of TASKS providing an overview of the total performance on Form A.5(1) iii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Size of functional units . . . . . 96 -MATRIX: Number of possible broad functional units in a total performance . . 97	-MATRIX: Rules for number of functional units . . . . . 98 -MATRIX: Identifying TASKS . . . 99	-MATRIX: Adequacy of descriptive titles 100	FORM A.5(1) SUMMARY OF PROCEDURES . . . 101

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Schedule for information collection	B.2			A.5(1): SUMMARY OF TASKS

Sub-STEP B.3.1

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Expert informant and criterion behavior to be described — i	Ask questions designed to get description of criterion behavior at highest (broadest) level of generality — ii	Listing of TASKS providing an overview of the total performance on FORM A.5(1) — iii
BROAD functional units — i.a	Identify and label as TASKS — ii.a	Total performance divided into TASKS — iii.a
NARROW functional units — i.b	Identify and label as STEPS or Sub-STEPS — ii.b	Tasks divided into STEPS and Sub-STEPS — iii.b

JOB PERFORMANCE

B.3.1 CRITERIA FOR IDENTIFYING THE SIZE OF FUNCTIONAL UNITS OF "PERFORMANCE"

IDENTIFICATION MATRIX

CRITERIA	*Functional units which have:* *-An identifiable beginning and end* *-An identifiable goal or end result* *AND* *-Involve many steps and sub-steps (i.e., are complex)*	*Functional units which have:* *-An identifiable beginning and end* *-An identifiable goal or end result* *BUT* *-Do not involve many steps and sub-steps (i.e., are not complex)*
SIZE OF FUNCTIONAL UNITS	BROAD* functional units	NARROW functional units

**The same performance can be divided into different functional units varying in breadth.*

EXAMPLES of Performance Differing in the Number of Constituent Steps or Sub-Steps	-Developing tests	VS.	-Developing a test item
	-Developing a curriculum	VS.	-Developing one lesson plan
	-Conducting an experiment	VS.	-Selecting a sample

B.3.1

CRITERIA FOR IDENTIFYING THE NUMBER OF BROAD FUNCTIONAL UNITS INTO WHICH THE SAME TOTAL PERFORMANCE MAY BE DIVIDED

IDENTIFICATION MATRIX

CRITERIA	*When the functional units are LESS INCLUSIVE*	*When the functional units are MORE INCLUSIVE*
NUMBER OF BROAD FUNCTIONAL UNITS	A LARGER number of broad functional units will result	A SMALLER number of broad functional units will result

EXAMPLES (Both examples are acceptable divisions of the same total performance into functional units)	THE DEVELOPMENT PROCESS A. PLAN INFORMATION COLLECTION B. COLLECT INFORMATION C. ANALYZE INFORMATION D. CREATE AND SEQUENCE LESSON UNITS E. STATE OBJECTIVES F. ASSESS SIMULATION NEEDS G. DEVELOP TESTS H. FORMULATE INSTRUCTIONAL STRATEGIES I. DEVELOP INSTRUCTIONAL MATERIALS J. EVALUATE AND REVISE INSTRUCTIONAL MATERIALS	THE DEVELOPMENT PROCESS A. COLLECT AND ANALYZE INFORMATION B. STATE OBJECTIVES AND DEVELOP TESTS C. FORMULATE STRATEGIES AND DEVELOP INSTRUCTIONAL MATERIALS D. EVALUATE AND REVISE INSTRUCTIONAL MATERIALS

B.3.1

RULES OF THUMB IN DIVIDING A TOTAL PERFORMANCE INTO BROAD FUNCTIONAL UNITS

DECISION MATRIX

GOALS	CONVENIENCE in performing and keeping records of subsequent analysis	Having an OVERVIEW of the total performance	SEQUENCING contingent units
ACTION TO TAKE	*Create broad functional units which have a roughly equal number of sub-units (i.e., steps or sub-steps)*	*Create a sufficient number of broad functional units so that the analyst is less likely to lose sight of where he is when doing more detailed analyses*	*Create broad functional units which clearly suggest a proper sequence*
LIKELY MAXIMUM NUMBER FOR COMPLEX PERFORMANCES	10-15 broad functional units	10-15 broad functional units	10-15 broad functional units

B.3.1

DETERMINING THE SIZE OF FUNCTIONAL UNITS TO TREAT AS AND LABEL AS: TASKS

DECISION MATRIX

CONDITIONS	Functional units are BROAD and relatively few in number	Functional units are NARROW and relatively many in number
ACTION TO TAKE	*Identify and label broad functional units as: TASKS*	*Identify and label narrower functional units as: STEPS or Sub-STEPS*
FORMS TO USE	FORM A.5(1): SUMMARY OF TASKS and QUESTIONS associated with it	FORM A.5(2): SUMMARY OF STEPS FORM A.5(3): SUMMARY OF Sub-STEPS and QUESTIONS associated with them
SEE ▷	Section A.5.2(a)	Section A.5.2(a)

B.3.1

CRITERIA FOR DETERMINING THE ACCEPTABILITY OF DESCRIPTIVE TITLES OF "TASKS"

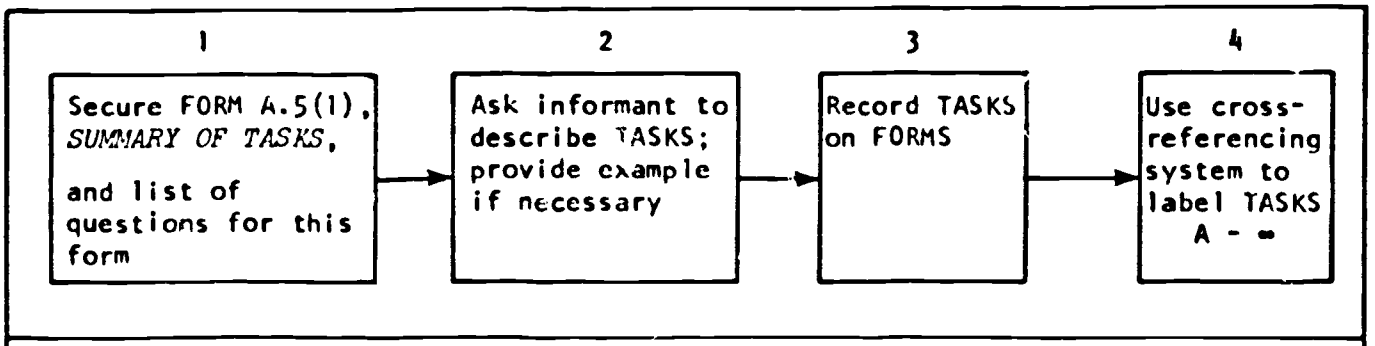
STANDARDS MATRIX

GOALS	To permit easy identification of segments of performance and the organization of record-keeping for all information concerning related sub-segments (i.e., steps and sub-steps)	To permit subsequent ordering of TASKS to fulfill the requirements of an instructional strategy
CRITERIA	*TASK titles provide an explicit OVERVIEW of "performance"*	*TASK titles suggest a SEQUENCE where a sequence of tasks exists*
EXAMPLES	"PERFORMING RESEARCH" A. FORMULATING PROBLEMS AND HYPOTHESES B. PLANNING AND DESIGNING THE INVESTIGATION C. CONDUCTING THE INVESTIGATION D. INTERPRETING THE RESEARCH RESULTS E. PREPARING REPORTS	"PERFORMING AS AN ORTHOPEDIC SURGEON" A. GATHERS CLINICAL INFORMATION B. USES SPECIAL DIAGNOSTIC INFORMATION C. DEVELOPS A DIAGNOSIS D. DECIDES ON APPROPRIATE CARE E. IMPLEMENTS TREATMENT F. PROVIDES CONTINUING CARE

B.3.1

ILLUSTRATION SUMMARIZING PROCEDURES IN COLLECTING DESCRIPTIONS OF "TASKS"*

DIAGRAM



QUESTIONS FOR FORM A.5(1)

RECOMMENDED QUESTION FORMATS

ORIENTING STATEMENT

"Let's see if we can get a big picture or an overview of what it is you do."

QUESTION

"What are the major tasks or functions involved when you _____?"
activity

ALTERNATES

"What are the major tasks or functions involved in performing a _____?"
activity

"What are the major tasks or functions involved in _____?"
activity

"What are the major tasks or functions involved in performing as a _____?"
job title

PROVIDE AN EXAMPLE WHEN NECESSARY

STATEMENT

"Here's an example of what I mean."*

*If possible, provide an example from the performance area under study.

REDUCED ILLUSTRATION OF FORM A.5(1)

Form A.5(1)

SUMMARY OF TASKS

A

B

C

D

E

For relatively non-complex performances, begin description at the STEP (B.3) or Sub-STEP levels (B.3.3).

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A listing of all the STEPS which make up each TASK in the criterion behavior (recorded on FORM A.5(2)).*
WHAT YOU WILL WORK FROM	(1) A list of all the major TASKS involved in the total criterion behavior.
WHAT YOU WILL DO	(1) Ask informant for a description of all the STEPS which make up each TASK.
FORMS YOU WILL USE	FORM A.5(2) for recording all the STEPS within each TASK.

DESCRIPTION OF SUB-STEP	B.3.2

INPUT	ACTION	OUTPUT
List of TASKS involved in "performance" iv	Ask informant for description of STEPS within each TASK (for all tasks) v	Listing of all STEPS in each TASK on FORM A.5(2): providing an overview of each TASK vi

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Levels of generality in describing performance . .106	-MATRIX: Dividing tasks into steps 106	-MATRIX: How to describe performance at the step level . . . . 107 -MATRIX: Filling out FORM A.5(2) . . 103	FORM A.5(2) SUMMARY OF PROCEDURES . . 109

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Planned order of information collection	A.3.1	Form A.5(1)	B.3.1	Form A.5(2): Summary of STEPS (and associated questions)
Identification of TASKS	B.2.2			

Sub-STEP B.3.2

JOB DIAGRAM

INPUT	ACTION	OUTPUT
List of TASKS involved in "performance" — iv	Ask informant for description of STEPS within each TASK (for all tasks) — v	Listing of all STEPS in each TASK on FORM A.5(2): providing an overview of each TASK — vi
Total performance to be sub-divided — iv.a	Divide total performance into functional units at broadest level of generality — v.a	Description of TASKS — vi.a
TASKS within total performance to be sub-divided — iv.b	Divide total performance into functional units at an intermediate level of generality — v.b	Description of STEPS within TASKS — vi.b
STEPS within tasks to be sub-divided — iv.c	Divide total performance into functional units at the lowest level of generality — v.c	Description of Sub-STEPS within STEPS — vi.c

JOB PERFORMANCE

B.3.2

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING FUNCTIONAL UNITS AT DIFFERING LEVELS OF GENERALITY

CRITERIA	-*Involves many constituent sub-units*	-*Involves an intermediate number of constituent sub-units*	-*Involves the least number of constituent sub-units*
LEVELS OF GENERALITY	Functional units at HIGHEST level of generality	Functional units at an INTERMEDIATE level of generality	Functional units at the LOWEST (MOST SPECIFIC) level of generality
LABELS	TASK	STEP	Sub-STEP

B.3.2

DECISION MATRIX

DETERMINING HOW TO SATISFY THE DIFFERING GOALS SERVED BY DIVIDING PERFORMANCE INTO TASKS, STEPS, AND Sub-STEPS

GOALS	To provide an overview of the total performance within which segments can be easily classified or organized	To provide an overview of a task within which segments can be easily classified or organized	To provide a specific, detailed description of terminal behavior
ACTION TO TAKE	*Divide total performance into TASKS*	*Divide tasks into STEPS*	*Describe Sub-STEPS within STEPS*
FORMS TO USE	FORM A.5(1)	FORM A.5(2)	FORM A.5(3)

B.3.2

DIFFERING CRITERIA FOR ADEQUATELY DESCRIBING PERFORMANCE AT DIFFERENT LEVELS OF GENERALITY

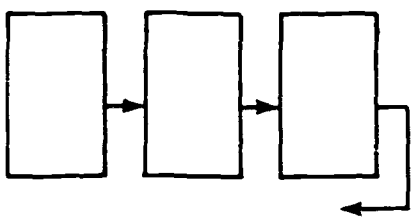
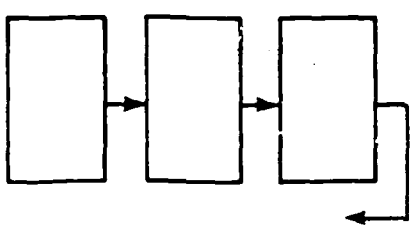
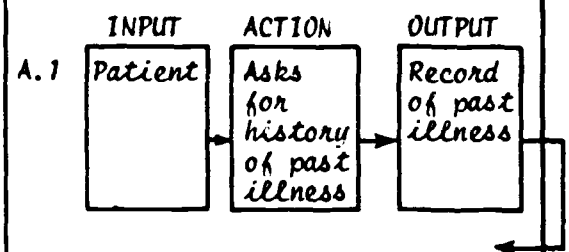
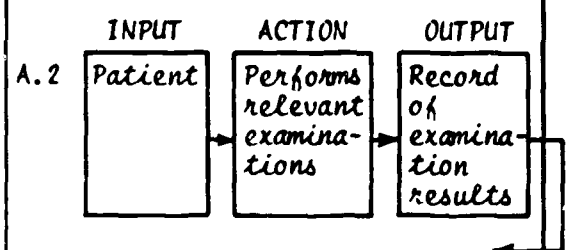
STANDARDS MATRIX

GOALS	The primary purpose in describing TASKS: To provide an OVERVIEW of total performance and an ORGANIZING system for grouping of constituent STEPS	The primary purpose in describing STEPS: To provide an OVERVIEW of a task and an ORGANIZING system for grouping of constituent Sub-STEPS	The primary purpose in describing Sub-STEPS: To provide a basis for: (1) stating instructional objectives; (2) performing more detailed task analysis
PROPERTIES OF AN ADEQUATE DESCRIPTION	-Exact number of tasks identified is not crucial -Exact labeling of tasks is not crucial -Adequacy is based on capacity of the identification of tasks--to organize further analysis of performance (and recording of results) at more detailed levels, i.e., describing STEPS	-Exact number of steps identified is not crucial -Exact description of inputs, actions, and outputs is not crucial -Adequacy is based on capacity of the identification of steps--to organize further analysis of performance (and recording of results) at more detailed levels, i.e., describing Sub-STEPS	-Comprehensive identification of all Sub-STEPS is crucial -Exact descriptions of inputs, actions, and outputs is important -Descriptions should convey a sound, specific model of how performance is actually carried out
FOR PROCEDURES SEE ▶	Section B.3.1	This section	Section B.3.3

B.3.2

STANDARDS MATRIX

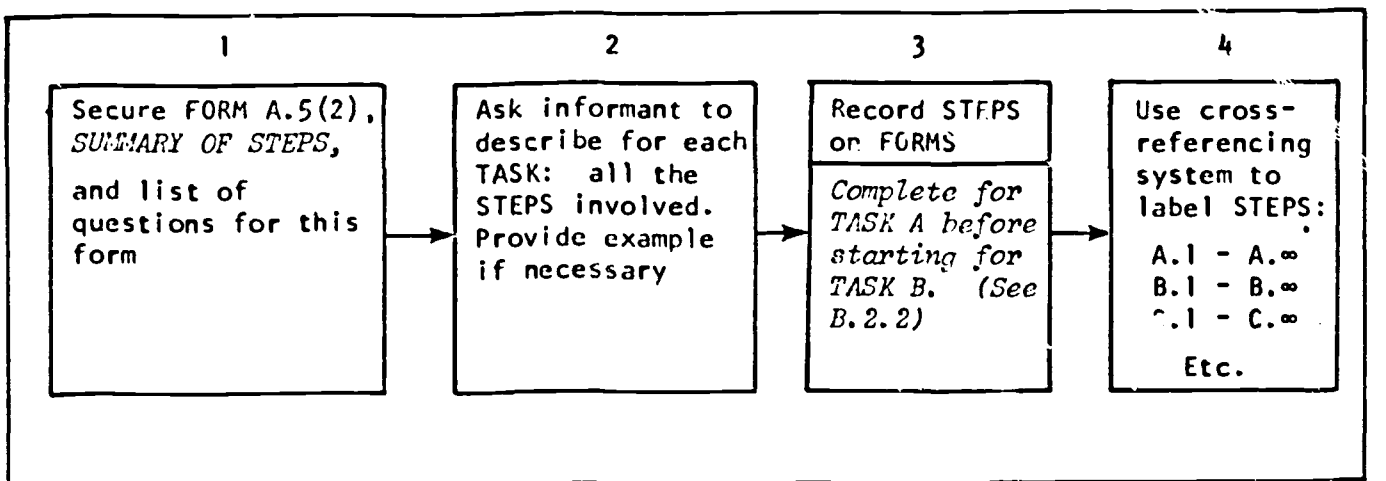
TWO REQUIREMENTS IN FILLING OUT FORM A.5(2): SUMMARY OF STEPS

CRITERIA	-A description of the step in sentence form (optional)	-A description of input, action, and output for each step
EXAMPLES	*Obtains clinical information from patient* A.1  *Performs a physical examination of patient* A.2 	*Obtains clinical information from patient*  *Performs a physical examination of patient* 

B.3.2

ILLUSTRATION SUMMARIZING PROCEDURES IN COLLECTING DESCRIPTIONS OF "STEPS"

DIAGRAM



QUESTIONS FOR FORM A.5(2)

RECOMMENDED QUESTION FORMATS

ORIENTING STATEMENT

"Now, let's see if we can identify the major steps within each task."

QUESTION A

"What are the major steps involved in _____ (Task A)?"

QUESTION A.1

"For Step 1, _____ (Step), what are the input conditions, the actions taken, and the resulting outputs?"

QUESTIONS A.2-A.n

Repeat same type of question as in A.1 for all steps in Task A.

QUESTIONS B-B.n

Repeat same type of question as A, then A.1-A.n, for all steps in Task B.

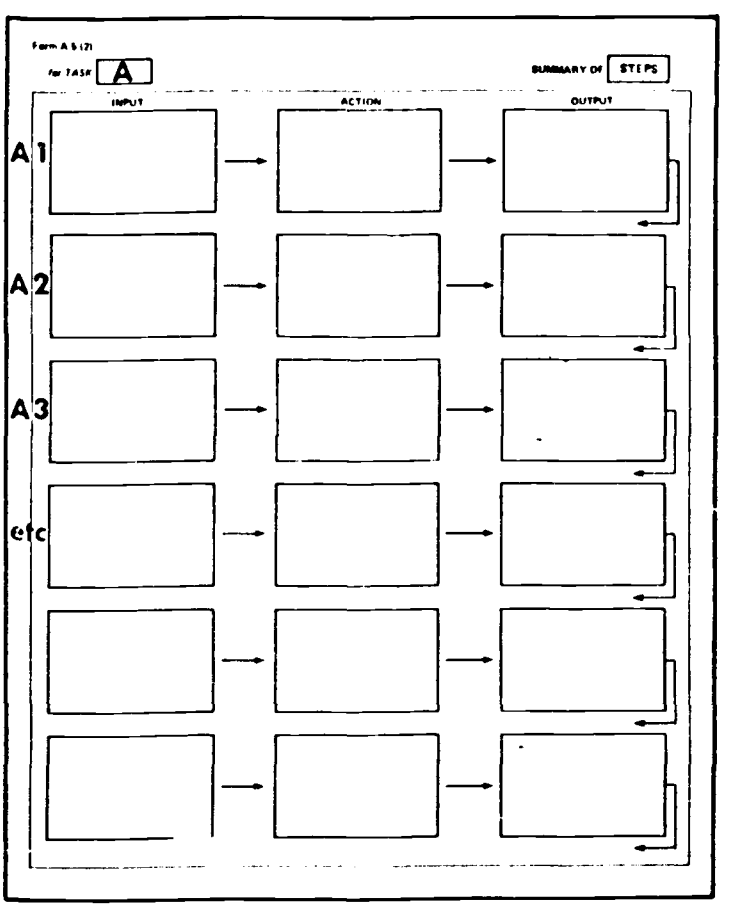
Repeat the above procedure for all tasks.

PROVIDE AN EXAMPLE WHEN NECESSARY

STATEMENT

"Here's an example of what I mean."

REDUCED ILLUSTRATION OF FORM A.5(2)



PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A listing of all the SubSTEPS which make up each STEP (recorded on FORM A.5(3)).*
WHAT YOU WILL WORK FROM	(1) A listing of all the STEPS involved in each TASK.
WHAT YOU WILL DO	(1) Ask informant for a description of all the SubSTEPS which make up each STEP.
FORMS YOU WILL USE	FORM A.5(3) for recording all the SubSTEPS that make up each STEP.

DESCRIPTION OF Sub-STEP	B.3.3

INPUT	ACTION	OUTPUT
List of STEPS involved in each TASK vii	Ask informant for description of Sub-STEPS within each STEP (for all steps and all tasks) viii	Listing of all Sub-STEPS within each STEP on Form A.5(3) providing a detailed and specific description of procedures to follow ix

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
	-MATRIX: How to meet task description goals 116	-MATRIX: Completeness of task description . . 117 -MATRIX: Appropriate levels of generality . . . 118 -MATRIX: Performance requirements . . 119	Form A.5(3) SUMMARY OF PROCEDURES 120

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Planned order of information collection	B.2.2			Form A.5(3): Summary of Sub-STEPS (and associated questions)
Identification of TASKS	B.3.1	Form A.5(1)	B.3.1	
Identification of STEPS	B.3.2	Form A.5(2)	B.3.2	

Sub-STEP B.3.3

JOB DIAGRAM

INPUT	ACTION	OUTPUT
List of STEPS involved in each TASK vii	Ask informant for description of Sub-STEPS within each STEP (for all steps and all tasks) viii	Listing of all Sub-STEPS within each STEP on Form A.5(3) providing a detailed and specific description of procedures to follow ix

GOALS OF TASK DESCRIPTION		*Identification of:*
To obtain information needed in statements of objectives vii.a	Obtain description that is complete viii.a	All information required in statements of objectives: full description of inputs, actions, outputs ix.a
To obtain information needed as a basis for subsequent task analysis vii.b	Obtain description that is at appropriate level of generality viii.b	Description of inputs, actions, outputs that can readily lead to description of alternatives required by task analysis ix.b
To obtain information needed as a basis for subsequent formulation of instructional strategies vii.c	Obtain description that identifies performance requirements viii.c	-Performance direction -Recall requirements -Transfer requirements ix.c

JOB PERFORMANCE

NOTE:

1. *Section B.3.3 (this section) is concerned with task descriptions obtained at the lowest level of generality.*

2. *If the criterion behavior has been described down to the Sub-STEP level, this section applies to the Sub-STEPS obtained.*

3. *If the criterion behavior is sufficiently complex and detailed such that Sub-STEPS need to be divided further, i.e., into Sub-Sub-STEPS:*

   (a) Sub-STEPS should be treated as per the treatment given STEPS (i.e., use Section B.3.2); and

   (b) Sub-Sub-STEPS (the lowest level of detail obtained) should be treated as per this section (i.e., Section B.3.3).

NOTE

The description of non-complex criterion behavior, i.e., a total performance that does not involve very many steps and sub-steps, should begin with this section, B.3.3 (or, if desired, with B.3.2 (STEPS).

EXAMPLES

JOBS	SUBJECT MATTER
e.g., filing	e.g., addition or subtraction
e.g., typing	e.g., drawing blueprints
e.g., using a simple desk calculator	e.g., doing short laboratory experiments

B.3.3

DETERMINING HOW TO MEET THE GOALS OF DESCRIBING PERFORMANCE AT THE LOWEST LEVEL OF GENERALITY (Sub-STEP OR Sub-Sub-STEP LEVEL)

DECISION MATRIX

GOALS	To obtain information that can serve in subsequent formulations of statements of objectives	To obtain a description of performance that can serve as a take-off point for subsequent task analysis	To obtain a description of performance that can serve as a take-off point for subsequent formulation of instructional strategies
ACTION TO TAKE	*Obtain complete description of:* -inputs -actions -outputs	*Obtain a description at an appropriate level of generality*	*Obtain description identifying performance requirements*
FOR STANDARDS SEE	Page 117	Page 118	Page 119

B.3.3

CRITERIA FOR DETERMINING THE COMPLETENESS OF TASK DESCRIPTION OF A SUB-STEP (SO IT CAN SERVE IN STATEMENT OF OBJECTIVES)*

STANDARDS MATRIX

TO BE DESCRIBED	INPUT -Signals -People -Objects -Behavior -Conditions of people -Situations -Performer's -Words own behavior	ACTION -Response to the input(s)	OUTPUT -Products -Outcomes -Results
CRITERIA FOR COMPLETENESS OF DESCRIPTION	*-Inputs regularly encountered are identified* *-Unusual conditions that sometimes prevail are also identified* *-Availability of performance aids is also identified*	*-Action or actions taken in response to input conditions are identified* *-Alternative actions (where they exist) are identified*	*-Outputs that mark the end of a chain (i.e., do not become an input to the next sub-step) are identified* *-Standards for acceptability of output are identified (time to produce; or quality)*

EXAMPLE

"Revises programmed lesson on basis of tryout results"

-Regularly encountered:

INPUT: *Results of lesson tryout*

-In response to an input:

ACTION: *Revises program in light of revealed lesson shortcomings*

-End of chain marked by an:

OUTPUT: *Revised program (ready for use)*

-In response to same input an alternative

ACTION: *e.g., seeks additional tryout results*

-Unusual, atypically encountered

INPUT: *Incomplete results for large segment of tryout sample*

-Performance aid

Job aid provides possible patterns of tryout results

-Standards for

OUTPUT: *90% of test items for program are passed by 90% of sample*

*Use as many copies of FORM A.5(3) as are necessary to describe a given Sub-STEP so that it meets standards described on pages 117, 118, and 119.

B.3.3

STANDARDS ≠ MATRIX

CRITERIA FOR DETERMINING THE SUITABILITY OF LEVEL OF GENERALITY IN DESCRIPTION OF A SUB-STEP (SO IT CAN SERVE AS A BASIS FOR SUBSEQUENT TASK ANALYSIS)*

GOALS OF TASK ANALYSIS	To identify for a given Sub-STEP alternative INPUTS which require different ACTIONS	To identify for a given Sub-STEP the different ACTIONS associated with the different INPUTS	To identify for a given Sub-STEP the different OUTPUTS that result from the different ACTIONS
CRITERIA FOR SUITABILITY OF DESCRIPTION OF SUB-STEP TO MEET MORE GOALS	*Level of generality at which a Sub-STEP INPUT is described allows for further, easy description of alternative inputs; i.e., the wording of the description is not too far removed conceptually from the wording required to describe the alternative inputs.*	*Level of generality at which a Sub-STEP ACTION is described allows for further, easy description of alternative actions associated with the alternative inputs.*	*Level of generality at which a Sub-STEP OUTPUT is described allows for further, easy description of alternative outputs resulting from the alternative actions taken.*
	-Description at the Sub-STEP level comes closest to a description of what the job holder or performer would say in describing what he does; without the alternative conditions that are provided in the task analysis.		

	Sub-STEP INPUT	Sub-STEP ACTION	Sub-STEP OUTPUT
POSITIVE EXAMPLE Suitable Level of Generality	*"Error scores on program plus error scores on criterion test"* →	*"Revised program in light of patterns of error scores"* →	*"Removal of specific program weaknesses"*
	Task analysis can readily proceed to describe different combinations of program and test errors.	Task analysis can readily proceed to describe different revision strategies to be taken.	Task analysis can readily proceed to describe specific changes resulting in the program.
NEGATIVE EXAMPLE Unsuitable Level of Generality	*"Tryout results"* →	*"Made revisions in program"* →	*"Improved program"*
	This description is one level of generality too high, too far removed from the specific detail needed.		

*Use as many copies of FORM A.5(3) as are necessary to describe a given Sub-STEP so that it meets standards described on pages 117, 118, and 119

≠If informant cannot provide this information during description of a Sub-STEP, it will be necessary to develop it during the task analysis for the Sub-STEP.

B.3.3

STANDARDS' MATRIX

CRITERIA FOR DETERMINING THE COMPLETENESS OF TASK DESCRIPTION OF A SUB-STEP (SO IT CAN SERVE IN THE FORMULATION OF INSTRUCTIONAL STRATEGIES)*

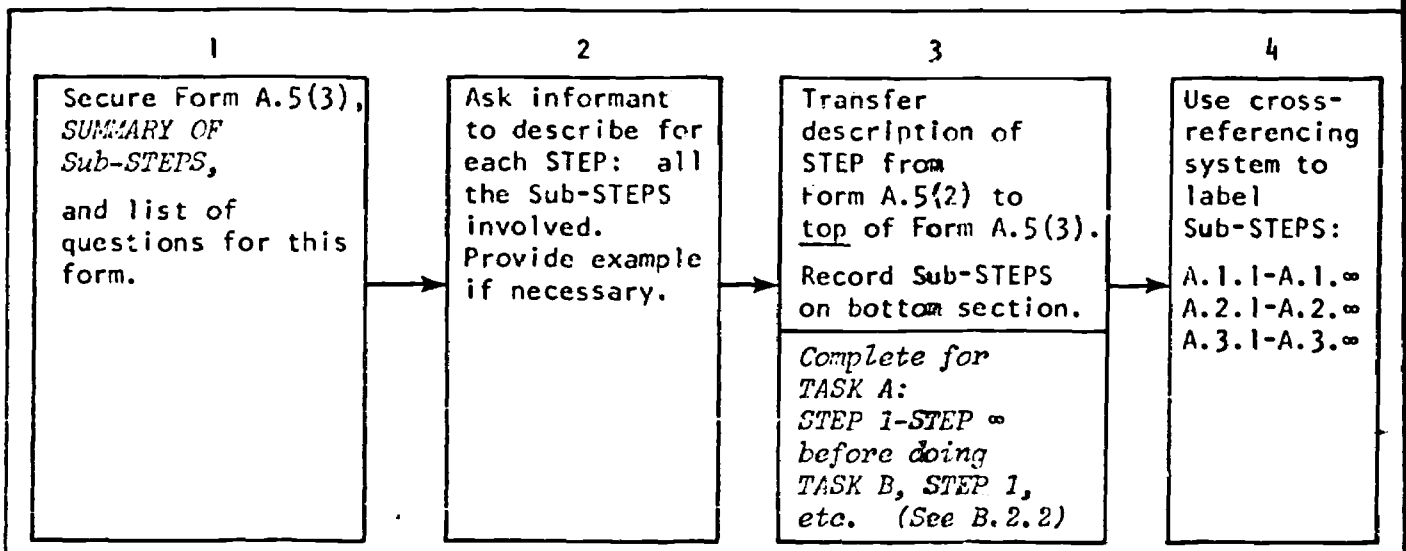
TO BE DESCRIBED	DIRECTION OF PERFORMANCE	WHAT IS TO BE RECALLED	WHAT IS TO BE TRANSFERRED
CRITERIA FOR COMPLETENESS OF DESCRIPTION	*Description identifies criterion behavior requirements:* *(a) Given an INPUT, the performer will exhibit the appropriate ACTION;* *and if the reverse is also required:* *(b) Given the ACTION, the performer will exhibit or produce the INPUT.*	*Description specifies that:* *(a) All the possible instances of a class of INPUTS must be recalled during exhibition of criterion behavior (and by implication, all must have been experienced during instruction or training);* *(b) All the possible instances of a class of ACTIONS must be recalled during exhibition of criterion behavior (and by implication, all must have been experienced during instruction or training).*	*Description specifies that:* *(a) Some instances of a class of INPUTS can be responded to only on the basis of transfer and by implication will not have been experienced during instruction or training);* *(b) Some instances of a class of ACTIONS must be made only on the basis of transfer and by implication will not have been experienced during instruction or training).*
EXAMPLES "Revises programmed lessons"	(a) GIVEN THIS INPUT: *Pattern of tryout results* *PRODUCES THIS ACTION* *Revises program accordingly* *AND, IF REQUIRED, THE REVERSE* (b) GIVEN THE ACTION *A specific type of revision* *IDENTIFIES THE INPUT* *Identifies the pattern of tryout results that would prompt that type of revision*	(a) *Description specifies that all possible variations within a given pattern (class) of tryout results must be recalled by the performer;* (b) *Description specifies that all possible variations within a given pattern (class) of program revision must be recalled by the performer.*	(a) *Description specifies that some variations within the same pattern of results will be new and will require transfer (i.e., will not have been experienced in training);* (b) *Description specifies that some variations in the way revisions are made must depend on transfer (i.e., will not have been practiced in training).*

*Use as many copies of FORM A.5(3) as are necessary to describe a given Sub-STEP so that it meets standards described on pages 117, 118, and 119.

B.3.3

ILLUSTRATION SUMMARIZING PROCEDURES IN COLLECTING DESCRIPTIONS OF "Sub-STEPS"

DIAGRAM



QUESTIONS FOR FORM A.5(3)

RECOMMENDED QUESTION FORMATS

ORIENTING STATEMENT

"Now, let's see if we can identify the major sub-steps within each step."

QUESTION A.1

"What are the sub-steps involved in _____ (Step A.1) ?"

QUESTION A.1.1

For Sub-Step A.1.1, _____ (Sub-Step A.1.1) what are the input conditions, the actions taken, and the resulting outputs?"

QUESTIONS A.1.2-A.1.n

Repeat same type of question as in A.1.1 for all sub-steps in Step A.1.

Repeat same type of question as above for all sub-steps in all other steps in Task A.

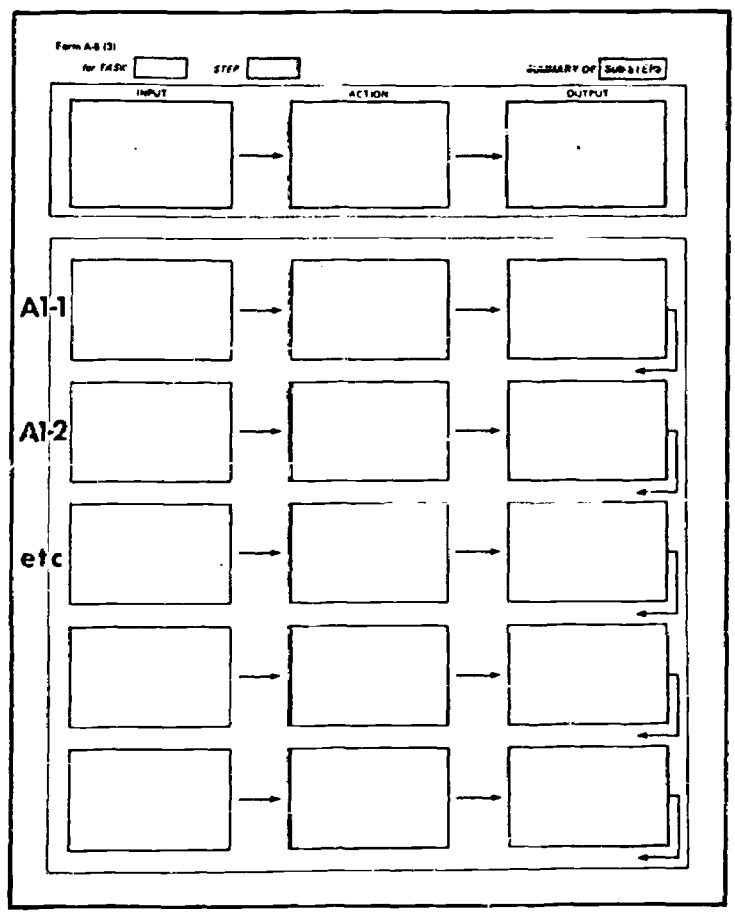
Repeat the above procedure for all tasks.

PROVIDE AN EXAMPLE WHEN NECESSARY

STATEMENT

"Here's an example of what I mean."

REDUCED ILLUSTRATION OF FORM A.5(3)



AMPLE

EXAMPLE OF TASK DESCRIPTION OF A "STEP" AND ITS COMPONENT "Sub-STEPS"

	INPUT	ACTION	OUTPUT
1	Raw test scores and use of a statistics text	Create intervals for grouping scores	Intervals of scores and frequencies for interval recorded

1	Unordered test scores i	Inspect for and compute the differences between highest and lowest scores ii	Range of test scores iii
2	Range of test scores and number of scores iv	Determine an appropriate number of intervals and the interval size v	Interval size and the number of intervals to create vi
3	Raw scores and Sequenced score intervals on paper vii	Inspect each score and make a frequency tally alongside the appropriate interval viii	Distribution of scores and frequencies by intervals ix

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A breakdown (and recording on FORMS) of the knowledge domain:* ... *major areas* ... *major topics* ... *sub topics* ... *sub-sub topics*
WHAT YOU WILL WORK FROM	(1) Informant expertise
WHAT YOU WILL DO	(1) Ask questions of informant (and record results) designed to get a description of the knowledge domain.
FORMS YOU WILL USE	FORMS A.5(8) + A.5(9) for recording the subdivisions (major areas, topics, etc.) of the subject matter.

*

DESCRIPTION OF Sub-STEP	B.3.4

INPUT	ACTION	OUTPUT
Knowledge domain to be sub-divided into constituent units and units described x	Ask informant to sub-divide and describe knowledge domain into units at varying levels of generality xi	Listing of all: MAJOR AREAS MAJOR TOPICS Sub-TOPICS (Sub-Sub-TOPICS) on FORMS A.5(8) and (9) xii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Unit sizes in sub-dividing knowledge domains . . . 127	-MATRIX: How to sub-divide total knowledge domains into units . . 128	-MATRIX: Adequacy of sub-division of knowledge domain . . 126, 129	FORM A.5(8) FORM A.5(9) SUMMARY OF PROCEDURES . . . 130

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Schedule for information collection	B.2			FORM A.5(8): SUMMARY OF MAJOR AREAS AND TOPICS
				FORM A.5(9): SUMMARY OF Sub-TOPICS and Sub-Sub-TOPICS

* *This Sub-STEP (B.3.4) does not follow the previous one. B.3.4 and B.3.5 together cover "knowledge domains." The previous three Sub-STEPS, B.3.1, B.3.2, and B.3.3 cover "performance." Thus, B.3.3 represents the end of the sequence for "performance."*

Sub-STEP B.3.4

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Knowledge domain to be sub-divided into constituent units and units described x	Ask informant to sub-divide and describe knowledge domain into units at varying levels of generality xi	Listing of all: MAJOR AREAS MAJOR TOPICS Sub-TOPICS (Sub-Sub-TOPICS) on FORMS A.5(8) and (9) xii
Total knowledge domain to be sub-divided x.a	Divide knowledge domain into units at broadest level of generality xi.a	Listing of MAJOR AREAS xii.a
MAJOR AREAS to be sub-divided x.b	Divide knowledge domain into units at intermediate level of generality xi.b	Listing of MAJOR TOPICS within MAJOR AREAS xii.b
MAJOR TOPICS to be sub-divided x.c	Divide knowledge domain into units at lower level of generality xi.c	Listing of Sub-TOPICS within MAJOR TOPICS xii.c
Sub-TOPICS to be sub-divided x.d	Divide knowledge domain into units at lowest level of generality xi.d	Listing of Sub-Sub-TOPICS within Sub-TOPICS xii.d

JOB PROCEDURES

B.3.4

DIFFERING CRITERIA FOR DESCRIPTIONS OF KNOWLEDGE DOMAIN FOR SECTIONS B.3.4 AND B.3.5

STANDARDS MATRIX

	Section B.3.4 (This Section)	Section B.3.5 (Next Section)
GOALS	To sub-divide a knowledge domain into conceptual units that: (a) Allow an overview of the knowledge domain (b) Organize material and make further more detailed analyses and record keeping manageable (c) Provide a tentative basis for ultimate sequencing of instruction	(a) To identify the specific behavior the learner is expected to exhibit that indicates his mastery of a knowledge domain (b) Serves as a basis for further analyses and procedures -Task analysis -Learning analysis -Statements of objectives -Formulation of instructional strategies
CRITERIA	*-Exact number of sub-divisions is not crucial* *-Exact labeling of sub-divisions is not crucial* *-Adequacy of sub-divisions of a knowledge domain and their descriptive labeling is based on their capacity to facilitate further analyses:* *e.g., to call attention to particular areas for which terminal behaviors must be identified* *e.g., to insure systematic progress from one area to another* *-Sequencing of areas and topics is adequate if it parallels the way the knowledge domain is currently being taught*	*-Comprehensive identification of all required terminal behaviors is crucial* *-Exact specification and description of terminal behaviors is crucial:* *••Inputs, actions, and outputs should be described* *••Direction of terminal behavior should be described* *••Recall and transfer requirements should be specified*

B.3.4

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING UNITS WHICH SUB-DIVIDE KNOWLEDGE DOMAINS AT DIFFERING LEVELS OF GENERALITY

CRITERIA	*-Involves <u>many</u> constituent sub-units*	*-Involves an <u>intermediate</u> number of constituent sub-units*	*-Involves the <u>least</u> number of constituent sub-units*
LEVELS OF GENERALITY	Highest	Intermediate	Lowest: -MOST DETAILED -MOST SPECIFIC
LABELS	MAJOR AREAS	MAJOR TOPICS	Sub-TOPICS or Sub-Sub-TOPICS (if obtained)

EXAMPLES (1)	Headings for groups of chapters in texts	Chapter headings	<u>Sub-TOPICS</u> Section headings <u>Sub-Sub-TOPICS</u> Paragraph headings
(2)	Chapter headings in texts	Section headings within chapters	<u>Sub-TOPICS</u> Paragraph headings <u>Sub-Sub-TOPICS</u> Itemized or numbered sub-sub-sections
(3)	Major principles	Sub-principles	-Concepts -Facts

B.3.4

DETERMINING HOW MANY LEVELS OF GENERALITY ARE REQUIRED TO SUB-DIVIDE AND DESCRIBE A KNOWLEDGE DOMAIN

DECISION MATRIX

CONDITIONS	Knowledge Domain is <u>large</u> size, complexity, or degree of integration	Knowledge Domain is <u>intermediate</u> size, complexity, or degree of integration	Knowledge Domain is <u>small</u> size, complexity, or degree of integration
ACTION TO TAKE	*Sub-divide knowledge domain into:* 1. *MAJOR AREAS* 2. *MAJOR TOPICS* 3. *Sub-TOPICS* 4. *Sub-Sub-TOPICS*	*Sub-divide knowledge domain into:* 1. *MAJOR AREAS* 2. *MAJOR TOPICS* 3. *Sub-TOPICS* *OR into:* 2. *MAJOR TOPICS* 3. *Sub-TOPICS* 4. *Sub-Sub-TOPICS*	*Sub-divide knowledge domain into:* 2. *MAJOR TOPICS* 3. *Sub-TOPICS* *OR into:* 3. *Sub-TOPICS* 4. *Sub-Sub-TOPICS*
FORMS TO USE	FORMS: A.5(8) A.5(9)	FORMS: A.5(8) A.5(9)	FORM A.5(9)

B.3.4

STANDARDS MATRIX

CRITERIA FOR DETERMINING THE ACCEPTABILITY OF LABELS OR DESCRIPTIVE TERMS OF SUB-DIVISION UNITS

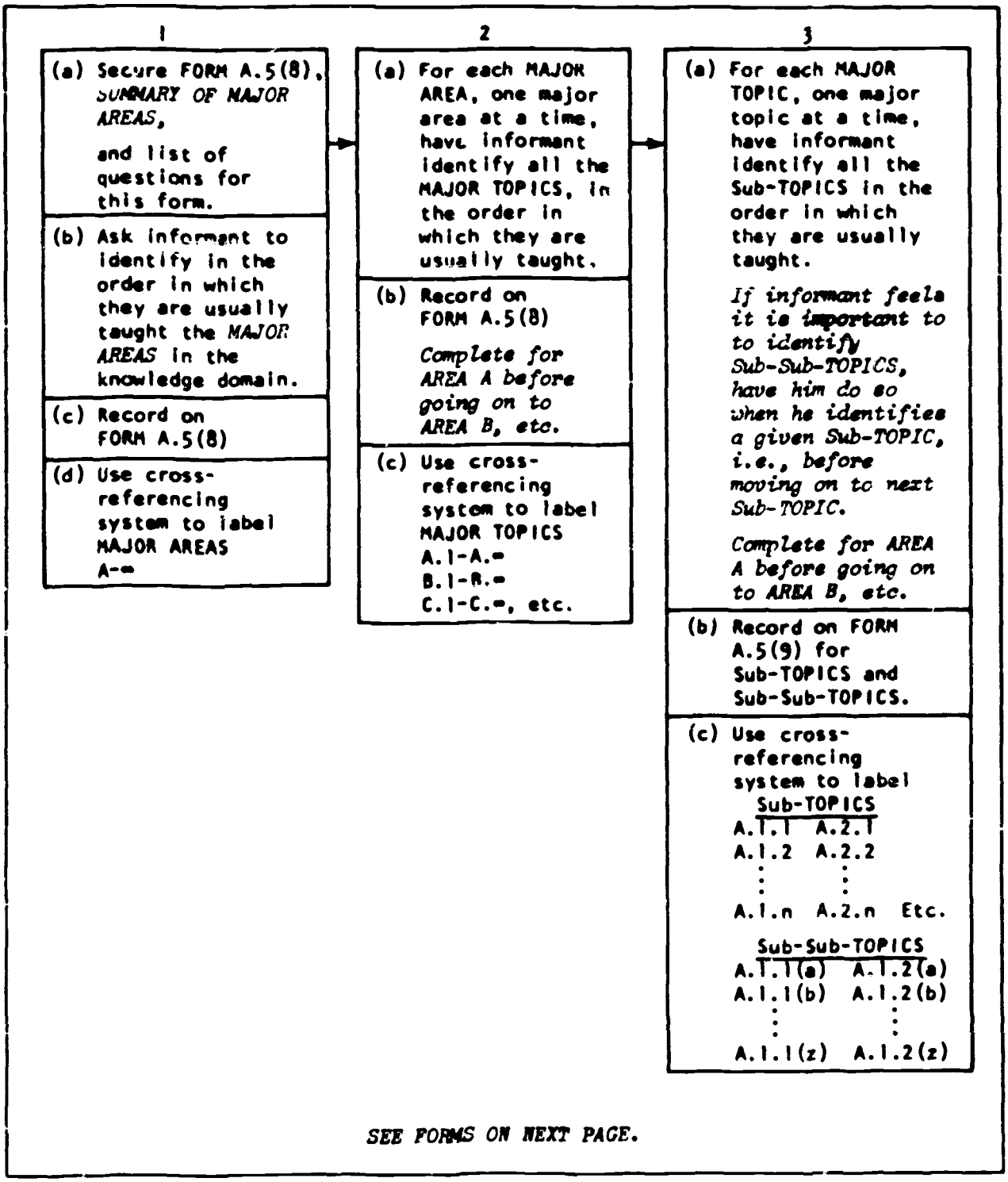
LEVELS OF GENERALITY	Highest or Intermediate e.g., MAJOR AREAS e.g., MAJOR TOPICS	Lowest e.g., Sub-TOPICS e.g., Sub-Sub-TOPICS
CRITERIA	-*Provide an overview* -*Allow for organization of constituent sub-units* -*Make analysis and recording of descriptions of constituent sub-units easier*	-*Provide an easy transition to description of terminal behaviors* ••*Describe specific facts, concepts, or principles the learner is expected to master (Section B.3.5)* ••*Describe actual behavior that must be displayed to reflect that mastery*

EXAMPLES "Physics"	MAJOR AREAS	MAJOR TOPICS	Terms, Concepts
	WAVE MOTION		Foot candle Standard candle Illumination Lumen
		Vibrational Waves Sound Music	
	ELECTRICITY		Principles
		Electrons, Protons, and Neutrons Electric Charges in Motion Electrical Circuits Electric Power Magnetism Motors	Relationship between illumination and distance
			Labels
			Photometer (instrument)
	LIGHT		This listing is at a specific or detailed enough level so that the subsequent description of terminal behavior can readily specify how the concepts, principles, etc., are to be dealt with.
		Velocity Reflection and Refraction Lenses Mirrors Color	

B.3.4

ILLUSTRATION SUMMARIZING HOW TO SUB-DIVIDE KNOWLEDGE DOMAINS

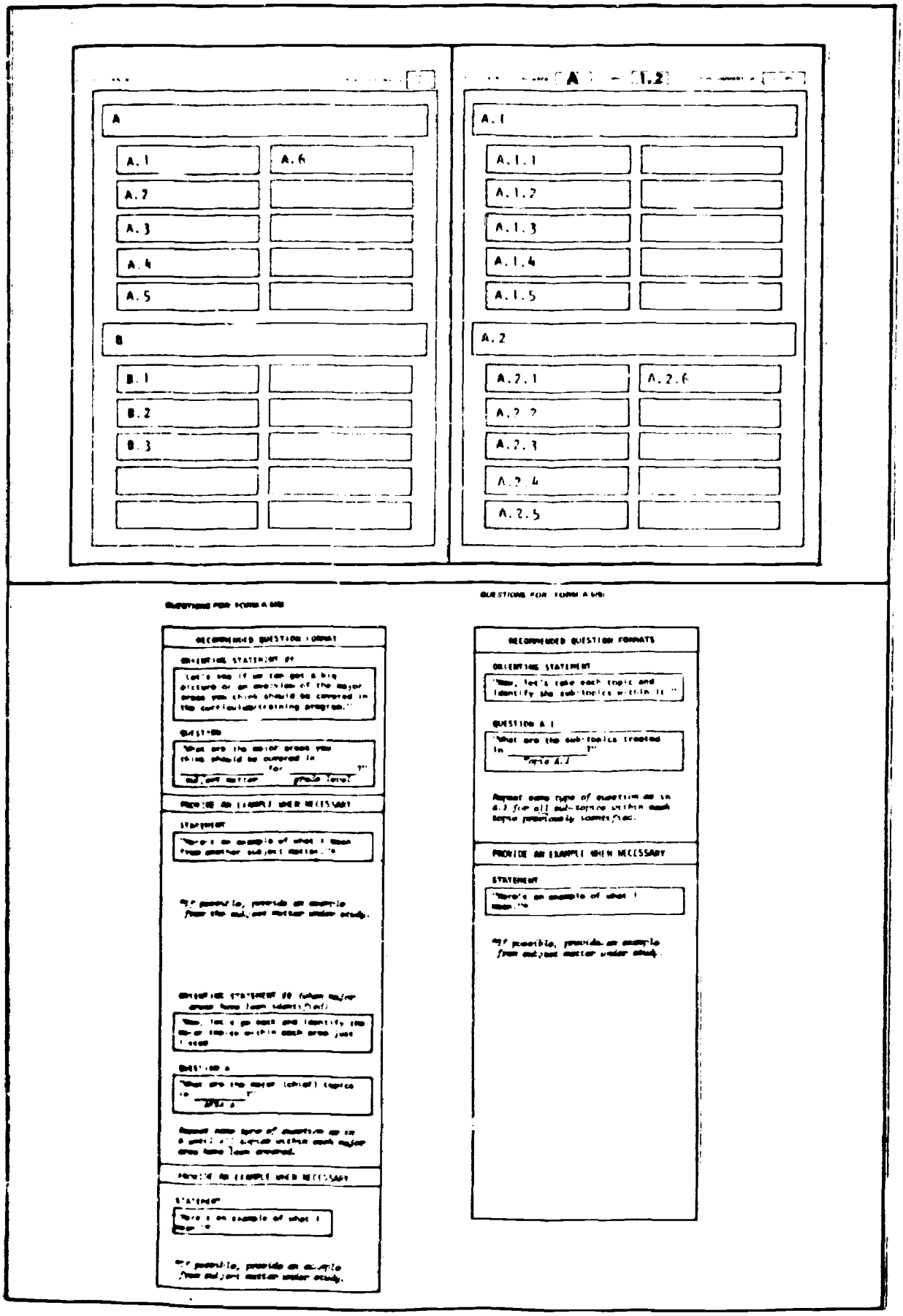
DIAGRAM



SEE FORMS ON NEXT PAGE.

B.3.4

REDUCED ILLUSTRATION OF FORMS A.5(8) AND A.5(9)



PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A recording of each terminal behavior by competency level indicating whether the behavior involves RECALL and/or TRANSFER of INPUTS and/or ACTIONS.*
WHAT YOU WILL WORK FROM	(1) Descriptions of Sub-topics (2) Informant expertise
WHAT YOU WILL DO	(1) Ask informant to describe the terminal behavior(s) involving each Sub-topic; (2) Classify all terminal behavior by competency level; (3) Record each terminal behavior by competency level involved.
FORMS YOU WILL USE	FORM A.5(10) for recording a description of each terminal behavior (in the knowledge domain).

DESCRIPTION OF Sub-STEP	B.3.5

INPUT	ACTION	OUTPUT
Identification of specific Sub-TOPICS (or Sub-Sub-TOPICS): facts, concepts, principles, etc. xiii	Ask informant to describe terminal behavior involving the Sub-TOPIC (or Sub-Sub-TOPIC), and then record or classify it for required level of competency xiv	Description and cross-referencing of terminal behavior on FORM A.5(10) at competency level I, II, III, or IV xv

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Specific vs. classes of inputs or actions . . . . 136 -MATRIX: Old vs. new class examples . . . . 137 -MATRIX: Recall vs. transfer requirements . . 138 -MATRIX: Old/new and recall/transfer. 139	-MATRIX: Classifying terminal behavior into competency levels . . . . . 142 -MATRIX: How to meet "description" goals . . . . . 143 -MATRIX: When to use a sample of examples vs. all examples 139	-MATRIX: Correct classification . 142 -MATRIX: Objectivity of descriptions . . 144 -MATRIX: Completeness of descriptions . . 146 -MATRIX: Terminal behavior requirements . . 147	FORM A.5(10) SUMMARY OF PROCEDURES 148

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		FORMS A.5(8) A.5(9)	B.3.4	FORM A.5(10): Description of Terminal Behaviors

Sub-STEP B.3.5

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Identification of specific Sub-TOPICS (or Sub-Sub-TOPICS): facts, concepts, principles, etc. xiii	Ask informant to describe terminal behavior involving the Sub-TOPIC (or Sub-Sub-TOPIC), and then record or classify it for required level of competency xiv	Description and cross-referencing of terminal behavior on FORM A.5(10) at competency level I, II, III, or IV xv

Terminal Behavior Involves:

INPUT recall ACTION recall xiii.a	Describe and record terminal behavior at appropriate level of competency xiv.a	Description and recording of terminal behavior at: lowest competency level LEVEL I xv.a
INPUT recall ACTION transfer xiii.b	Describe and record terminal behavior at appropriate level of competency xiv.b	Description and recording of terminal behavior at next highest competency level LEVEL II xv.b
INPUT transfer ACTION recall xiii.c	Describe and record terminal behavior at appropriate level of competency xiv.c	Description and recording of terminal behavior at next highest competency level LEVEL III xv.c
INPUT transfer ACTION transfer xiii.d	Describe and record terminal behavior at appropriate level of competency xiv.d	Description and recording of terminal behavior at the highest competency level LEVEL IV xv.d

BACKGROUND INFORMATION

B.3.5

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING WHEN TERMINAL BEHAVIOR INVOLVES SPECIFIC INPUTS VS. AN INPUT CLASS OR INVOLVES SPECIFIC ACTIONS VS. AN ACTION CLASS

CRITERIA	*INPUT** -*Does not belong to a class* -*It is particular, has its own properties* -*Has to be treated or responded to uniquely (e.g., labeled or described uniquely)* *ACTION* -*The sole, allowable way to respond to an input (specific input or class of inputs)*	*INPUT** -*Belongs to a class* -*It shares properties with other inputs in the class* -*Is to be treated or responded to in the same way (e.g., labeled or described the same way as other inputs in the class are labeled* *ACTION* -*There is more than one action possible for a given input* -*Each of the multiple actions can substitute for the other (because they belong to the same class of actions)*
LABEL	SPECIFIC	CLASS
INPUT EXAMPLES	-*A particular painting: "The Mona Lisa"* ••It is an input that is one of a kind ••Only this painting (input) can be called "The Mona Lisa" -*A particular author, street, country, state* ••Each of these is a one-of-a-kind input only ••Each can be called by a particular name: *Hemingway, Bayard Street, Peru, New Mexico, etc.*	-*Any painting* ••It belongs to a class of inputs ••Any painting (input) can be called "a painting" -*Any author, street, country, state* ••Each is a member of a class of "authors," "streets," "countries," or "states" ••Each can be labeled an "author," a "street," a "country," or a "state"
ACTION EXAMPLES	-The sole, allowable way to respond (action) to a specific input ••*Calling the Mona Lisa "The Mona Lisa"* ••*Calling a particular area on a map "Peru"* -The sole, allowable way to respond (action) to a class of inputs ••*Calling an example of a chair "a chair"* **Applies to OUTPUTS as well*	-Alternative, substitutable ways to respond (action) to a specific input ••*Identifying the properties of the Mona Lisa that make it a "DaVinci" EITHER by listing them OR by pointing to similar properties in other DaVinci's* -Alternative, substitutable ways to respond (action) to a class of inputs ••*Defining the class "chair" EITHER by a descriptive statement OR by pointing to an example of it*

B.3.5

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING WHEN TERMINAL BEHAVIOR INVOLVES EXAMPLES OF CLASSES WHICH ARE OLD OR NEW

CRITERIA	-*An example of an INPUT class is old when:* ••*It has been encountered in training or instruction* -*An example of an ACTION class is old when:* ••*It has been practiced during training or instruction*	-*An example of an INPUT class is new when:* ••*It is similar to those encountered in training* ••*But has not itself been encountered in training* -*An example of an ACTION class is new when:* ••*It is substitutable for an old action belonging to a class* ••*But has itself not be practiced during training or instruction*
LABEL	OLD EXAMPLE	NEW EXAMPLE
EXAMPLES OF NEW AND OLD EXAMPLES	INPUT CLASS -*Three examples of a "rectangle" are presented during instruction:* ••A 3' X 5' *rectangle* ••A 4' X 7' *rectangle* ••A 2' X 1' *rectangle* All these examples should be labeled old because they were all encountered during instruction ACTION CLASS -*The student has to learn to classify rectangles* -*During training he has practiced writing the word "rectangle" over examples of rectangles (and not over squares)* -*On a test afterwards he classifies rectangles the same way, by writing the word "rectangle" under the rectangles* This is an old example of the class of actions "classifying rectangles" because it was practiced that way during instruction	INPUT CLASS -*The same three rectangles (in the left-hand column) are presented during instruction* -*Now, on a test after instruction is over, these examples are presented:* ••A 2' X 7' *rectangle* ••A 3' X 9' *rectangle* These examples of a rectangle should be labeled new because they have not been encountered during instruction ACTION CLASS -*The student, as in the left-hand column, has to learn to classify rectangles and has practiced doing so during training by writing the word "rectangle" over examples of rectangles* -*On a test afterwards he is required to classify rectangles by pointing to them, by sorting them in piles, or by picking the single rectangle (among squares) present* These are new examples of the class of actions "classifying rectangles" because all these actions (belonging to the same class) were not practiced during instruction

5.3.5

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING WHEN EXHIBITION OF TERMINAL BEHAVIOR AFTER INSTRUCTION OF TRAINING REQUIRES RECALL VS. TRANSFER

CRITERIA	*INPUT* -*Specific inputs have been encountered during instruction* -*All examples of an input class have been encountered in instruction and are, therefore, old examples* *ACTION* -*Specific actions have been encountered during instruction* -*All examples of a class of actions have been encountered during instruction and are, therefore, old examples*	*INPUT* -*Not all examples of a class of inputs have been encountered in instruction; those that haven't are new examples* *ACTION* -*Not all examples of a class of actions have been encountered in instruction; those that haven't are new examples*
REQUIREMENTS	On a test: RECALL of INPUT or ACTION	On a test: TRANSFER of INPUT or ACTION
INPUT EXAMPLES	ENGLISH: INPUT RECALL -During instruction, three examples of a "verb phrase" *in a sentence are shown (e.g., "may have seen," "are marching past," and "would not have gone"]* -On a test, all three examples used during instruction appear. *To be able to correctly identify the sentences with the verb phrases,* the student simply has to correctly recall these old examples. INPUT RECALL is involved.	PHYSICS: INPUT TRANSFER -During instruction, two examples of *"perfectly elastic" objects (a metal shaft and a hard rubber ball) are shown resuming their original shape after a stress is removed* -On a test, a new example, a depressed coiled spring, is introduced. To be able to answer the test questions, i.e., *"What will happen when the stress is removed?"* the student has to rely on INPUT TRANSFER. He has to be able to see *the coiled spring* (the new example) as being similar to the old examples which he has encountered during training
ACTION EXAMPLES	[redacted] ACTION RECALL -In the above example, the action practiced during instruction involved *putting a check next to those sentences having verb phrases and leaving those without a verb phrase unchecked.* -On a test, *classifying sentences with verb phrases is performed exactly as during instruction, i.e., he puts check marks next to them.* The student simply has to recall the old action taken. ACTION RECALL is involved.	PHYSICS: ACTION TRANSFER -In the above example, the action practiced during instruction was to identify the example of a *perfectly elastic object was to write "perfectly elastic" on paper when shown one.* -*On a test, identification of a perfectly elastic example, old or new example, has to be made by some other action,* e.g., *pointing to examples that are perfectly elastic, OR* e.g., *by sorting examples into piles of perfectly elastic and non-perfectly elastic, OR* e.g., *by stating why the example is to be considered perfectly elastic* He must be able to substitute an equivalent action for the one practiced during training. ACTION TRANSFER is involved.

B.3.5

CRITERIA FOR DETERMINING WHEN TESTING OF TERMINAL BEHAVIOR IS LIKELY TO REQUIRE RECALL AND WHEN IT IS LIKELY TO REQUIRE TRANSFER

IDENTIFICATION MATRIX

CRITERIA	*Terminal behavior involves* *-Specific INPUTS* *-Specific ACTIONS*	*Terminal Behavior involves* *old examples of classes of* *INPUTS* *ACTIONS*	*Terminal Behavior involves* *new examples of classes of* *INPUTS* *ACTIONS*
REQUIREMENTS	Testing of terminal behavior requires RECALL	Testing of terminal behavior requires RECALL	Testing of terminal behavior requires TRANSFER

B.3.5

DETERMINING WHEN ALL EXAMPLES OF CLASSES WILL BE USED IN TRAINING AND THEREFORE BECOME "OLD" EXAMPLES (AND WHEN NOT)

DECISION MATRIX

CONDITIONS	INPUT CLASS -The total number of INPUTS (examples) belonging to the class is small OR -The total number of INPUTS is relatively large, but INPUTS are so dissimilar they almost have to be treated as specific INPUTS (i.e., transfer is difficult)	INPUT CLASS -The total number of INPUTS (examples) belonging to the class is large AND -INPUTS are not so dissimilar appearing that transfer becomes difficult	ACTION CLASS -Actions are of high strength (e.g., knowing a concept well) so that transfer to substitute actions is easy
ACTION TO TAKE	*-Use ALL examples of a class in instruction;* *and treat them as OLD examples in testing*	*-Use a SAMPLE of examples of a class in instruction;* *and treat them as NEW examples in testing*	*-Use a SAMPLE of examples of a class in instruction;* *and treat them as NEW examples in testing*

JOB PROCEDURES

B.3.5

DECISION MATRIX

HOW TO DETERMINE HOW TO CLASSIFY TERMINAL BEHAVIOR AT LEVELS OF COMPETENCY I, II, III, OR IV ON FORM A.5(10)

CONDITIONS	Testing of terminal behavior requires INPUT RECALL + ACTION RECALL	Testing of terminal behavior requires INPUT RECALL + ACTION TRANSFER	Testing of terminal behavior requires INPUT TRANSFER + ACTION RECALL	Testing of terminal behavior requires INPUT TRANSFER + ACTION TRANSFER
ACTION TO TAKE	*Classify at competency level I on FORM A.5(10)*	*Classify at competency level II on FORM A.5(10)*	*Classify at competency level III on FORM A.5(10)*	*Classify at competency level IV on FORM A.5(10)*
EXAMPLES FROM ENGLISH GRAMMAR: Sub-TOPIC "double negatives"	IN INSTRUCTION INPUT: *Two pictures in which a part of a person's body is missing* ACTION: *Checks the sentence (options given) which uses only one negative (in describing what is missing)* IN TESTING INPUT: Duplicates above ACTION: Duplicates above	IN INSTRUCTION INPUT: *Two pictures in which a part of a person's body is missing* ACTION: *Checks the sentence (options given) which uses only one negative (in describing what is missing)* IN TESTING INPUT: Duplicates above ACTION: *Instead of checking the correct sentence, has to make up a sentence using only one negative*	IN INSTRUCTION INPUT: *Two pictures in which a part of a person's body is missing* ACTION: *Checks the sentence (options given) which uses only one negative (in describing what is missing)* IN TESTING INPUT: *New pictures (with parts of automobiles missing)* ACTION: Duplicates above	IN INSTRUCTION INPUT: *Two pictures in which a part of a person's body is missing* ACTION: *Checks the sentence (options given) which uses only one negative (in describing what is missing)* IN TESTING INPUT: *New pictures (with parts of automobiles missing)* ACTION: *Instead of checking the correct sentence, has to make up a sentence using only one*

B.3.5

DETERMINING HOW TO MEET GOALS TO BE SERVED BY DESCRIPTIONS OF TERMINAL BEHAVIOR INVOLVING KNOWLEDGE DOMAINS

DECISION MATRIX

GOALS	To obtain information that can serve in subsequent formulation of **statements of objectives**	To obtain a description of terminal behavior that can serve as a take-off point for subsequent **task analyses**	To obtain a description and classification of terminal behavior that can serve as a take-off point for subsequent formulation of **instructional strategies**
ACTION TO TAKE	*Obtain complete and objective description of:* *-Inputs* *-Actions* *-Outputs* *involved in terminal behavior*	*Obtain description:* *-Identifying terminal behavior requirements*	*Obtain description and classify terminal behavior at proper competency level*
FOR STANDARDS SEE ▷	Pages 143, 146	Page 147	Page 142

B.3.5

CRITERIA FOR OBJECTIVITY IN DESCRIBING TERMINAL BEHAVIORS INVOLVING A KNOWLEDGE DOMAIN*

STANDARDS MATRIX

TO BE DESCRIBED	Verbal and non-verbal INPUTS -Words -People -Objects -Behavior of people -Conditions -One's own behavior -Signals	Verbal and non-verbal ACTIONS -Response to the input(s) ••Defines ••Classifies ••Identifies ••Labels ••Describes ••Interprets	Verbal and non-verbal OUTPUTS -Products -Results -Outcomes
CRITERIA FOR OBJECTIVITY OF DESCRIPTION	*-Inputs described are:* *••Observable* *••Measurable*	*-Actions described are explicit, i.e., they can be:* *••Observed* *••Pointed to* *••Measured* *-Actions described result in outputs which are:* *••Observable* *••Measurable* *••Conclusive evidence*	*-Outputs described are:* *••Observable* *••Measurable*

*These standards of objectivity are also applicable to task descriptions of PERFORMANCE (Section B.3.3).

B.3.5

POSITIVE AND NEGATIVE EXAMPLES OF DESCRIPTIONS OF TERMINAL BEHAVIORS REGARDING STANDARDS OF OBJECTIVITY

EXAMPLES	POSITIVE	NEGATIVE
INPUTS OR OUTPUTS	1. HISTORY e.g., "...resulting in an interpretation of the facts: consisting of conclusions based on the facts; conclusions are not simply restatement of the facts given; conclusions contain predictions about the future, etc." Criteria for assessing the outcome are made available.	1. HISTORY e.g., "...resulting in an interpretation of the facts which is creative." No criteria or guidelines for determining how the creativeness of an output is to be assessed.
ACTIONS	1. ART HISTORY e.g., "Groups examples of paintings belonging to the same school or period." The verb "groups" is explicit and its outcome is readily observable. The outcome is also testable or measurable.	1. ART HISTORY e.g., "Shows an awareness of the style of a given school or period." Both the outcome of and the explicit nature of "shows an awareness" are indeterminate in this statement. There is no indication of how "awareness" can be observed or measured.
	2. CHEMISTRY e.g., "Points to (or describes) the increase in the number of electrons as you go up the periodic table." The action is explicit and observable; its outcome is testable and measurable.	2. CHEMISTRY e.g., "Understands the periodic nature of chemical elements." Both the outcome of and the explicit nature of "understands" is left indeterminate. There is no indication of how it can be observed, tested or measured.
	3. ECONOMICS e.g., "Lists these key attributes of monetary and fiscal policy: ---- ---- ---- ---- ---- ---- The behavior and the evidence is explicit as to whether the student can distinguish between "the two types of policy."	3. ECONOMICS e.g., "Knows the difference between monetary and fiscal policy." It is indeterminate what the required evidence for "knowing the difference" is.

B.3.5

CRITERIA FOR COMPLETE DESCRIPTION OF TERMINAL BEHAVIORS INVOLVING A KNOWLEDGE DOMAIN

STANDARDS MATRIX

	Verbal and non-verbal INPUTS	Verbal and non-verbal ACTIONS	Verbal and non-verbal OUTPUTS
TO BE DESCRIBED	-Words -Objects -Conditions -Signals -People -Behavior of people -One's own behavior	-Response to the input(s) ••Defines ••Classifies ••Identifies ••Labels ••Describes ••Interprets	-Products -Results -Outcomes
CRITERIA FOR COMPLETENESS OF DESCRIPTION	*-The input which is to be presented in a test item stem is identified* *-The question concerning the input is presented* *-Indication of what type of aid (if any) is to be made available*	*-The action or actions to be produced (as an answer to the test item stem)* *-Alternative actions (where they exist) are identified*	*-The outputs that result from the action, i.e., evidence of action taken* *-Standards for acceptability of the output:* *••Content* *••Quality* *••Time to produce*
EXAMPLES	-Type of input e.g., *a diagram of a "diode" is presented* e.g., *the term "phylum" is presented* -Question e.g., *"What is the definition of _____?"* e.g., *"How does this differ from _____?"* -Type of aid provided e.g., *a dictionary is provided* e.g., *a table of logarithms is provided* e.g., *a copy of the periodic table is provided*	-Type of action e.g., *labels parts on the diagram as that of a "diode"* e.g., *defines the term "phylum" as "one of the primary divisions of the animal kingdom"* -Alternative action e.g., *gives an example of a "phylum"* e.g., *sorts pictures of plants into categories*	-Type of output e.g., *correctly labeled diagram* e.g., *verbal definition of a term* -Standards e.g., *list of points to be included in a description (however worded)* e.g., *how many examples of a principle to be provided*

B.3.5

CRITERIA FOR DETERMINING THE ADEQUACY OF THE IDENTIFICATION OF TERMINAL BEHAVIOR REQUIREMENTS FOR USE IN SUBSEQUENT TASK ANALYSES

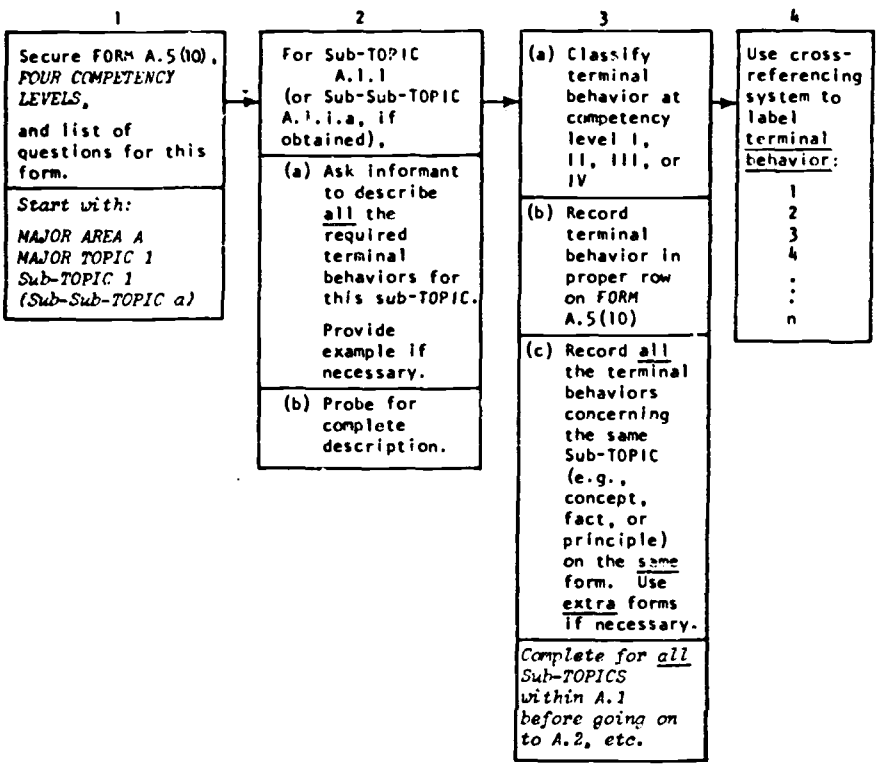
STANDARDS MATRIX

TO BE DESCRIBED	DIRECTION of terminal behavior during testing	What is to be RECALLED during testing	What is to be TRANSFERRED during testing
CRITERIA FOR ADEQUACY OF DESCRIPTION	*Description identifies whether either or both of the following will occur during testing:* *(a) Given an INPUT, the performer will exhibit the appropriate ACTION;* *and if the reverse is also required:* *(b) Given the ACTION, the performer will exhibit or produce the INPUT.*	*Description identifies whether the INPUTS and ACTIONS to appear on tests will have been experienced during instruction and hence be old examples, to be RECALLED.*	*Description identifies whether some of the INPUTS and ACTIONS to appear on tests will NOT have been experienced during instruction and hence be new examples, requiring TRANSFER.*
EXAMPLES	*PHYSICS* Given this INPUT: *An example of a solid, liquid, or gas,* Student takes this ACTION: *Labels the example as "solid," "liquid," or "gas."* AND IN ADDITION THE REVERSE IS REQUIRED: Given the ACTION: *Given the labels "solid," "liquid," or "gas,"* Student is required to take the ACTION: *Citing an example of a solid, liquid, or gas.*	*PHYSICS* INPUT AND/OR ACTION RECALL INPUT: Old examples will appear on tests *e.g., student will be shown "mercury" on a test* (which will have also been shown during instruction). ACTION: Student will be required to exhibit old action, one used during instruction *e.g., writes the word "mercury" as test answer*	*PHYSICS* INPUT AND/OR ACTION TRANSFER INPUT: New examples will appear on tests (examples not used during instruction) *e.g., shown brine on a test* (not used during instruction). ACTION: Student will be required to exhibit a new action (not used during instruction) *e.g., groups it with liquids (having labeled it during instruction)*

B.3.5

ILLUSTRATION SUMMARIZING HOW TO DESCRIBE, RECORD, AND CLASSIFY TERMINAL BEHAVIORS FOR A KNOWLEDGE DOMAIN

DIAGRAM



QUESTIONS FOR FORM A.5(10)

RECOMMENDED QUESTION FORMAT

ORIENTING STATEMENT

"Now, for each of the sub-topics (sub-sub-topics)*, let's identify the facts, concepts, principles, or terms, etc., to be covered and also identify how the learner is expected to exhibit that he has learned them. For example, after having learned a concept, will he be expected to define it verbatim or will he be expected to give an example of the concept covered during instruction or will he be expected to give a new example (one not covered during instruction).

*Use the more detailed level whenever it is obtained.

QUESTION A.1.1

"Let's take *Sub-Topic A.1.1*. What are the terms, concepts, facts, or principles you want the learner to learn?"

QUESTION A.1.1 (Continued)

"For each of the *facts, concepts, principles, etc.* you mentioned, what kind of mastery do you expect?"

Repeat for all sub-topics.

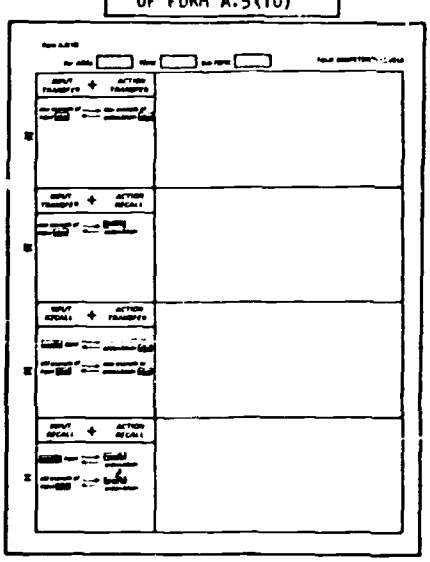
PROVIDE AN EXAMPLE WHEN NECESSARY

STATEMENT

"Here's an example of what I mean."*

**If possible, provide an example from subject matter under study.*

REDUCED ILLUSTRATION OF FORM A.5(10)



B.3.5

EXAMPLE OF A DESCRIPTION OF TERMINAL BEHAVIORS

Form A.5(10)

For AREA C TOPIC 1 Sub-TOPIC 12 FOUR COMPETENCY LEVELS

	INPUT TRANSFER + ACTION TRANSFER	
IV	new example of input [class] ⟵⟶ new example of action/chain [class]	Sub-TOPIC 12 is the concept "monetary policy" -When presented either with examples (of the implementation of "monetary policy") used during instruction or with other examples, identifies (i.e., labels) them as examples of monetary policy; or is able to list the attributes of the actions that qualify them for the label; or is able to to provide additional examples.
	INPUT TRANSFER + ACTION RECALL	
III	new example of input [class] ⟵⟶ [specific] action/chain	
	INPUT RECALL + ACTION TRANSFER	
II	[specific] input ⟵⟶ new example of action/chain [class] old example of input [class] ⟵⟶ new example of action/chain [class]	
	INPUT RECALL + ACTION RECALL	
I	[specific] input ⟵⟶ [specific] action/chain old example of input [class] ⟵⟶ [specific] action/chain	

STEP B.3

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
B.3.1			-Description, labeling, and cross-referencing of: TASKS	A.5(1)
B.3.2			-Description, labeling, and cross-referencing of: STEPS	A.5(2)
B.3.3			-Description, labeling, and cross-referencing of: Sub-STEPS (and Sub-Sub-STEPS)	A.5(3)
//Not part of a sequence				
B.3.4*			-Description of: MAJOR AREAS MAJOR TOPICS Sub-TOPICS (Sub-Sub-TOPICS)	A.5(8) A.5(9)
B.3.5*			-Description of: TERMINAL BEHAVIORS re: knowledge domains	A.5(10)

**For KNOWLEDGE DOMAIN only*

STEP B.4

B.4 Collect "task analysis," "learning analysis," and "competency analysis" information about criterion behavior.*

Sub-Steps B.4.2-B.4.5 are performed in sequence for each lowest level task description, and then, the complete sequence is repeated for the next (lowest level) task description obtained. For KNOWLEDGE DOMAIN, the description of each terminal behavior on FORM A.5(10) is the lowest level obtained.

B.4.1 Organize and store completed task description forms.

B.4.2 Identify and diagram discriminations, generalizations, and associations involved for each lowest level task description.

B.4.3 Determine whether the task analysis information obtained is at a sufficient level of detail; probe for and record additional information when necessary.

B.4.4 Perform a learning analysis for barriers to the learning of discriminations, generalizations, associations, and chains.

B.4.5 Identify and record on each set of diagrams information relevant to recall and transfer requirements.

STEP B.4

OVERVIEW

INPUT	ACTION	OUTPUT
Completed task description of criterion behavior	Collect task analysis and learning analysis information for each lowest level task description	Task analysis and learning analysis information for PERFORMANCE: Sub-STEPS[a] and/or KNOWLEDGE DOMAIN: terminal behaviors

[a] *Or Sub-Sub-STEPS, if obtained*

	INPUT	ACTION	OUTPUT
B.4.1	Completed task description forms for PERFORMANCE [A.5(1)-(3)] and/or KNOWLEDGE DOMAIN [A.5(8)-(9)] i	Organize (group) and store forms ii	Groupings of related forms adequately cross-referenced and sequenced iii
B.4.2	Completed task description FORMS: grouped and cross-referenced + task analysis FORMS and associated questions iv	Collect task analysis information for the lowest level task description v	Task analysis for: -Each performance "Sub-STEP" -Each knowledge domain "terminal behavior" vi
B.4.3	Provisional task analysis for each Sub-STEP vii	Determine adequacy of level of detail; and probe for more detail when necessary viii	Task analysis for each Sub-STEP at appropriate level of detail ix
B.4.4	Completed task analysis forms x	Perform a learning analysis xi	Record of learning difficulty: (a) for discriminations, generalizations, associations, and action generalizations for each Sub-STEP; and (b) for a series of Sub-STEPS that make up a chain xii
B.4.5	Completed task analysis forms xiii	Perform a competency analysis xiv	Record of post-instruction recall and transfer requirements xv

STEP B.4

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	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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B.4.2	-MATRIX: Inputs to be discriminated or generalized . 172 -MATRIX: Associations, action generalizations, and chains 180	-MATRIX: Diagramming discriminations and generalizations . 173-177 -MATRIX: Diagramming associations, action generalizations, and chains . . . 181-184	-MATRIX: Diagramming discriminations and generalizations . 178 -MATRIX: Diagramming associations, action generalizations, and chains 185	FORMS A.5(4)-(7) and/or FORMS A.5(11)-(14) SUMMARY OF PROCEDURES . . 190, 196
B.4.3	-MATRIX: Is task analysis at appropriate level of detail? . . 205	-MATRIX: Probing for more detail 205	-MATRIX: Task analysis at appropriate level of detail . . . 209	FORMS A.5(4)-(7) for PERFORMANCE and/or FORMS A.5(11)-(14) for KNOWLEDGE DOMAIN SUMMARY OF PROCEDURES . . 208
B.4.4	-MATRIX: Discrimination difficulties . . 216 Generalization difficulties . . 218 Association difficulties . . 220 Action generalization difficulties . . 222 Chain difficulties . . 224		-MATRIX: When are forms for learning analysis completed? . . 229	A.5(4) PERFORMANCE A.5(11) KNOWLEDGE DOMAIN (right-hand side) SUMMARY OF PROCEDURES . . 228
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PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A set of FORMS which describes each criterion behavior at varying levels of detail (e.g., tasks, steps, substeps, etc.), and in which the FORMS are appropriately sequenced.*
WHAT YOU WILL WORK FROM	(1) Completed task descriptions for either/or "performance" and/or "knowledge domain".
WHAT YOU WILL DO	(1) Group all task description FORMS belonging together into a set. (2) Sequence all the FORM sets.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	B.4.1

INPUT	ACTION	OUTPUT
Completed task description forms for PERFORMANCE [A.5(1)-(3)] and/or KNOWLEDGE DOMAIN [A.5(8)-(9)] i	Organize (group) and store forms ii	Groupings of related forms adequately cross-referenced and sequenced iii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
	-MATRIX: Grouping forms for PERFORMANCE . . 159 -MATRIX: Grouping forms for KNOWLEDGE DOMAIN 161	-MATRIX: Grouping forms for PERFORMANCE . 160 -MATRIX: Grouping forms for KNOWLEDGE DOMAIN 162	

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		A.5(1)-(3) and/or	B.3	
		A.5(8)-(10)	B.3	

Sub-STEP B.4.1

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Completed task description forms for PERFORMANCE [A.5(1)-(3)] and/or KNOWLEDGE DOMAIN (A.5(8)-(9)] i	Organize (group) and store forms ii	Groupings of related forms adequately cross-referenced and sequenced iii
Completed forms at HIGHEST level of generality i.a	Group and sequence all intermediate and lowest level forms relevant to the highest level grouping under which it is subsumed ii.a	A complete set of intermediate level task descriptions grouped under TASKS and/or MAJOR AREAS iii.a
Completed forms at INTERMEDIATE level of generality i.b	Group and sequence all lowest level forms relevant to the intermediate level grouping under which it is subsumed ii.b	A complete set of lowest level task descriptions grouped under STEPS and/or TOPICS iii.b
Completed forms at LOWEST level of generality i.c	Label and cross-reference lowest level task descriptions ii.c	A complete and cross-referenced set of lowest level task descriptions grouped under Sub-STEPS and/or criterion behaviors iii.c

JOB PROCEDURES

B.4.1

DECISION MATRIX

DETERMINING HOW TO GROUP, STORE, AND IDENTIFY COMPLETED TASK DESCRIPTION FORMS FOR "PERFORMANCE"

COMPLETED FORMS	FORM A.5(1) for TASKS	FORM A.5(2) for STEPS	FORM A.5(3) for Sub-STEPS
ACTION TO TAKE	(1) *Create a file folder for each TASK identified on FORM A.5(1), one for Task A, one for Task B, one for Task C, etc.*	(1) *Create a file folder for each STEP identified on FORM A.5(2), one for Step A.1, one for Step A.2, one for Step A.3, etc.*	(1) *Group and clip together for each Sub-STEP all the A.5(3) FORMS for Sub-Sub-STEPS (when obtained)*
	(2) *Within each TASK folder, store all the A.5(2) FORMS for all the STEPS belonging to that TASK.*	(2) *Within each STEP folder, store all the A.5(3) FORMS for all the Sub-STEPS belonging to that STEP.*	(2) *Make sure all A.5(3) FORMS for Sub-Sub-STEPS are labeled: e.g., A.1.1.1, A.1.1.2, etc., A.1.2.1, A.1.2.2, etc.*
	(3) *Make sure all A.5(2) FORMS are labeled: e.g., A.1, A.2, A.3, etc., B.1, B.2, B.3, etc.*	(3) *Make sure all A.5(3) FORMS are labeled: e.g., A.1.1, A.1.2, A.1.3, A.2.1, A.2.2, A.2.3, etc.*	(3) *Within each Sub-STEP grouping, sequence all the A.5(3) FORMS for Sub-Sub-STEPS which must be followed in sequence in the criterion behavior.*
	(4) *Within each TASK folder, sequence all the A.5(2) FORMS for STEPS for those STEPS which must be followed in sequence in the criterion behavior.*	(4) *Within each STEP folder, sequence all the A.5(3) FORMS for Sub-STEPS for those Sub-STEPS which must be followed in sequence in the criterion behavior.*	

B.4.1

CRITERIA FOR DETERMINING THE ADEQUACY OF GROUPING OF TASK DESCRIPTION FORMS FOR "PERFORMANCE"

STANDARDS MATRIX

STANDARDS	COMPLETENESS	CROSS-REFERENCING	SEQUENCING
CRITERIA	-*Each TASK folder contains all the forms for its constituent STEPS and all the forms for the Sub-STEPS and Sub-Sub-STEPS that belong to each STEP.* -*Each TASK folder will therefore include all the FORMS A.5(2) and all the FORMS A.5(3) related to that TASK.*	-*Each form in a TASK folder will be labeled or numbered.* -*Labeling will differentiate levels of detail (i.e., STEPS vs. Sub-STEPS vs. Sub-Sub-STEPS)*	-*Within each TASK folder, where terminal behavior calls for a fixed sequence, forms will be ordered paralleling that sequence.* -*Ordering of forms will be:* ··*First, by STEPS.* ··*Second, within STEPS, by Sub-STEPS.* ··*Third, within Sub-STEPS, by Sub-Sub-STEPS.*

TASK folders should be ordered in the sequence in which they are called for by criterion behaviors.

B.4.1

DETERMINING HOW TO GROUP, STORE, AND IDENTIFY COMPLETED TASK DESCRIPTION FORMS FOR "KNOWLEDGE DOMAIN"

DECISION MATRIX

COMPLETED FORMS	FORM A.5(8) for: MAJOR AREAS and MAJOR TOPICS	FORM A.5(9) for: Sub-TOPICS and Sub-Sub-TOPICS	FORM A.5(10) for: criterion behaviors (and competency levels)
ACTION TO TAKE	(1) *Create a file folder for <u>each</u> MAJOR AREA, one for Area A, one for B, one for C, etc.*	(1) *Create a file folder for each MAJOR TOPIC, one for A.1, one for A.2, one for A.3, etc.*	(1) *Group and clip together for each Sub-TOPIC (or for each Sub-Sub-TOPIC if obtained) <u>all</u> the A.5(10) FORMS for descriptions of criterion behaviors*
	(2) *Within each AREA folder, store <u>all</u> the A.5(8) FORMS for <u>all</u> the TOPICS belonging to that AREA.*	(2) *Within each TOPIC folder, store <u>all</u> the A.5(9) FORMS for all the Sub-TOPICS belonging to that TOPIC.* *(For Sub-Sub-TOPICS obtained, group them all under the relevant TOPIC.)*	(2) *Make sure all A.5(10) FORMS are labeled: A.1.1.1, A.1.1.2, etc., A.1.2.1, A.1.2.2, etc., A.1.3.1, A.1.3.2, etc.*
	(3) *Make sure all A.5(8) FORMS are labeled: A.1, A.2, A.3, etc., B.1, B.2, B.3, etc.*	(3) *Make sure all A.5(9) FORMS are labeled: A.1.1, A.1.2, A.1.2, etc., A.2.1, A.2.2, A.2.3, etc.*	
	(4) *Within each AREA folder, sequence all the A.5(8) FORMS for TOPICS in the order in which they are usually taught (in the order in which you completed them).*	(4) *Sequence Sub-TOPIC or (Sub-Sub-TOPIC) FORMS in the order in which they are currently taught.*	

B.4.1

CRITERIA FOR DETERMINING THE ADEQUACY OF GROUPING OF TASK DESCRIPTION FORMS FOR "KNOWLEDGE DOMAIN"

STANDARDS MATRIX

STANDARDS	COMPLETENESS	CROSS-REFERENCING	SEQUENCING
CRITERIA	-*Each MAJOR AREA folder contains all the forms for its constituent MAJOR TOPICS and all the forms for the Sub-TOPICS (and Sub-Sub-TOPICS, if obtained) and all the forms for terminal behaviors (competency level FORM).* -*Each MAJOR AREA folder will therefore include all the FORMS A.5(8), (9), and (10) related to that AREA.*	-*Each form in a MAJOR AREA folder will be labeled or numbered.* -*Labeling will differentiate levels of detail (i.e., TOPICS vs. Sub-TOPICS vs. Sub-Sub-TOPICS vs. criterion behaviors)*	-*Within each MAJOR AREA folder, forms will be ordered following the sequence in which the content is usually taught.* -*Ordering of forms will be:* ••*First, by TOPICS* ••*Second, within TOPICS, by Sub-TOPICS* ••*Third, within Sub-TOPICS, by Sub-Sub-TOPICS* **Descriptions of criterion behavior are not ordered.*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*Completed FORMS recording a task analysis for each lowest level task description -- identifying the descriminations, generalizations, associations and chains involved.*
WHAT YOU WILL WORK FROM	(1) Completed task description FORMS (2) Informant expertise (3) Lists of questions to ask informant.
WHAT YOU WILL DO	(1) Collect and record task analysis information for each subSTEP or for each terminal behavior.
FORMS YOU WILL USE	FORMS A.5(4)-(7) or FORMS A.5(11)-(14) for recording task analysis results for "performance" subSTEPS or for "knowledge domain" terminal behavior respectively.

DESCRIPTION OF Sub-STEP	B.4.2

INPUT	ACTION	OUTPUT
Completed task description FORMS: grouped and cross-referenced + task analysis FORMS and associated questions iv	Collect task analysis information for the lowest level task description v	Task analysis for: -Each performance "Sub-STEP" -Each knowledge domain "terminal behavior" vi

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Inputs to be discriminated or generalized . 172 -MATRIX: Associations, action generalizations, and chains 180	-MATRIX: Diagramming discriminations and generalizations 173-177 -MATRIX: Diagramming associations, action generalizations, and chains . . .131, 184	-MATRIX: Diagramming discriminations and generalizations 178 -MATRIX: Diagramming associations, action generalizations, and chains 185	FORMS A.5(4)-(7) and/or FORMS A.5(11)-(14) SUMMARY OF PROCEDURES 190, 196

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Grouped, completed task description forms	B.4.1	PERFORMANCE: A.5(1)-(3) and/or	B.3	FORMS A.5(4)-(7): TASK ANALYSIS: "PERFORMANCE"
		KNOWLEDGE DOMAIN: A.5(8)-(10)	B.3	FORMS A.5(11)-(14): TASK ANALYSIS: "KNOWLEDGE DOMAIN"

Sub-STEP B.4.2 JOB DIAGRAM

INPUT	ACTION	OUTPUT
Completed task description FORMS: grouped and cross-referenced + task analysis FORMS and associated questions iv	Collect task analysis information for the lowest level task description v	Task analysis for: -Each performance "Sub-STEP" -Each knowledge domain "terminal behavior" vi
INPUTS which have to be responded to differentially iv.a	Create diagram showing what the INPUTS are which have to be distinguished in order to make a differential response possible v.a	Diagram features representing DISCRIMINATIONS vi.a
INPUTS which have to be responded to in the same manner iv.b	Create diagram showing what the INPUTS are which have to be seen as the same in order to make the same response possible v.b	Diagram features representing GENERALIZATIONS vi.b
ACTIONS which are the responses to INPUTS iv.c	Create diagram showing the INPUTS and ACTIONS which have to be associated v.c	Diagram features representing ASSOCIATIONS vi.c
Sequence of associations iv.d	Collect and sequence series of diagrams for associations v.d	Series of diagrams representing CHAINS vi.d

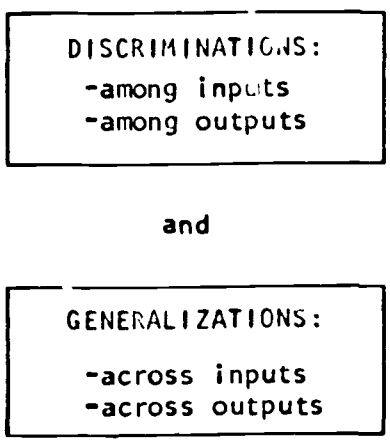
BACKGROUND INFORMATION

B.4.2

OVERVIEW OF THE TASK ANALYSIS PROCESS INCLUDING IDENTIFICATION OF THE MATRICES PROVIDED

INDEX

SKILL ELEMENTS	A DISCRIMINATION among INPUTS (OUTPUTS)	A GENERALIZATION across INPUTS (OUTPUTS) across ACTIONS	An ASSOCIATION between an INPUT and an ACTION	A CHAIN of associations
IDENTIFICATION MATRIX: "What They Are"	page 172	INPUTS page 172 ACTIONS page 180	page 180	page 180
DECISION MATRIX: "How to Diagram"	pages 173, 176	INPUTS pages 173, 177 ACTIONS page 181	page 181	page 181
STANDARDS MATRIX: "A Complete Analysis"	page 178	INPUTS page 178 ACTIONS page 185	page 185	page 185


DISCRIMINATIONS:
-among inputs
-among outputs
and
GENERALIZATIONS:
-across inputs
-across outputs

B.4.2

CRITERIA FOR IDENTIFYING WHEN CRITERION BEHAVIOR (IN PERFORMANCE OR IN KNOWLEDGE DOMAIN) INVOLVES A DISCRIMINATION AMONG INPUTS OR A GENERALIZATION ACROSS INPUTS*

IDENTIFICATION MATRIX

*Also applies to OUTPUTS

	among INPUTS	across INPUTS
CRITERIA	-Inputs have to be distinguished from one another	-Inputs have to be seen as similar
SKILL ELEMENTS	A DISCRIMINATION	A GENERALIZATION
INPUT EXAMPLES	-The chemistry student has to be able to tell the difference between examples of a liquid and examples of a gas (so that he can, when asked to do so, label them as "liquid" or "gas"). -The math student has to be able to tell the difference between addition formats and subtraction formats, e.g., $+4^{5}$ vs. -4^{5}, (so that he can perform the appropriate, different operations).	-The chemistry student also has to be able to see the similarity among various examples of a liquid (so that he can label them all as "liquids"). -The math student also has to be able to see the similarity among variations in "addition" formats, e.g., $+3^{4}$ and $(x+4)+(y+2)$, so he can perform the same "adding" operation.
EXAMPLES	-A media specialist has to be able to tell the difference between underexposed, properly exposed, and overexposed photographs he has taken (so he can decide whether to use or not use them or make decisions about future exposure times). -The English student has to be able to tell the difference between his writing that is well organized and that is not well organized (so he can decide to accept one or continue to make revisions in the other).	-The media specialist also has to be able to see the similarity across photographs of varying degrees of underexposure or see the similarity across photographs of varying degrees of overexposure (so that he can reject any that fall within the underexposed or within the overexposed range). -The English student has to be able to identify ranges of well organized writing (so that he can decide to accept "acceptable" variations) and he has to be able to identify ranges of poorly organized writing (so that he can decide to reject "unacceptable" variations).

B.4.2

WHAT A DISCRIMINATION IS AND WHAT IT ISN'T

IDENTIFICATION MATRIX

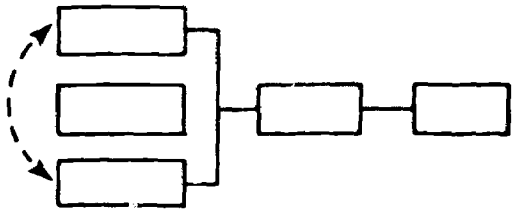
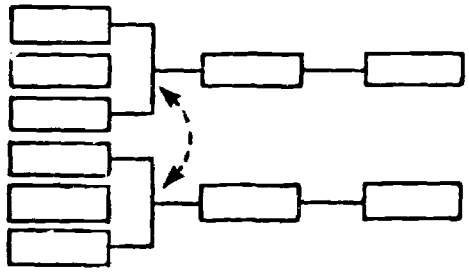
BEHAVIOR	A DISCRIMINATION among INPUTS	NOT A DISCRIMINATION (making a response to the INPUT)
CRITERIA	*-Seeing or perceiving the difference among INPUTS based on relevant properties of the INPUTS* *-Forms the basis for the ability to make a differential response to INPUTS requiring it*	*-Making the appropriate response (taking a different ACTION) to INPUTS requiring different responses.* *(See ASSOCIATION later.)*

EXAMPLES	DISCRIMINATION among INPUTS	The ACTION taken in response to the different INPUTS which have been distinguished from one another
MORSE CODE	Hearing the difference between three dots and a dash and four dots and a dash	Writing down the letter corresponding to three dots and a dash or the letter corresponding to four dots and a dash
CALLING PEOPLE BY NAME	Seeing a difference between identical twin boys (based on some identifying characteristic)	Calling one Jim and calling the other Bob
AIR DEFENSE	Seeing the difference (based on visual properties) or hearing the difference (based on auditory properties) between friendly and unfriendly aircraft	Reporting to headquarters of the approach of friendly or unfriendly aircraft OR firing at the unfriendly and withholding fire from the friendly aircraft

B.4.2

CONTRASTING DISCRIMINATIONS AND GENERALIZATIONS

IDENTIFICATION MATRIX

BEHAVIOR	GENERALIZATION	DISCRIMINATION
CRITERIA	-*Seeing or perceiving the similarity among INPUTS belonging to the same class (based on their relevant attributes)* -*Forms the basis for the ability to make the same response to all INPUTS requiring it*	-*Seeing or perceiving the difference among INPUTS based on relevant properties of the INPUTS* -*Forms the basis for the ability to make a differential response to INPUTS requiring it*
EXAMPLES		
GENERAL	similarities within a class 	differences between classes 
PHYSICS	-Seeing the similarities among all types of materials which qualify for the label "solids"	-Seeing the differences between those types of materials which are solids and those which are liquids e.g., Is mercury a liquid or a solid?

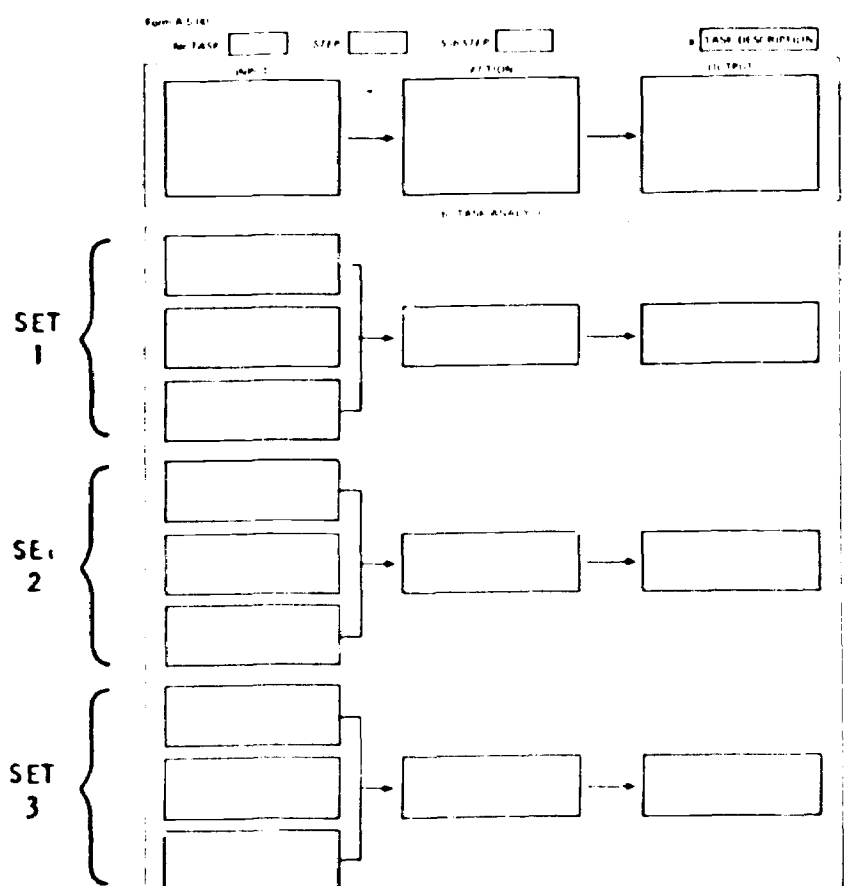
B.4.2

DETERMINING WHICH PORTION OF FORM A.5(4) TO USE IN DIAGRAMMING DISCRIMINATIONS AND GENERALIZATIONS

DECISION MATRIX

CONDITIONS	A DISCRIMINATION among INPUTS to be diagrammed	A GENERALIZATION across INPUTS to be diagrammed
ACTION TO TAKE	-*Describe two or three different specific inputs or two or three different input classes in two or three separate sets of rectangles in the INPUT column.** -*If there are additional different inputs to be discriminated from the two or three already recorded, use Supplementary FORM A.5(5).*	-*Describe two or three examples of each input class in each single set of rectangles in the INPUT column.* -*If there are more examples to be recorded within each class, use Supplementary FORM A.5(6).*

**See Section B.3.5 for definition of specific inputs and input classes.*



DISCRIMINATION:

Among Set 1, Set 2, and Set 3

GENERALIZATION:

Within Set 1,
Within Set 2,
Within Set 3

B.4.2

"PERFORMANCE" EXAMPLE OF DIAGRAMMING FOR A "DISCRIMINATION" AND A "GENERALIZATION"

Form A 5 (4)

for TASK C STEP 4 Sub-STEP 2 a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Subtraction problems vii		

b. TASK ANALYSIS

(4) - (+3) vii.a.1

(7) - (+5) vii.a.2

(14) - (+2) vii.a.3

DISCRIMINATIONS: The math student has to discriminate between input classes vii.a and vii.b; he has to recognize the difference in notations between vii.a examples and vii.b examples

(4) - (-3) vii.b.1

(7) - (-5) vii.b.2

(14) - (-2) vii.b.3

GENERALIZATIONS: He also has to generalize across inputs within each input class (e.g., within vii.a); he has to recognize the similarity in notation of all the vii.a examples and all vii.b examples.

B.4.2

"KNOWLEDGE DOMAIN" EXAMPLE OF DIAGRAMMING FOR A "DISCRIMINATION" AND A "GENERALIZATION"

Form A 5 (11)

for AREA D TOPIC 2 Sub-TOPIC 1 BEHAVIOR 1 a. TASK DESCRIPTION

INPUT: Types of matter (i)

ACTION:

OUTPUT:

b. TASK ANALYSIS

- wood (i.a.1)
- cloth (i.a.2)
- ice (i.a.3)

DISCRIMINATIONS: The physics student has to discriminate between examples belonging to three classes of matter: the i.a class, the i.b class, and the i.c class.

GENERALIZATIONS: He also has to generalize across, i.e., see the similarity among, all examples within a class: e.g., i.a.1, i.a.2, and i.a.3.

- water (i.b.1)
- gasoline (i.b.2)
- syrup (i.b.3)
- helium (i.c.1)
- nitrogen (i.c.2)
- oxygen (i.c.3)

B.4.2

DETERMINING HOW TO DIAGRAM DISCRIMINATIONS FOR "SPECIFIC" INPUTS AND FOR INPUT "CLASSES"

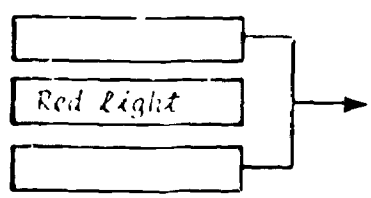
DECISION MATRIX

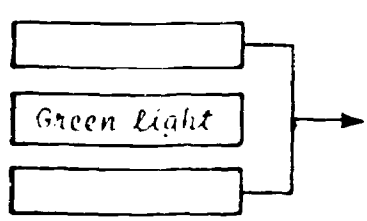
CONDITIONS	Discriminations among specific INPUTS to be diagrammed on FORM A.5(4) or on FORM A.5(11)	Discriminations among INPUT CLASSES to be diagrammed on FORM A.5(4) or on FORM A.5(11)
ACTION TO TAKE	*(1) Make only one entry in each "set" of three input rectangles (indicating it is specific).* *OR* *(2) Optionally, create a diagram with only one rectangle for each specific input.*	*(1) Make more than one entry in each "set" of three input rectangles (indicating it is a class of inputs).**

EXAMPLES

"DRIVING" EXAMPLE

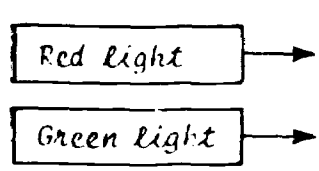
(1)





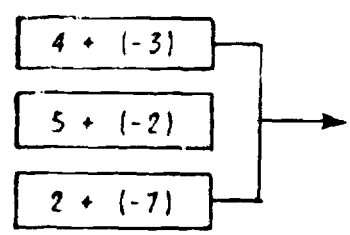
OPTIONAL, ALTERNATIVE DIAGRAMMING

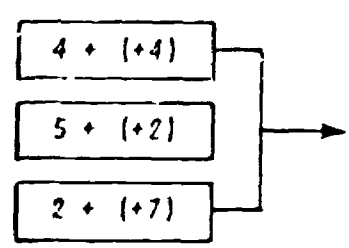
(2)



"ALGEBRA" EXAMPLE

(1)





**NOTE: Classes rarely are restricted to just three members. They are diagrammed in threes merely for convenience. See next page for use of supplementary diagrams where necessary.*

B.4.2

DETERMINING HOW MANY INPUTS WITHIN A "CLASS" TO DIAGRAM IN A REPRESENTATION OF A GENERALIZATION*

DECISION MATRIX

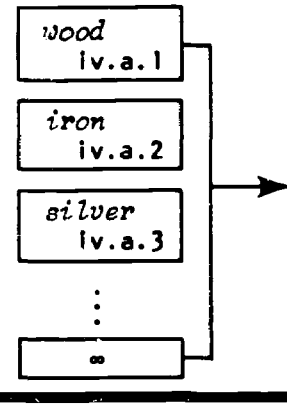
CONDITIONS	-The entire class of INPUTS is FINITE and also is relatively SMALL: i.e., probably not exceeding a total of 10 inputs	-The entire class of INPUTS is LARGE (can be considered INFINITE), and -All the inputs are highly similar (generalization likely to be easy)	-The entire class of INPUTS is relatively LARGE (not infinite) and, -All the inputs are highly dissimilar (generalization likely to be difficult)
ACTION TO TAKE	-Diagram all the inputs; -Use Supplementary GENERALIZATION FORM A.5(6) - PERFORMANCE, FORM A.5(12) - KNOWLEDGE DOMAIN, when necessary	-Diagram only a representative sample of the inputs -Diagram examples of frequently and infrequently occurring inputs -Use Supplementary GENERALIZATION FORM A.5(6) - PERFORMANCE, FORM A.5(12) - KNOWLEDGE DOMAIN, when necessary	-Diagram all the highly dissimilar inputs -Use Supplementary GENERALIZATION FORM A.5(6) - PERFORMANCE, FORM A.5(12) - KNOWLEDGE DOMAIN, when necessary
EXAMPLES	e.g., INSTRUCTIONAL TECHNOLOGY: *For purposes of teaching about all the types of "evaluation," diagram all the types belonging to the class, i.e., "informal," "formative," and "evaluative"* e.g., MEDICINE: *For purposes of teaching about the class concept "venereal disease," since the types are limited in number, diagram them all*	e.g., TRIGONOMETRY: *For purposes of teaching what a "sine" is, since all right-angled triangles are highly similar, only a small sample of right-angled triangles need be represented* e.g., ENGLISH: *For purposes of teaching what a "singular" noun is, since most singular nouns are highly similar, even though the class "singular nouns" is huge, only a sample need be represented*	e.g., SPELLING: *For purposes of teaching the "past participles" of a large number of selected, irregular verbs, since all are highly dissimilar (i.e., see, go, come, etc.), all should be represented in the diagrams;* (generalization is not possible, and each separate association will have to be taught, *i.e., see-have seen, go-have gone, come-have come, etc.*

*Review page 139 in Section B.3.5 regarding recall and transfer requirements.

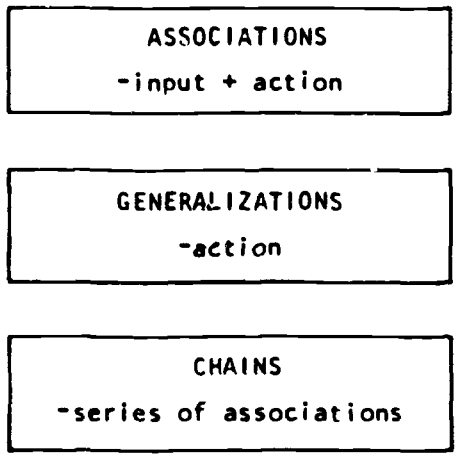
B.4.2

CRITERIA FOR DETERMINING THE ADEQUACY OF THE DIAGRAMMING OF DISCRIMINATIONS AND GENERALIZATIONS*

STANDARDS MATRIX

STANDARDS	COMPLETENESS	SPATIAL DIFFERENTIATION	CROSS-REFERENCING
CRITERIA	-*All the different specific inputs are diagrammed* -*Examples within a class of inputs:* ··*Small class fully represented* ··*Large class of dissimilar examples fully represented* ··*Large class of similar examples only sampled*	-*Specific/class inputs:* ··*A specific input is represented by one rectangle* ··*A class of inputs is represented by a set of joined rectangles* -*Each different specific input or each different class of inputs is assigned a spatially separate and different set of rectangles* -*All the represented examples of a class of inputs are grouped within a single set of rectangles*	-*All inputs for a give given Sub-STEP are identified by the same Roman number, e.g., i, or iv, or vii, etc.* -*Each different specific input or each different class of inputs is identified by a different lower case letter: a, b, c, d, etc.* -*All examples within a class are identified by Arabic numbers: a.1, a.2, a.3, a.4, etc., b.1, b.2, b.3, b.4, etc.* -*Classes of examples that are only sampled should be identified as non-exhaustive, e.g., by using an infinity symbol (∞)* 

*Each different output is generally represented by a single rectangle. Since most outputs become inputs for the next Sub-STEP, differentiations in diagramming will be taken care of when the next Sub-STEP is diagrammed. For outputs which mark the end of a chain of Sub-STEPS, further differentiation than is possible in a single rectangle for each output may be necessary. For example, ranges of acceptable outputs (generalizations) may have to be represented.


ASSOCIATIONS
-input + action
GENERALIZATIONS
-action
CHAINS
-series of associations

B.4.2

CRITERIA FOR IDENTIFYING WHEN CRITERION BEHAVIOR INVOLVES ASSOCIATIONS, GENERALIZATION OF ACTIONS, OR CHAINING

IDENTIFICATION MATRIX

CRITERIA	-*Inputs require <u>different</u> ACTIONS be taken in response to them* -*Different specific inputs or different input classes have to be linked with their own particular ACTIONS*	-*A given specific input or a given input class can be responded to by alternative actions* -*The alternative actions are interchangeable* -*Actions must be seen as being interchangeable*	-*A <u>series</u> of sequenced INPUT-ACTION associations have to be run off in their entirety for behavior to be completed* *e.g., a series of Sub-STEPS (PERFORMANCE)* *e.g., a complete series of associations for terminal behavior (KNOWLEDGE DOMAIN)*
SKILL ELEMENTS	An ASSOCIATION between INPUT + ACTION	An ACTION GENERALIZATION	A CHAINING of a <u>series</u> of ASSOCIATIONS
EXAMPLES	<u>e.g., MEDIA WORK</u> *The media specialist has to associate the proper actions, "increase in exposure time," and "reduction in exposure time," when faced with photographs (inputs) that are underexposed or that are overexposed.*	<u>e.g., ENGLISH</u> *The English student has to be able to take one or more <u>interchangeable</u> actions, saw, revision strategies, in order to edit writing having a particular fault. When the writing appears disorganized, he might:* *••Use headings, or* *••Rearrange sections, or* *••Provide an overview*	<u>e.g., INSTRUCTIONAL TECHNOLOGY</u> *Most of the Sub-STEPS in this handbook have to be performed in sequence. The technologist therefore has to learn to perform each Sub-STEP, follow it in sequence with the next Sub-STEP, the next, and so on.*

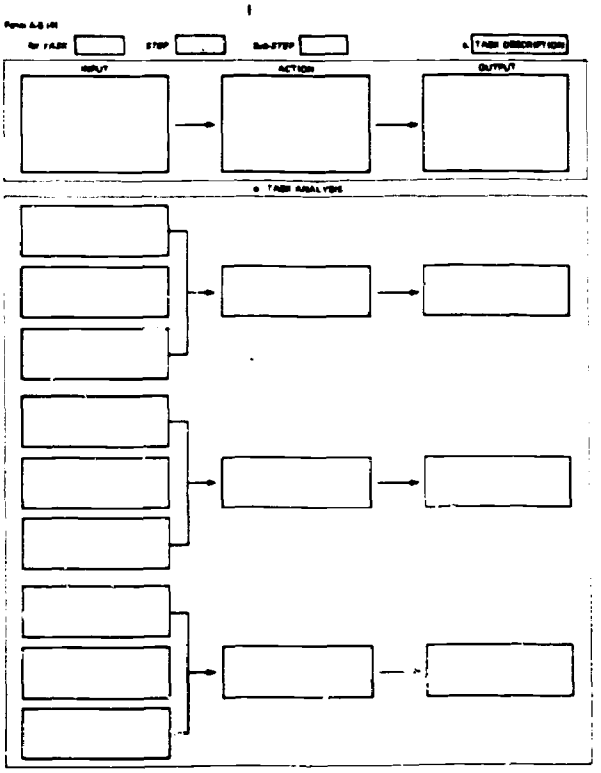
B.4.2

DETERMINING HOW TO DIAGRAM ASSOCIATIONS, ACTION GENERALIZATIONS, AND CHAINS

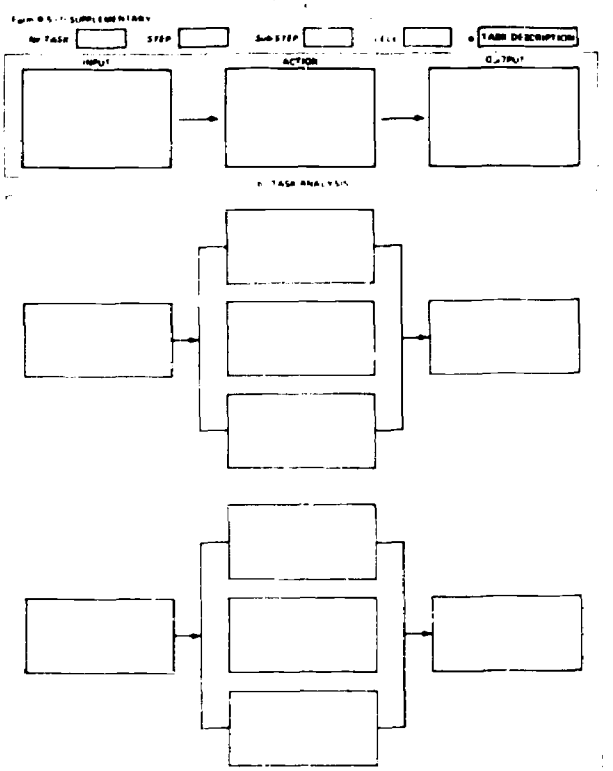
DECISION MATRIX

CONDITIONS	If terminal behavior involves a single ACTION to be associated with an input	If terminal behavior involves multiple, interchangeable ACTIONS to be ASSOCIATED with an input i.e., ACTION	If terminal behavior involves a CHAIN of sequenced ASSOCIATIONS
ACTION TO TAKE	-*Describe the ACTION to be associated with each set of rectangles* -*Enter description in the ACTION (middle) column* -*Use FORM A.5(4) below*	-*Describe the alternative ACTIONS to be associated with each input class* -*Enter descriptions in the set of actions in the ACTION (middle) column* -*Use FORM A.5(7) below*	-*Collect all the task analysis forms for all the separate Sub-STEPS that make up the chain (PERFORMANCE)* -*Collect all the task analysis forms for the terminal behavior in a KNOWLEDGE DOMAIN* -*Represent the chain by serially (spatially) ordering all the diagrams for each sub-STEP* *(See page 146)*

FORM A.5(4)



FORM A.5(7) SUPPLEMENTARY



B.4.2 "PERFORMANCE" EXAMPLE OF DIAGRAMMING OF AN ASSOCIATION*

Form A-5 (4)

for TASK C STEP 4 SUB-STEP 2 a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Subtraction problems	Does subtraction problems	Answers

b. TASK ANALYSIS

(4) - (+3) vii.a.1

(7) - (+5) vii.a.2

(14) - (+2) vii.a.3

→ Subtracts the two numbers viii.a → A lesser number ix.a

ASSOCIATIONS: The math student has to associate each of two actions, viii.a and viii.b, with the appropriate class of inputs, i.e., vii.a and vii.b, respectively.

(4) - (-3) vii.b.1

(7) - (-5) vii.b.2

(14) - (-2) vii.b.3

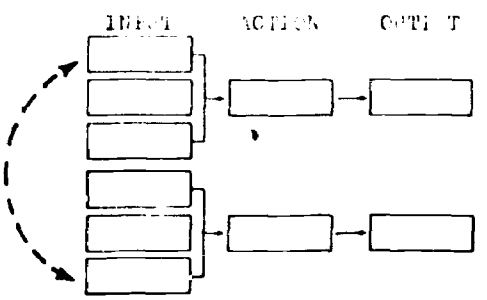
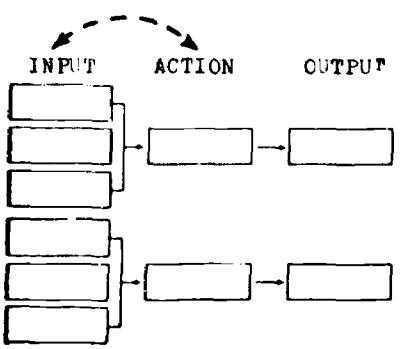
→ Adds the two numbers viii.b → A larger number ix.b

*A sequenced series of individual diagrams, like the one on this page (a diagram for each Sub-STEP), collectively represents the diagram for a CHAIN.

B.4.2

THE DIFFERENCE BETWEEN "DISCRIMINATIONS" AND "ASSOCIATIONS"

IDENTIFICATION MATRIX

SKILLS	DISCRIMINATION	ASSOCIATION
CRITERIA	*-Seeing the difference(s) between INPUTS* *••In the diagram to the left, the discrimination involves seeing the difference in notation between the class viia (a combination of a minus sign and a plus sign) and the class viib (a combination of two minus signs)*	*-Linking an appropriate ACTION to an INPUT or INPUT class* *••In the diagram to the left, the association involves linking the viiia ACTION (subtracting) with the appropriate INPUT class (viia) and linking the viiib ACTION (adding) with the appropriate INPUT class (viib)*
EXAMPLES	The discrimination involves only INPUTS 	The association involves the linking of INPUT and ACTION 

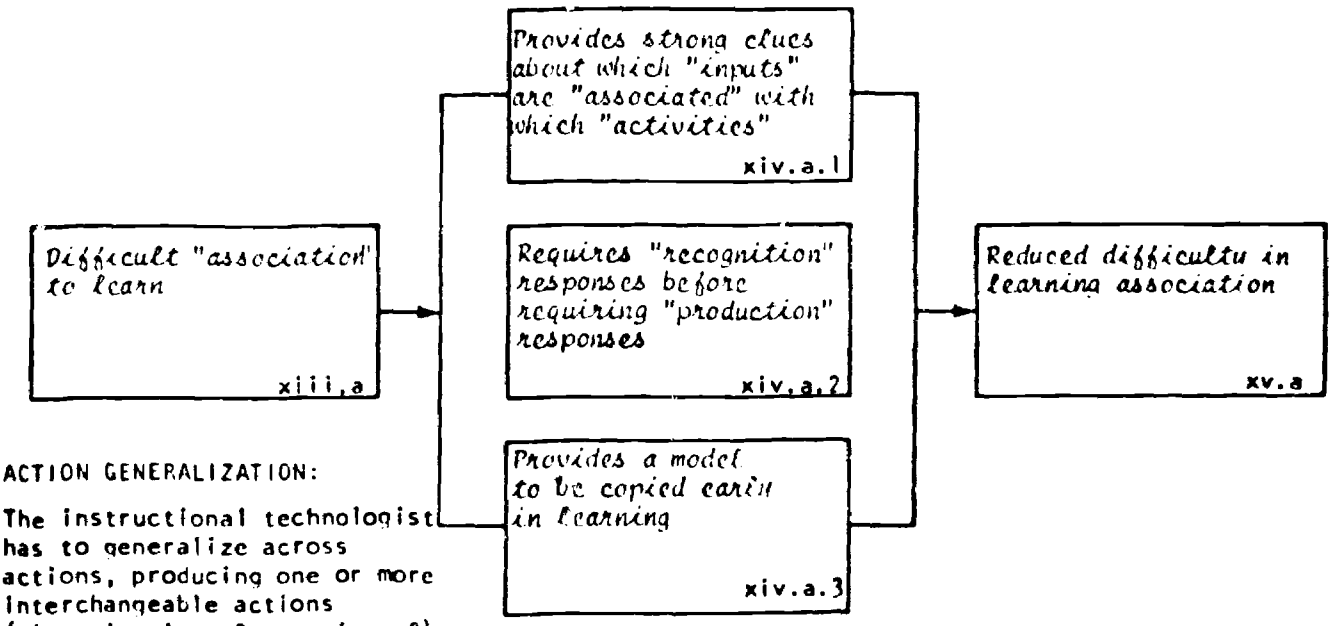
B.4.2 "PERFORMANCE" EXAMPLE OF DIAGRAMMING FOR AN "ACTION GENERALIZATION"

Form A-5 (7) SUPPLEMENTARY

for TASK E STEP 1 SUB-STEP 3 CELL 2 a. TASK DESCRIPTION

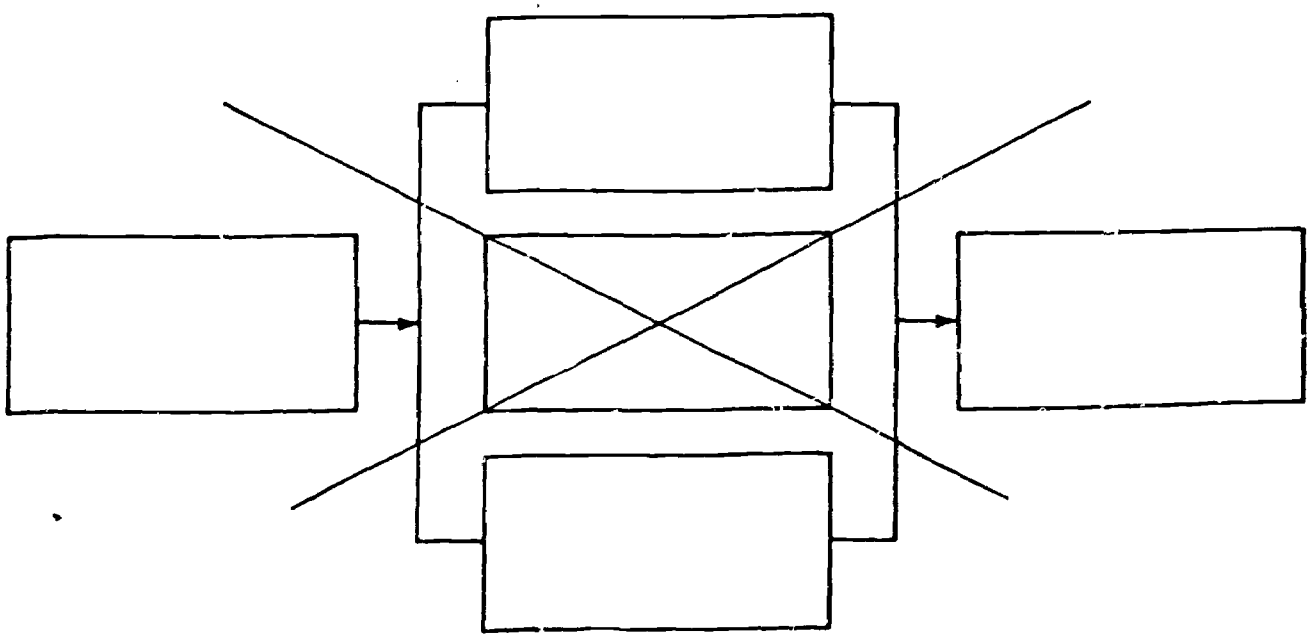
INPUT	ACTION	OUTPUT
Learning problems xiii	Uses technique to reduce learning difficulty xiv	Learning difficulty reduced (all students accommodated) xv

b. TASK ANALYSIS



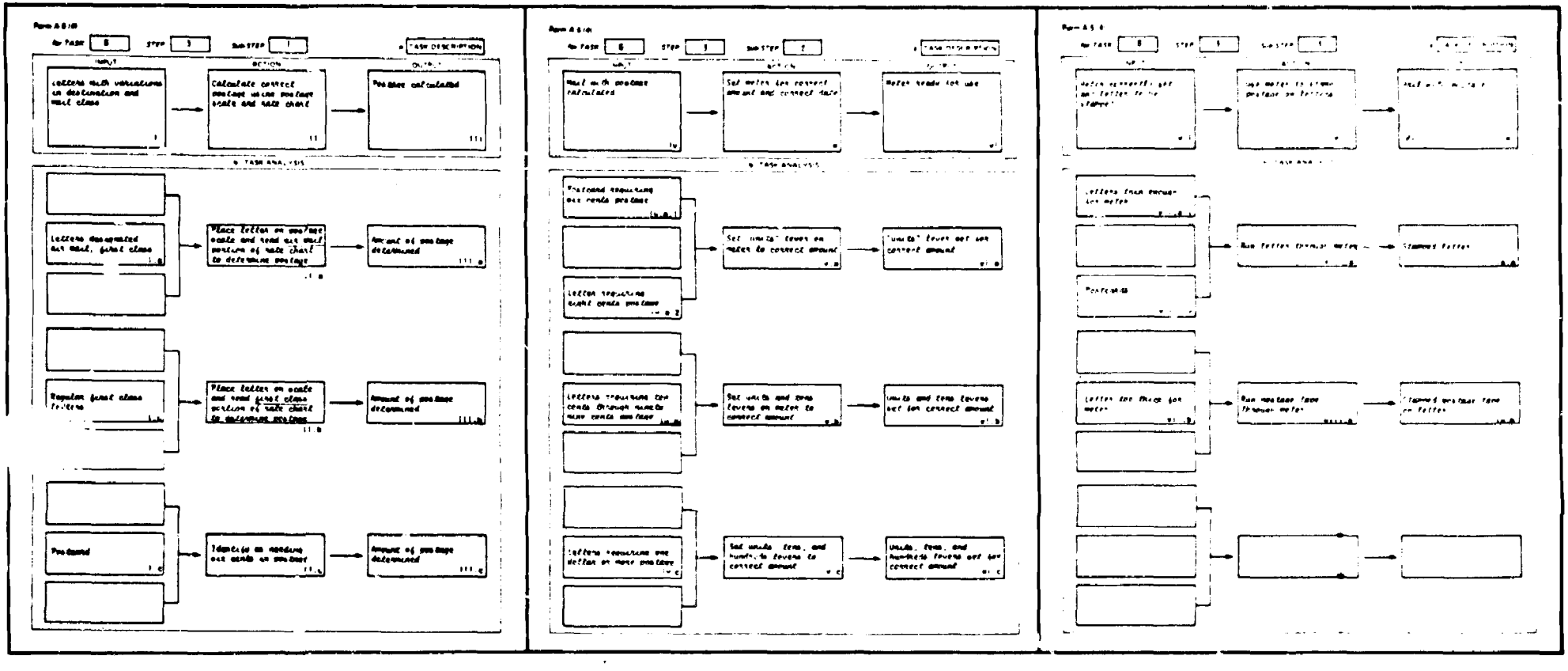
ACTION GENERALIZATION:

The instructional technologist has to generalize across actions, producing one or more interchangeable actions (xiv.a.1, xiv.a.2, or xiv.a.3) when faced with input xii.a.



B.4.2

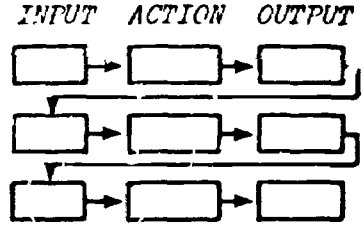
DIAGRAMMING A CHAIN



B.4.2

CRITERIA FOR DETERMINING THE ADEQUACY OF THE DIAGRAMMING OF ASSOCIATIONS, ACTION GENERALIZATIONS, AND CHAINS

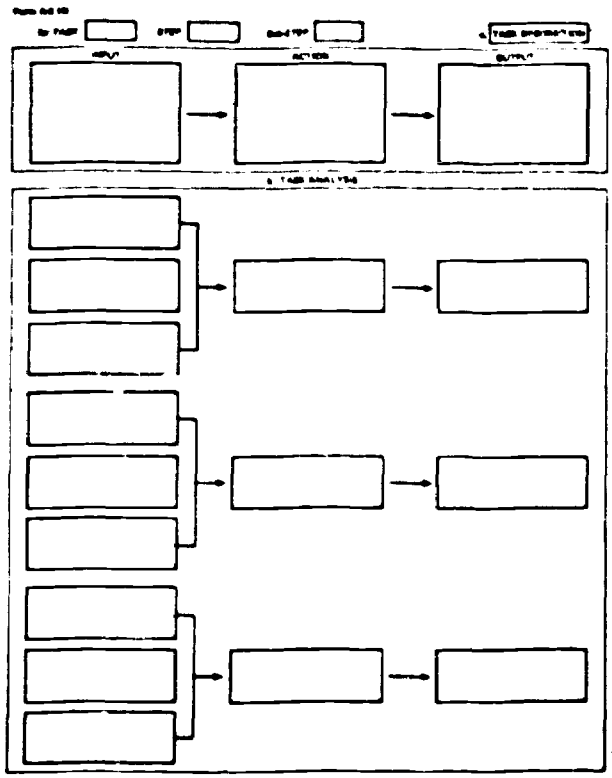
STANDARDS MATRIX

STANDARDS	COMPLETENESS	SPATIAL DIFFERENTIATION	CROSS-REFERENCING
CRITERIA	*ASSOCIATIONS* *-For each different specific input, the diagram should identify the action associated with it* *-For each different class of inputs, the diagram should identify the action associated with it*	*ASSOCIATIONS* *-Each different action is represented by one rectangle*	*ASSOCIATIONS* *-All actions for a given Sub-STEP are identified by the same Roman number, e.g., ii, or v, or viii, etc.* *-Each different action is identified by a different lower case letter: a, b, c, d, e, etc.*
	ACTION GENERALIZATION *-Each set of alternative or interchangeable actions is identified*	*ACTION GENERALIZATION* *-Each set of alternative or interchangeable actions is identified by a set of joined rectangles*	*ACTION GENERALIZATION* *-All actions in a set of actions are identified by the same Roman number and the same lower case letter, e.g., xiv.a, or xvii.b, etc.* *-Each different action (rectangle) in a set of actions is identified by a different Arabic number: xiv.a.1, xiv.a.2, xiv.a.3, etc.*
	CHAINS *-There should be a task analysis diagram for each lowest level task description (A series of such diagrams graphically represents the whole chain)*	*CHAINS* *-Each form for the lowest level task description unit (i.e., a performance Sub-STEP or a knowledge domain terminal behavior) graphically represents a unit of the chain*	*CHAINS* *-Each successive diagram in the chain is identified by a progression of Roman numbers:* *INPUT ACTION OUTPUT* 

JOB PROCEDURES

QUESTIONS TO BE USED IN OBTAINING TASK ANALYSIS INFORMATION

FORM A.5(4)



QUESTIONS FOR FORM A.5(4)

RECOMMENDED QUESTION FORMATS

ORIENTING STATEMENT

"Now, we want some more detail about each sub-step."

QUESTION 1 (Discriminations)

"Let's take Sub-STEP _____ (*Sub-Step #*).
When you are _____ (*activity*)
what different _____ (*input conditions*)
are there that would cause you to take a different course of action?"

QUESTION 2 (Associations)

"For each of these different _____ (*input conditions*), what different course of action would you take?"

QUESTION 3 (Action Generalization)

"One at a time, let's take each of these _____ (#) actions you mentioned.
Are there alternative ways to _____ (*action*)?"

QUESTION 4 (Input Generalization)

"One by one, let's take these _____ (#) types of _____ (*input conditions*) you mentioned; are there possible variations within each type that would still lead you to deal with them all in the same way, i.e., _____ (*action to be taken*)?"

QUESTION 5 (Discriminations - Outputs)

"For each of these _____ (#) _____ (*input conditions*), what differences in outcomes, if any, are there?"

QUESTION 6

"Are there standards about these _____ (*outcomes*) which are crucial for satisfactory performance?"

B.4.2

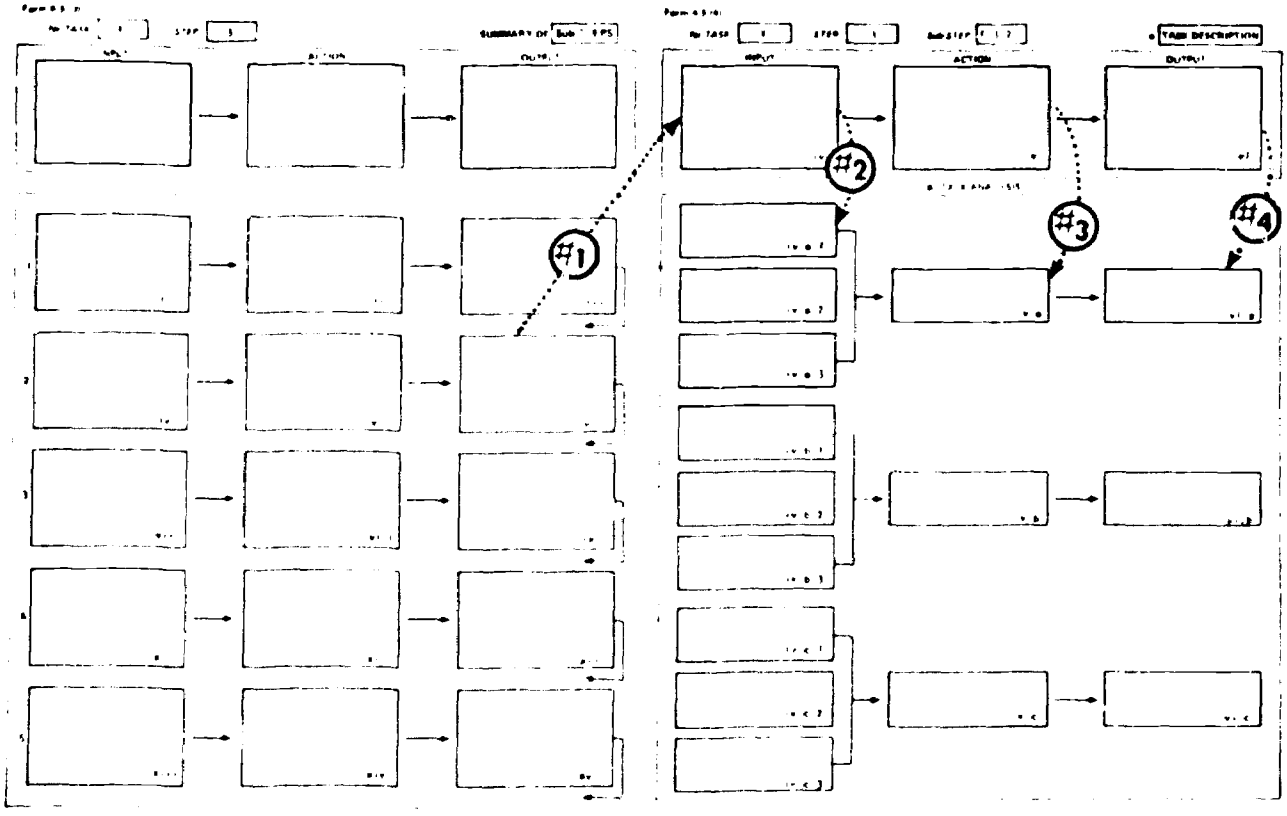
ILLUSTRATION SUMMARIZING PROCEDURES FOR DIAGRAMMING TASK ANALYSIS INFORMATION FOR A "PERFORMANCE" SUB-STEP*

DIAGRAM

#1	#2	#3	#4
Transfer from task description FORM A.5(3): "Summary of Sub-STEPS" the description of a Sub-STEP	Ask expert informant to break the INPUT at top of FORM A.5(4) into the separate inputs which have to be discriminated and ge eralized	Ask expert informant to identify each ACTION to be associated with each different set of inputs	Ask expert informant to identify each OUTPUT that results from each different action
To top of task analysis FORM A.5(4)	Record information in INPUT column in bottom section of FORM A.5(4)	Record information in ACTION column in bottom section of FORM A.5(4)	Record information in OUTPUT column in bottom section of FORM A.5(4)

FORM A.5(3)

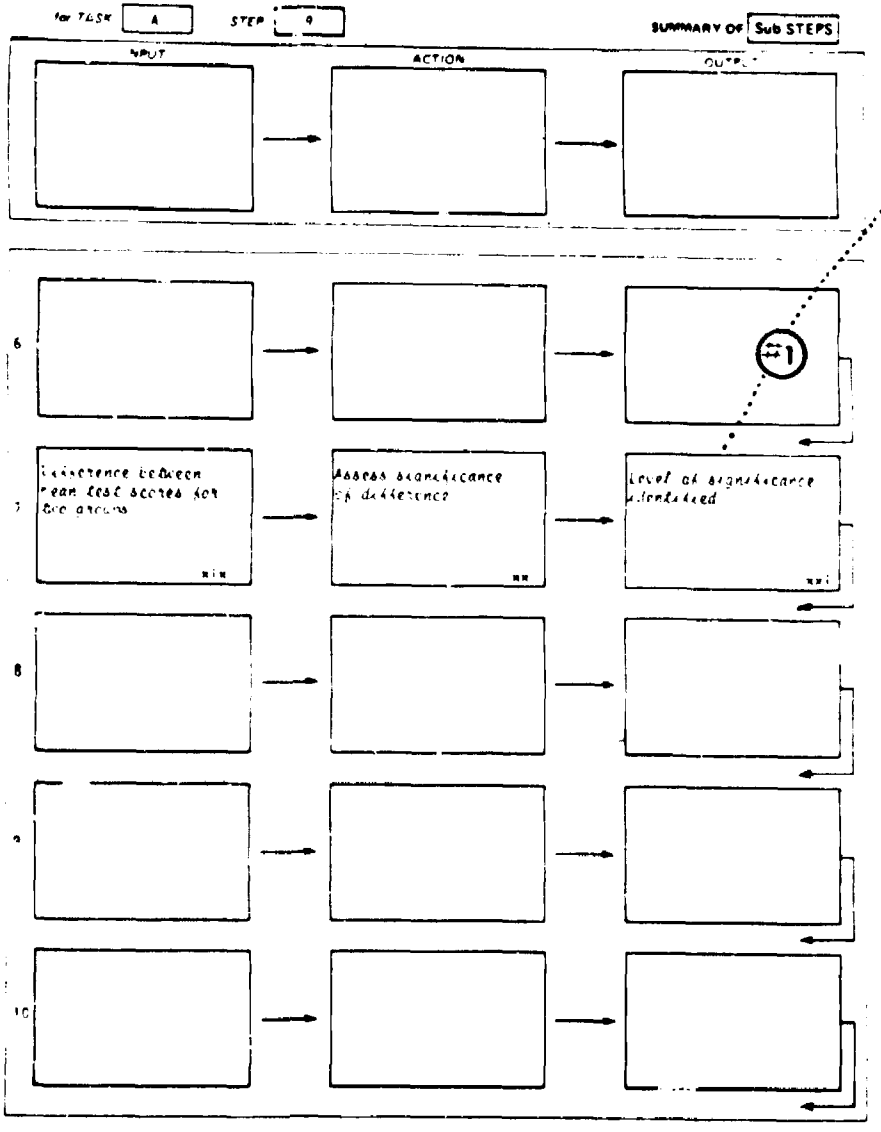
FORM A.5(4)



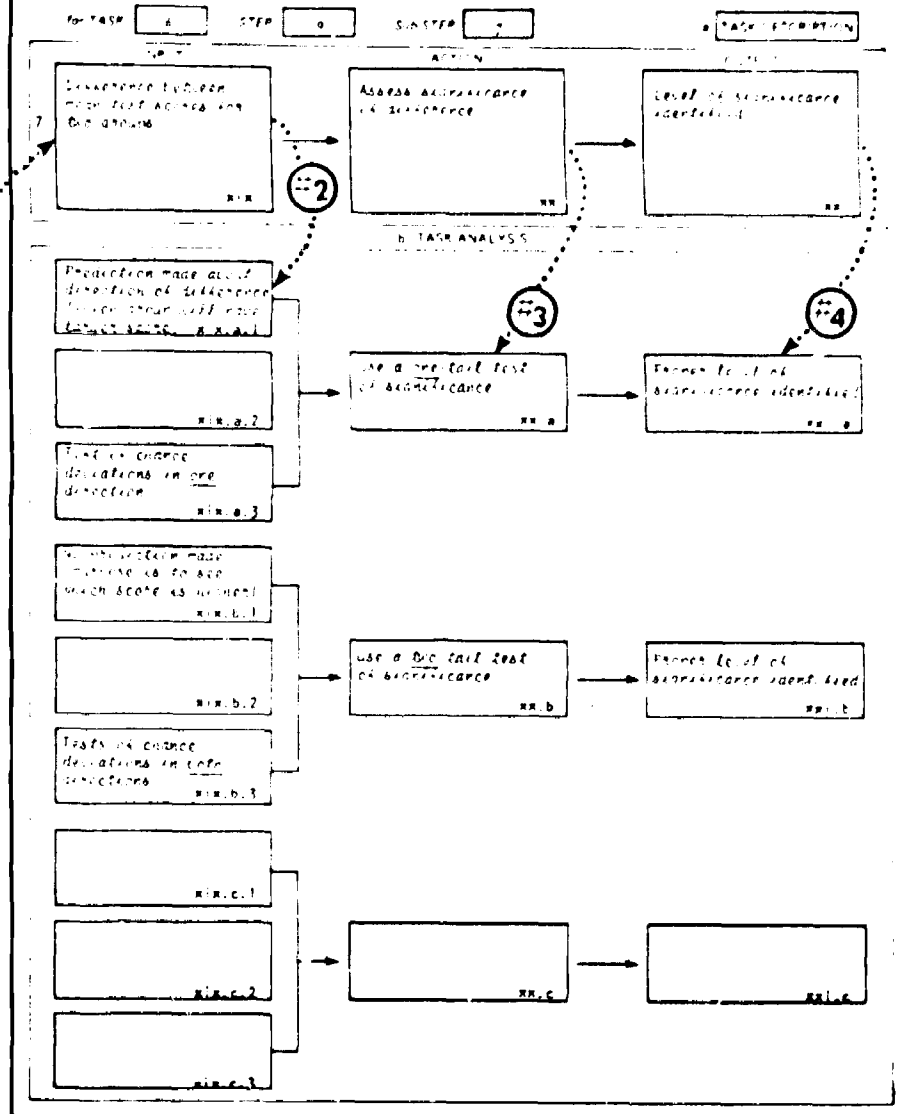
*See example on opposite page

EXAMPLE

FORM A.5(3)



FORM A.5(4)



Form A-5 (4)

EXAMPLE #1 (Driving)

for TASK [ ] STEP [ ] Sub-STEP [ ] a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Railroad crossing using signals to indicate approaching train vi	Makes approach depending on conditions vii	Decision to continue or stop viii

b. TASK ANALYSIS

Flashing light signal at crossing vi.a.1	Decelerates and stops before crossing vii.a	Vehicle stopped before crossing viii.a
Lavered gate at crossing vi.a.2		
Ringing bell at crossing vi.a.3		
NO SIGNAL: No train coming vi.b.1	Looks both ways and proceeds without stopping vii.b	Vehicle in continued motion viii.b
NO SIGNAL: Train stopped at a distance vi.b.2		
NO SIGNAL: Train moving slowly at a distance vi.b.3		

Form A-5 (4)

EXAMPLE #2 (Speaking "English")*

for TASK ____ STEP ____ Sub-STEP ____ a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Personal pronouns x	Uses present tense of the verb "to be" xi	Correct subject-verb pair xii

b. TASK ANALYSIS

he x.a.1 she x.a.2 it x.a.3	Says "is" xi.a	Correct singular pair xii.a
we x.b.1 you SINGULAR AND PLURAL x.b.2 they x.b.3	Says "are" xi.b	Correct plural pair (plus singular "you" exception) xii.b
I x.c.1	Says "am" xi.c	Correct first person singular pair xii.c

*N.B. This is a diagram for the "performance," speaking English, not "stating rules," which would be "knowledge domain"

SUMMARY OF PROCEDURES
FOR DIAGRAMMING
TASK ANALYSIS INFORMATION
FOR ALL TERMINAL BEHAVIORS
RELATED TO A Sub-TOPIC*
IN A KNOWLEDGE DOMAIN

*Or, if obtained, related to the lower level Sub-Sub-TOPIC

PLUS
TASK ANALYSIS EXAMPLES

B.4.2

ILLUSTRATION SUMMARIZING PROCEDURES FOR DIAGRAMMING TASK ANALYSIS INFORMATION FOR A BEHAVIOR IN A "KNOWLEDGE DOMAIN"

DIAGRAM

#1	#2	#3	#4
Transfer a criterion behavior from FORM A.5(10) to the top of FORM A.5(11)	Ask expert informant to break the INPUT at top of FORM A.5(11) into the separate inputs which have to be discriminated and generalized	Ask expert informant to identify each ACTION to be associated with each different set of inputs	Ask expert informant to identify each OUTPUT that results from each different action
Enter the "given" in the input square. Enter the student's response in the action square	Record information in INPUT column in bottom section of FORM A.5(11)	Record information in ACTION column in bottom section of FORM A.5(11)	Record information in OUTPUT column in bottom section of FORM A.5(11)

SEE EXAMPLE
ON OPPOSITE PAGE

QUESTIONS FOR FORM A.5(11)

RECOMMENDED QUESTION FORMAT

ORIENTING STATEMENT

"Now we want to get specific detail about the content and terminal behavior expected for each *fact, concept, principle, etc.* you just identified."

QUESTION #1

"Let's take *fact, concept, principle, etc.* What will the learner be given (INPUT) when you test him? What will he be expected to do (ACTION)? What will the OUTPUT consist of?"

QUESTION #2 (Discriminations)

"Let's take the INPUT you mentioned. From what other different type(s) of INPUTS does the learner have to discriminate it?"

QUESTION #3 (Associations/Chains)

"For each INPUT you identified, what action does the learner have to take?"

QUESTION #4 (INPUT Generalization)

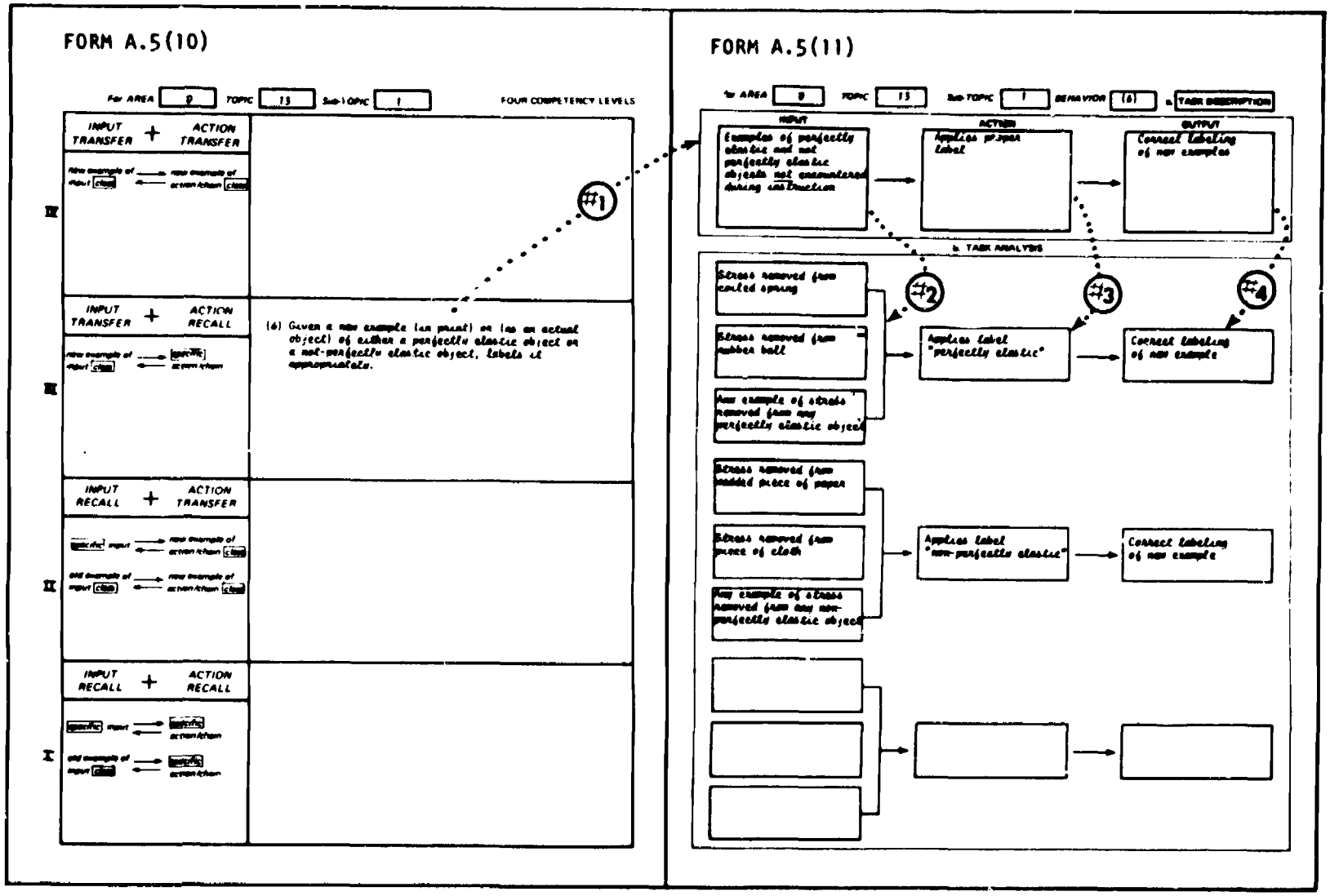
"For each INPUT, are there possible variations that nevertheless require the learner to take the same ACTION?"

QUESTION #5 (ACTION Generalization)

"Let's take each of these ACTIONS. Is there an alternative form it can take?"

QUESTION #6 (Discriminations - Outputs)

"For each INPUT, is there a different outcome? What?"


FORM A.5(10)
For AREA 9 TOPIC 13 Sub-TOPIC 1
FOUR COMPETENCY LEVELS
INPUT TRANSFER + ACTION TRANSFER
IV
#1
INPUT TRANSFER + ACTION RECALL
III
(6) Given a new example (an event) or (an) an actual object) of either a perfectly elastic object or a not-perfectly elastic object, labels it appropriately.
INPUT RECALL + ACTION TRANSFER
II
INPUT RECALL + ACTION RECALL
I
FORM A.5(11)
for AREA 9 TOPIC 13 Sub-TOPIC 1 BEHAVIOR (6) b. TASK DESCRIPTION
INPUT
ACTION
OUTPUT
Examples of perfectly elastic and not perfectly elastic objects not encountered during instruction
Applies proper label
Correct labeling of new examples
b. TASK ANALYSIS
Stress removed from coiled spring
Stress removed from rubber ball
New example of stress removed from any perfectly elastic object
#2
#3
#4
Applies label "perfectly elastic"
Correct labeling of new example
Stress removed from folded piece of paper
Stress removed from piece of cloth
New example of stress removed from any non-perfectly elastic object
Applies label "non-perfectly elastic"
Correct labeling of new example

Form A-5 (11)

EXAMPLE #1 (Trigonometry)

for AREA | TOPIC | Sub-TOPIC | BEHAVIOR | a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Given:  and asked to define trigonometric functions	Defines trigonometric function using letters	Correct definition of trigonometric functions for right-angled triangles

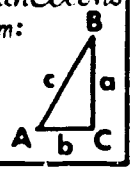
b. TASK ANALYSIS

Asked to define sine a	Writes: $\frac{a}{c}$	Definition of sine a
Asked to define cosine A	Writes: $\frac{b}{c}$	Definition of cosine A
Asked to define tangent A	Writes: $\frac{a}{b}$	Definition of tangent A

m A-5 (11)

EXAMPLE #2 (Trigonometry)

for AREA | TOPIC | Sub-TOPIC | BEHAVIOR | a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Given the definition of right-angled trigonometric functions and this diagram: 	Labels the functions	Correct labeling of trigonometric functions

b. TASK ANALYSIS

Asked to label: $\frac{c}{a}$	Labels the function cosecant A	Correct label
Asked to label: $\frac{c}{b}$	Labels the function secant A	Correct label
Asked to label: $\frac{b}{a}$	Labels the function cotangent A	Correct label

EXAMPLE #3 (Statistics)

for AREA [ ] TOPIC [ ] Sub-TOPIC [ ] BEHAVIOR [ ] a. TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Question: Under what conditions do you use each of the three measures of central tendency	States the conditions and the statistics to use	Correct matching of conditions and statistics to use

b. TASK ANALYSIS

-Greatest reliability wanted OR -Other computations are to follow OR -Distribution is symmetrical	States the condition (to the left) and says, "Use the mean"	Correct match
-Distribution is badly skewed OR -An incomplete distribution is given OR -Uncertainty about quality of unit of measurement OR -Interest in whether certain cases fall in upper or lower half of distribution	States the condition (to the left) and says, "Use the median"	Correct match
-Quickest estimate of central tendency wanted OR -Rough estimate satisfactory OR -Need to know most typical case	States the condition (to the left) and says, "Use the mode"	Correct match

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A task analysis complete to the lowest level of detail required in order to identify what skills the target audience does not have and must be taught.*
WHAT YOU WILL WORK FROM	(1) Provisional task analysis for each performance SubSTEP or for each knowledge domain terminal behavior.
WHAT YOU WILL DO ·	(1) Determine whether task analysis has been completed at an appropriate enough level of detail (and complete it if it has not been).
FORMS YOU WILL USE	FORMS A.5(4)-(7) or FORMS A.5(11)-(14) for recording task analysis results for "performance" subSTEPS or for "knowledge domain" terminal behavior respectively.

DESCRIPTION OF Sub-STEP	B.4.3

INPUT	ACTION	OUTPUT
Provisional task analysis for each Sub-STEP vii	→ Determine adequacy of level of detail; and probe for more detail when necessary viii	→ Task analysis for each Sub-STEP at appropriate level of detail ix

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Is task analysis at appropriate level of detail? . . .205	-MATRIX: Probing for more detail 205	-MATRIX: Task analysis at appropriate level of detail . . .209	FORMS A.5(4)-(7) for PERFORMANCE and/or FORMS A.5(11)-(14) for KNOWLEDGE DOMAIN SUMMARY OF PROCEDURES . . . 208

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		FORMS A.5(4)-(7) OR FORMS A.5(11)-(14)	B.4.2	SAME AS COMPLETED FORMS

Sub-STEP B.4.3

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Provisional task analysis for each Sub-STEP vii	Determine adequacy of level of detail; and probe for more detail when necessary viii	Task analysis for each Sub-STEP at appropriate level of detail ix
Learner population can perform the ACTIONS identified in task analysis diagrams vii.a	Accept the task analysis as complete viii.a	Task analysis at an appropriate level of detail ix.a
Learner population cannot perform the ACTIONS identified in task analysis diagrams vii.b	Probe for more detail, and continue to obtain lower level task analysis information viii.b	Task analysis at an appropriate level of detail; i.e., at level at which learners can perform the actions ix.b

JOB PROCEDURES

B.4.3

CRITERIA FOR IDENTIFYING WHEN A TASK ANALYSIS FOR A GIVEN SUB-STEP IS OR ISN'T AT AN ADEQUATE LEVEL OF DETAIL

IDENTIFICATION MATRIX

ADEQUACY OF DETAIL IN TASK ANALYSIS DIAGRAM	ADEQUATE	INADEQUATE
CRITERIA	*Target learner population CAN (without further action) take all the ACTIONS identified in the task analysis diagram for a given Sub-STEP*	*Target learner population CANNOT (without further action) take all the ACTIONS identified in the task analysis diagram for a given Sub-STEP*
EXAMPLES	See opposite page	See opposite page

B.4.3

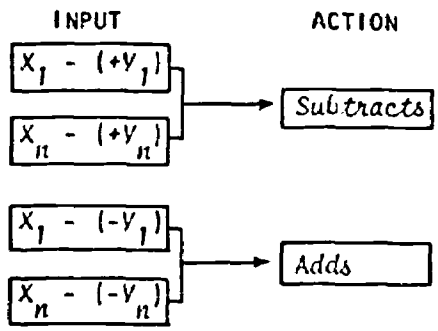
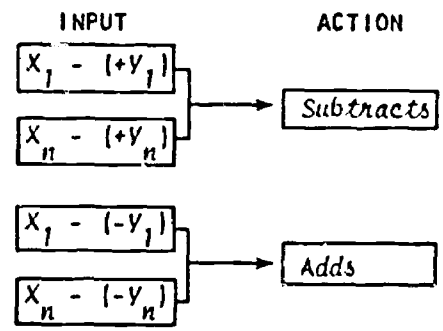
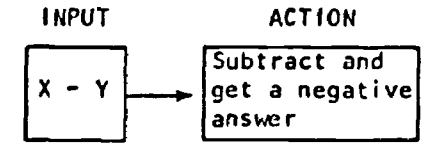
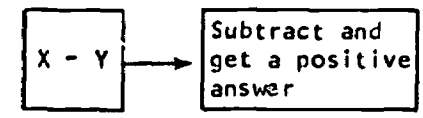
DETERMINING WHAT TO DO WHEN TASK ANALYSIS DIAGRAM IS OR IS NOT AT AN ADEQUATE LEVEL OF DETAIL

DECISION MATRIX

CONDITIONS	Task analysis diagram IS at an adequate level of detail (i.e., judgment is made that all ACTIONS can be performed)	Task analysis diagram IS NOT at an adequate level of detail (i.e., judgment is made that all ACTIONS cannot be performed)
ACTION TO TAKE	*Accept diagram as complete*	*-Identify the component discriminations, generalizations, and associations involved in taking the ACTION* *-Create a diagram showing the component discriminations, generalizations, and associations* *-Continue getting more detail, until it is judged that all identified actions in each new diagram CAN be taken*
EXAMPLES	See opposite page (Situation #1)	See opposite page (Situation #2)

B.4.3

EXAMPLE OF DECIDING WHEN IT IS NECESSARY TO OBTAIN ADDITIONAL TASK ANALYSIS INFORMATION

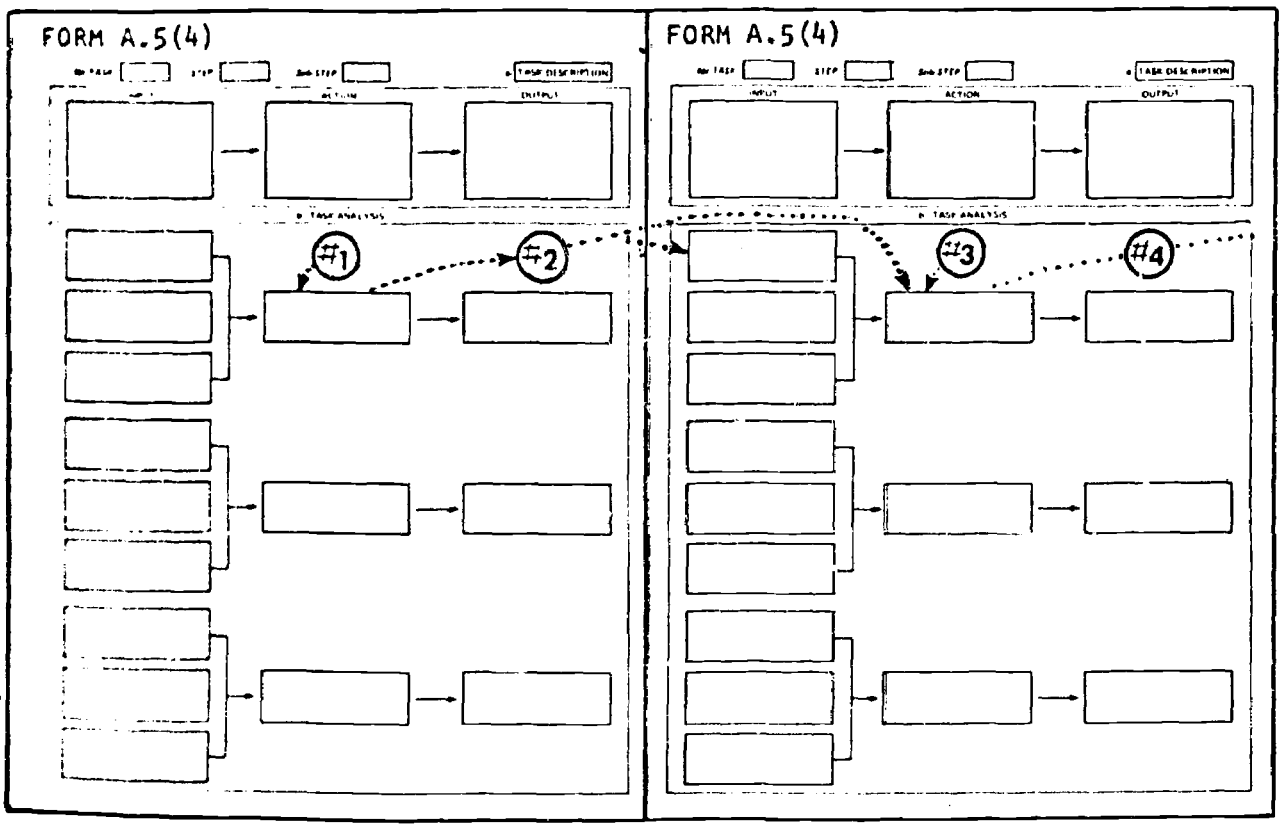
EXAMPLES	SITUATION #1	SITUATION #2
IDENTIFYING WHETHER TASK ANALYSIS DIAGRAMS ARE ADEQUATE	 The technologist judges that the target learner population is able to add and to subtract.	 The technologist judges that the target learner population is NOT able to subtract in all situations.
ACTION TO TAKE BASED ON JUDGED ADEQUACY OF TASK ANALYSIS DIAGRAMS	The above diagram is at an adequate level of detail because: (1) The learner population can take all the actions identified; and (2) All the discriminations and generalizations (about positive and negative numbers) *which the learner population has to practice* are identified. NO FURTHER, MORE DETAILED DIAGRAMMING IS NEEDED	The above diagram is NOT at an adequate level of detail because: (1) The learner population cannot subtract in all situations; (2) The discriminations and generalizations involved in subtracting need to be diagrammed; e.g.,  when Y is larger than X  when Y is smaller than X (3) The population can take these actions; they do, however, have to practice discriminating between the two situations where Y is either larger or smaller than X; and (4) If they could not take these newly diagrammed actions, the discriminations and generalizations involved in them would have to be identified; and (5) Analysis would continue until it is judged that all diagrammed actions can be made.

B.4.3

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN GETTING MORE DETAILED TASK ANALYSIS INFORMATION WHEN NEEDED

DIAGRAM

#1	#2	#3	#4
With help of informant expert inspect task analysis diagrams for each Sub-STEP [FORM A.5(4)] or for each criterion behavior [FORM A.5(II)]	If judgment is made that target learner population CAN make all the actions, no further analysis is necessary	On each new diagram inspect all the actions and make judgment whether the target learner population CAN or CANNOT take all the identified ACTIONS	Continue as in #3 until point is reached where judgment is made that all ACTIONS can be taken
Make judgment whether the target learner population CAN or CANNOT take all the identified actions. *Ignore the discriminations, generalizations, and associations*	If judgment is made that target learner population CANNOT make all the actions, on a separate, new FORM A.5(4) or A.5(II), diagram the discriminations, generalizations, and associations involved in the actions which cannot be taken	On each new diagram inspect all the actions and make judgment whether the target learner population CAN or CANNOT take all the identified ACTIONS	Continue as in #3 until point is reached where judgment is made that all ACTIONS can be taken



B.4.3

CRITERIA FOR DETERMINING WHETHER TASK ANALYSIS DIAGRAMS ARE AT AN ADEQUATE LEVEL OF DETAIL

STANDARDS MATRIX

STANDARDS	NUMBER OF SEPARATE TASK ANALYSIS DIAGRAMS -FOR EACH Sub-STEP or -FOR EACH CRITERION BEHAVIOR	WHAT IS IDENTIFIED ON EACH NEW DIAGRAM	CROSS-REFERENCING
CRITERIA	*For each already diagrammed ACTION which is judged not in the repertoire of the target learner population, a new, separate diagram should be prepared*	*Each new diagram identifies the component discriminations, generalizations, and associations involved in the ACTION from the "parent" diagram (the action which it was judged could not be taken by the target learner population*	*Simple filing of new diagrams with the parent diagrams is probably sufficient*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A recorded analysis of the potential sources of difficulties the target audience may have in acquiring the discriminations, generalizations, associations, and chains involved in the criterion behavior.*
WHAT YOU WILL WORK FROM	(1) Completed task analysis forms.
WHAT YOU WILL DO	(1) Perform a learning analysis for each SubSTEP; (2) Perform a learning analysis for the series of SubSTEPS that make up a criterion behavior.
FORMS YOU WILL USE	Right-hand side of FORM A.5(4) or FORM A.5(11) for recording results of 'learning analysis'.

DESCRIPTION OF Sub-STEP	B.4.4

INPUT	ACTION	OUTPUT
Completed task analysis forms x	Perform a learning analysis xi	Record of learning difficulty: (a) for discriminations, generalizations, associations, and action generalizations for each Sub-STEP; and (b) for a series of Sub-STEPS that make up a chain xii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Discrimination difficulties . . 216 Generalization difficulties . . 218 Association difficulties . . 220 Action generalization difficulties . . 222 Chain difficulties . . 224		-MATRIX: When are forms for learning analysis completed? . . . 229	A.5(4) PERFORMANCE A.5(11) KNOWLEDGE DOMAIN (right-hand side) SUMMARY OF PROCEDURES . . . 228

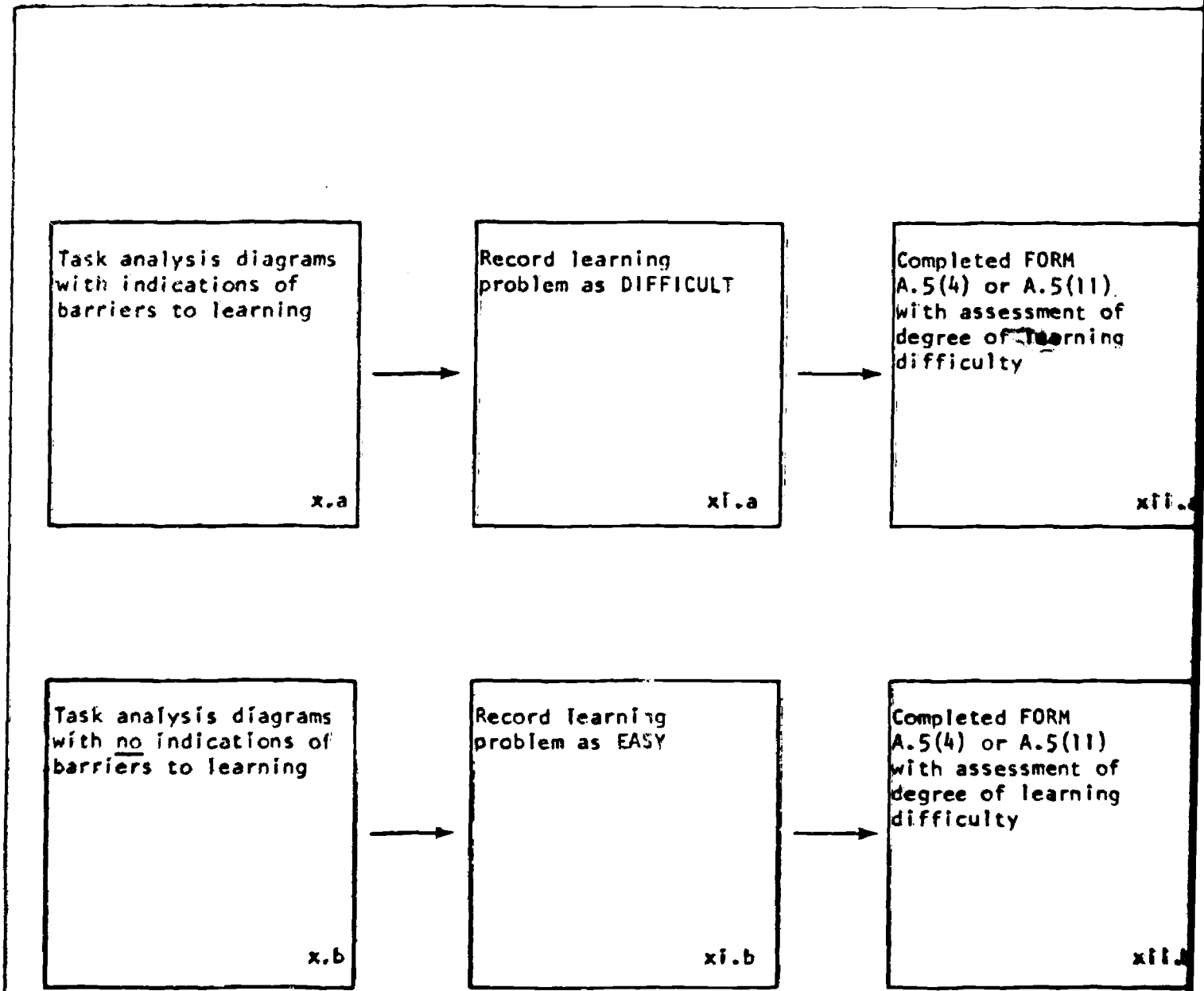
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Completed Forms A.5(4)-(7) or A.5(11)-(14)	B.4.3	Right-hand side of A.5(4) or of A.5(11)

Sub-STEP B.4.4

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Completed task analysis forms x	Perform a learning analysis xi	Record of learning difficulty: (a) for discriminations, generalizations, associations, and action generalizations for each Sub-STEP; and (b) for a series of Sub-STEPS that make up a chain xii



BACKGROUND INFORMATION

B.4.4

ILLUSTRATION SUMMARIZING WHAT IS COVERED IN THIS SECTION

DIAGRAM

BARRIERS TO LEARNING	DISCRIMINATIONS AMONG INPUTS	GENERALIZATIONS ACROSS INPUTS	ASSOCIATIONS BETWEEN INPUTS AND ACTIONS	ACTION GENERALIZATIONS	CHAINS
WHAT IS COVERED	-Similarity of inputs -Number of inputs -Number of properties defining inputs	-Dissimilarity of inputs -Number of inputs -Number of properties defining inputs	-Number of associations -Strength of existing associations	-Integrative strength of actions associated with inputs	-Number of Sub-STEPS -Difficulty in discriminating between outputs -Existing associations between outputs and other actions
APPEARS ON PAGE	216	213	220	222	224

B.4.4

IDENTIFICATION MATRIX

THREE CRITERIA FOR IDENTIFYING INPUTS WHICH ARE LIKELY TO BE DIFFICULT TO DISCRIMINATE* (THE THREE CRITERIA MAY BE JOINTLY MET)

CRITERIA	-*INDIVIDUAL inputs are highly SIMILAR* -*CLASSES of inputs are highly SIMILAR to one another*	-*There are MANY individual inputs to be discriminated among* -*There are MANY classes of inputs to be discriminated*	-*The NUMBER of PROPERTIES which form the basis for discriminations among individual inputs or among classes of inputs are MANY (e.g., three or more)*
JUDGMENT OF DIFFICULTY	DIFFICULT to discriminate among inputs	DIFFICULT to discriminate among inputs	DIFFICULT to discriminate among inputs
EXAMPLES	See opposite page	See opposite page	See opposite page

*Also applies to OUTPUTS.

B.4.4

EXAMPLES ILLUSTRATING DIFFERING DEGREES OF DIFFICULTY IN DISCRIMINATING AMONG INPUTS (OUTPUTS)

EXAMPLES	POSITIVE EXAMPLES	NEGATIVE EXAMPLES
DISCRIMINATION DIFFICULTY DUE TO ▼ SIMILARITY AMONG INPUTS to be discriminated	High similarity among inputs to be discriminated difficult e.g., *distinguishing between two tones at frequencies 4500 and 4520*	Low similarity among inputs to be discriminated not difficult e.g., *distinguishing between two tones at frequencies 4500 and 6000*
	(The task being to say whether they are the same or different)	
LARGE NUMBER OF INDIVIDUAL INPUTS OR OF INPUT CLASSES to be discriminated	Large number of inputs to be discriminated difficult e.g., *distinguishing among the performances of 20 gymnasts*	Small number of inputs to be discriminated not difficult e.g., *distinguishing among the performances of 5 gymnasts*
	(The task being to give each a different rank according to quality of performance)	
LARGE NUMBER OF PROPERTIES RE: INPUTS which form the basis for DISCRIMINATION among inputs	Many properties to inputs to be discriminated difficult e.g., *making a discrimination about the adequacy of a single essay based on all these properties:* *-Content completeness* *-Correctness of content* *-Organization* *-Quality of writing*	Few properties to inputs to be discriminated not difficult e.g., *making a discrimination about the adequacy of a single essay based on this property:* *-Content completeness*
	(The task being to decide whether the essay is acceptable or unacceptable)	

B.4.4

IDENTIFICATION MATRIX

THREE CRITERIA FOR IDENTIFYING INPUTS (OR OUTPUTS) ACROSS WHICH GENERALIZATION IS LIKELY TO BE DIFFICULT*
(ALL THREE CRITERIA MAY APPLY SINGLY OR JOINTLY)

CRITERIA	-*Inputs are highly dissimilar* ·*surface or apparent dissimilarity may conceal a functional similarity*	-*The class of inputs is large;* *i.e., there are many inputs within the class across which generalization is required*	-*The number of properties of inputs which form the basis for the generalization* *are MANY* *(e.g., three or more)*
JUDGMENT OF DIFFICULTY	Generalization across inputs is DIFFICULT	Generalization across inputs is DIFFICULT	Generalization across inputs is DIFFICULT
EXAMPLES	See opposite page	See opposite page	See opposite page

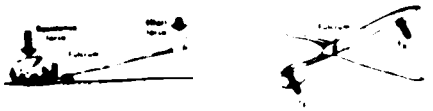
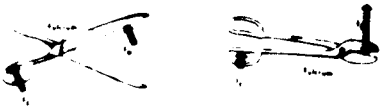
*Also applies to OUTPUTS

B.4.4

EXAMPLES ILLUSTRATING DIFFERING DEGREES OF DIFFICULTY IN GENERALIZING ACROSS INPUTS (OUTPUTS)

<table>
<tr><th>EXAMPLES</th><th>POSITIVE EXAMPLES</th><th>NEGATIVE EXAMPLES</th></tr>
<tr><td>GENERALIZATION DIFFICULTY DUE TO ▽</td><td><u>High</u> dissimilarity among inputs across which generalization must be made

<u>difficult</u></td><td><u>Low</u> dissimilarity among inputs across which generalization must be made

<u>not difficult</u></td></tr>
<tr><td>DISSIMILARITY AMONG INPUTS</td><td>e.g., generalizing across levers that are of the same type (#1) (i.e., fulcrum between resistance force and effort force)
  </td><td>e.g., generalizing across levers that are of the same type (#1) (i.e., fulcrum between resistance force and effort force)
  </td></tr>
<tr><td colspan="3">(The task is to classify a given lever according to type)</td></tr>
<tr><td>LARGE NUMBER OF INPUTS WITHIN A CLASS</td><td><u>Large</u> number of inputs across which generalization must be made

<u>difficult</u>

e.g., generalizing across the <u>1729</u> different species that belong to the same order: "rodents"</td><td><u>Small</u> number of inputs across which generalization must be made

<u>not difficult</u>

e.g., generalizing across the <u>6</u> different species that belong to the same order: "monotremes"</td></tr>
<tr><td colspan="3">(The task is to classify a given species according to its proper order)</td></tr>
<tr><td>LARGE NUMBER OF PROPERTIES WHICH FORM THE BASIS FOR GENERALIZATION</td><td><u>Many</u> properties to inputs across which generalization must be made

<u>difficult</u>

e.g., generalizing across types of Oriental rugs based on:
-size
-number of colors
-type of pattern
-number of borders
-type of weave</td><td><u>Few</u> properties to inputs across which generalization must be made

<u>not difficult</u>

e.g., generalizing across types of Oriental rugs based on:
-number of borders
-type of pattern</td></tr>
<tr><td colspan="3">(The task is to identify the type of Oriental rug)</td></tr>
</table>

B.4.4

TWO CRITERIA FOR IDENTIFYING INPUT/ACTION ASSOCIATIONS WHICH ARE LIKELY TO BE DIFFICULT TO LEARN

IDENTIFICATION MATRIX

CRITERIA	-*Large number of associations to be learned*	-*Other actions are already strongly associated with the input; this provides competition with the new action to be associated with the same input*
JUDGMENT OF DIFFICULTY	Learning the association is likely to be DIFFICULT	Learning the association is likely to be DIFFICULT
EXAMPLES	See opposite page	See opposite page

B.4.4

EXAMPLES ILLUSTRATING DIFFERING DEGREES OF DIFFICULTY IN ASSOCIATING INPUTS AND ACTIONS

EXAMPLES	POSITIVE EXAMPLES	NEGATIVE EXAMPLES
DIFFICULTY LEARNING ASSOCIATIONS DUE TO ▽	Large number of associations between inputs and actions difficult	Small number of associations between inputs and actions not difficult
LARGE NUMBER OF ASSOCIATIONS TO BE LEARNED	e.g., *associating a particular function with a particular dial on equipment containing two or more dozen indicators (airplane instrument panel)*	e.g., *associating a particular function with a particular dial on equipment containing less than one dozen indicators (automobile instrument panel)*
	(Task involves selecting the dial which provides information concerning a particular function)	
OTHER ACTION(S) STRONGLY ASSOCIATED WITH INPUT (offering competition)	Other actions already strongly associated with an input difficult	No other actions strongly associated with an input not difficult
	e.g., *associating the French word for a given object when the German word is already well learned*	e.g., *associating the French word for a given object when no other foreign language is known*
	(The task is to produce the word when shown the object)	

B.4.4

A CRITERION FOR IDENTIFYING WHEN ACTION GENERALIZATION WILL BE DIFFICULT

IDENTIFICATION MATRIX

LEVEL OF DIFFICULTY	RELATIVELY DIFFICULT	RELATIVELY EASY
CRITERIA	-*Action is not part of or does not lie on a dimension within a strongly held or strongly integrated repertoire*	-*Action is part of or lies on a dimension within a strongly held or strongly integrated repertoire*
EXAMPLES	See opposite page	See opposite page

B.4.4

EXAMPLES ILLUSTRATING DIFFERING DEGREES OF DIFFICULTY IN ACHIEVING ACTION GENERALIZATION

ACTION GENERALIZATION DIFFICULT DUE TO ▼	POSITIVE EXAMPLE	NEGATIVE EXAMPLE
LACK OF INTEGRATIVE STRENGTH	e.g., *the learner is not able to respond in a variety of ways. He can only respond in one way--the practiced way. (Cite examples taught him.)* Because either: (a) English is not his native language, and/or (b) because the component discriminations, generalizations, and associations that make up the action to be taken are not well learned.	e.g., *the learner is able to respond in a variety of ways* *•Use his own words* *•Cite examples* *•Draw analogies* Because either: (a) English is his native language, and/or (b) because the component discriminations, generalizations, associations that make up the action to be taken are well learned.
	(The task is to compare and contrast the advantages of propeller and jet-driven engines)	

B.4.4

THREE CRITERIA FOR IDENTIFYING CHAINS THAT WILL BE DIFFICULT TO LEARN

IDENTIFICATION MATRIX

CRITERIA	*Large series of Sub-STEPS*	*Outputs in any Sub-STEP are difficult to discriminate*	*Outputs of a given Sub-STEP which become the inputs for the next Sub-STEP are associated with other actions*
LEVEL OF DIFFICULTY	DIFFICULT	DIFFICULT	DIFFICULT
EXAMPLES	See opposite page	See opposite page	See opposite page

B.4.4

EXAMPLES ILLUSTRATING DIFFERING DEGREES OF DIFFICULTY IN CHAINING A SERIES OF Sub-STEPS

EXAMPLES	POSITIVE EXAMPLES	NEGATIVE EXAMPLES
LEARNING OF CHAINS DIFFICULT DUE TO ▽	Large series of Sub-STEPS involved in the chain difficult	Small series of Sub-STEPS involved in the chain not difficult
LARGE SERIES OF Sub-STEPS	*e.g., assembling a carburetor* *e.g., producing a curriculum*	*e.g., installing a rubber blade on a windshield wiper* *e.g., producing a single practice item*
OUTPUTS IN A Sub-STEP ARE DIFFICULT TO DISCRIMINATE*	Difficult discrimination about outputs difficult *e.g., a checklist is not available when assessing the adequacy of a finished product*	Easy discrimination about outputs not difficult *e.g., a checklist is available when assessing the adequacy of a finished product*
	(Output of the last Sub-STEP in a chain)	
OUTPUTS IN A Sub-STEP (which become the inputs for the next Sub-STEP) ARE ASSOCIATED WITH OTHER ACTIONS*	Existing association between output and another action difficult *e.g., last musical note in a phrase is already strongly associated with notes other than the new ones to be learned (and performed)*	No existing association between output and another action not difficult *e.g., the last musical note in a phrase is NOT already strongly associated with notes other than the new ones to be learned (and performed)*
	(The task is to play the correct notes from start to finish)	

*See pages 216 and 217 for discriminations among INPUTS.

**See pages 220 and 221 for associations between inputs and actions.

JOB PROCEDURES

B.4.4

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN PERFORMING A LEARNING ANALYSIS

DIAGRAM

WITH THE HELP OF AN INFORMANT EXPERT, PERFORM A LEARNING ANALYSIS AND RECORD RESULTS ON THE RIGHT-HAND SIDE OF FORM A.5(4) OR FORM A.5(11)✱

✱SEE QUESTIONS TO USE ON OPPOSITE PAGE.

#1

Inspect and rate diagrammed discriminations for potential learning difficulties.

Record a rating for each of the three factors.

#2

Inspect and rate diagrammed generalizations for potential learning difficulties.

Record a rating for each of the three factors.

#3

Inspect and rate diagrammed associations for potential learning difficulties.

Record a rating for each of the two factors.

#4

Inspect and rate diagrammed action generalizations for potential learning difficulties.

Record a rating for the one factor.

#5

Inspect and rate individual task analysis diagram and a related series of diagrams (representing a chain) for potential learning difficulties.

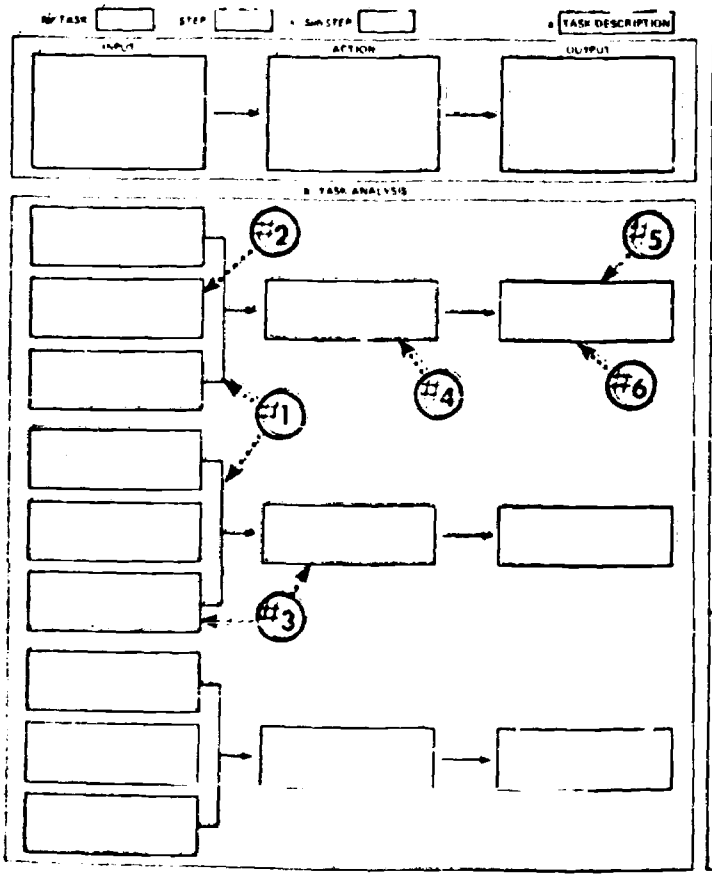
Record an individual rating on each form and a series rating on the last form.

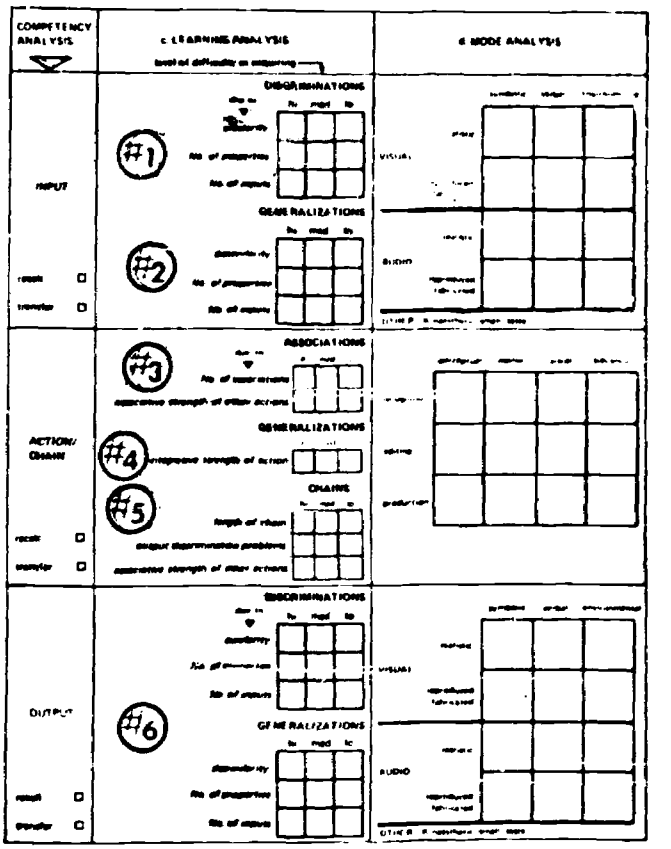
#6

Inspect and rate diagrammed discriminations and generalizations for OUTPUTS for potential learning difficulties.

Record a rating for all the factors.

A.5(4)





B.4.4

CRITERIA FOR DETERMINING THE ADEQUACY OF RECORDING THE ASSESSMENT OF LEARNING DIFFICULTIES

STANDARDS MATRIX

PROPERTIES	COMPLETENESS	CROSS-REFERENCING
CRITERIA	*-There is a rating for properties describing each of the following:* *INPUTS* *discriminations* *generalizations* *ACTION/CHAINS* *associations* *action generalizations* *chains* *OUTPUTS* *discriminations* *generalizations*	*-Labeling is not required* *-Entries are made on right-hand side of the task analysis forms*

QUESTIONS FOR FORM A 5(4) Continued

RECOMMENDED QUESTION FORMATS

ORIENTING STATEMENT

"Let's analyze the difficulties in learning the skills in this sub-step."

QUESTION 1 (Re: Discriminations)

"Is it difficult to tell the difference between _____ (input conditions)?"

"Is this difficulty due to the fact that the _____ (input conditions) are highly similar?"

"What properties of the _____ (input conditions) do you have to pay attention to in order to see the difference?"

QUESTION 2 (Re: Generalizations)

"Within each type of _____ (input condition) is it difficult to see the similarities (ignore the differences) if present?"

"Is this due to a high degree of dissimilarity among _____ (input conditions)?"

"What properties of the _____ (input conditions) do you have to pay attention to in order to see the similarities?"

QUESTION 3 (Re: Associations)

"For any of these _____ (input conditions) is there an existing action people now perform very often? What?"

QUESTION 4 (Re: Outputs)

Repeat same type of questions as for inputs.

B.4.4

EXAMPLE OF A LEARNING ANALYSIS FOR A "PERFORMANCE" Sub-STEP

EXAMPLE

Form A-8 (4)

for TASK [ ] STEP [ ] Sub-STEP [ ] a TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Levelness of ground where golf ball lies (vi)	Assumes appropriate stance (leg position) (vii)	Stance appropriate to terrain (viii)

b. TASK ANALYSIS

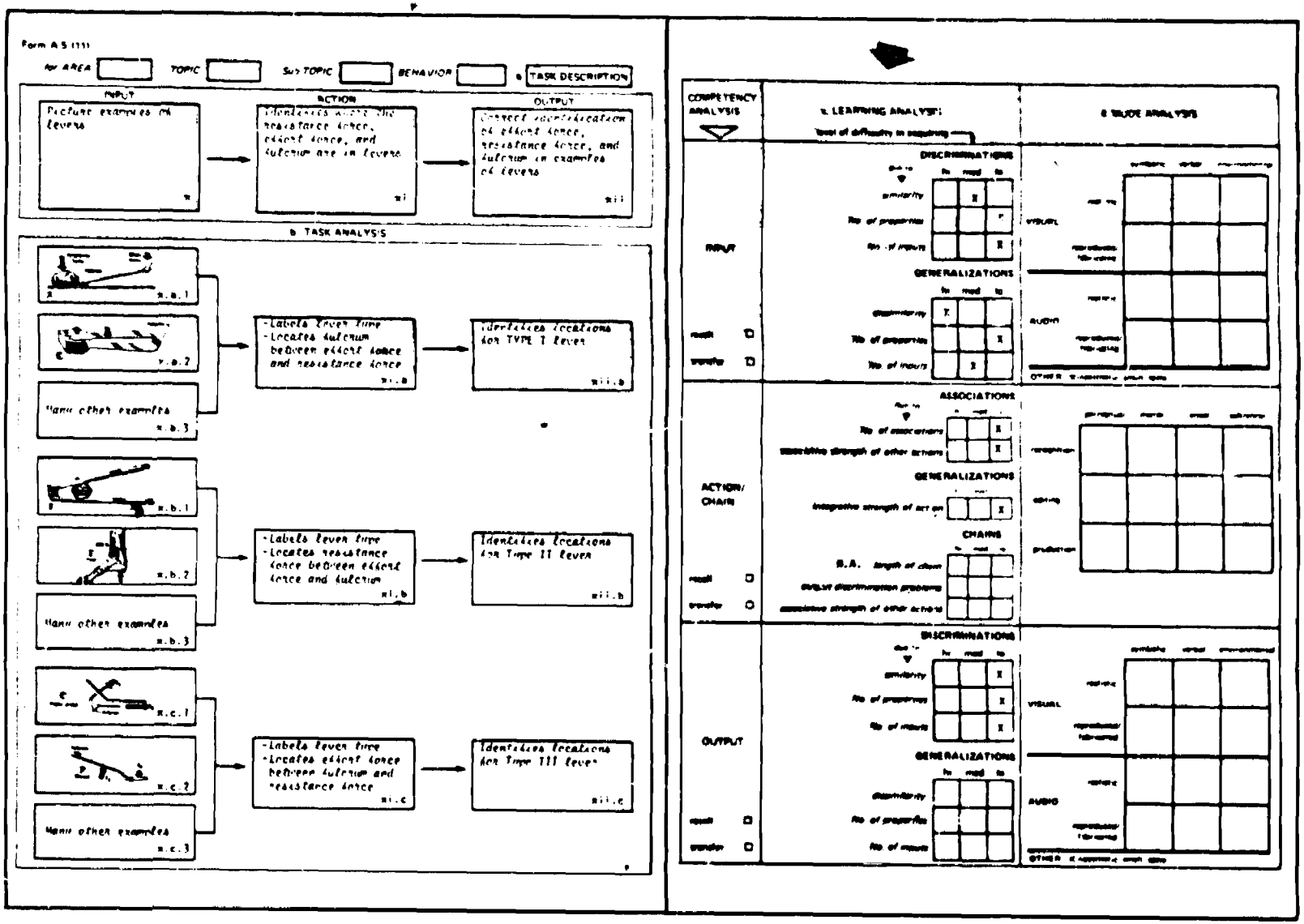
Uphill lie (vi.a.1)	Assumes appropriate stance (leg position) (vii.a)	Stance for uphill position (viii.a)
[ ]		
Other varying degrees of uphill lie (vi.a.=)		
[ ] (vi.b.1)	Assumes appropriate stance (leg position) (vii.b)	Normal stance assumed (viii.b)
Flat lie		
[ ] (vi.b.=)		
Downhill lie (vi.c.1)	Assumes appropriate stance (leg position) (vii.c)	Stance for downhill position (viii.c)
[ ]		
Other varying degrees of downhill lie (vi.c.=)		

COMPETENCY ANALYSIS	c. LEARNING ANALYSIS (level of difficulty in acquiring)	d MODE ANALYSIS
INPUT — recall ☐ transfer ☐	DISCRIMINATIONS (due to: similarity; No of properties; No of inputs) — hi / med / lo GENERALIZATIONS (dissimilarity; No of properties; No of inputs) — hi / med / lo	symbolic / verbal / environmental; VISUAL (real-time; reproduced/fabricated); AUDIO (real-time; reproduced/fabricated); OTHER
ACTION/CHAIN — recall ☐ transfer ☐	ASSOCIATIONS (No of associations; associative strength of other actions) GENERALIZATIONS N.A. (integrative strength of action) CHAINS N.A. (length of chain; output discrimination problems; associative strength of other actions)	perceptual / motor / verbal / sub-verbal; recognition; editing; production
OUTPUT — recall ☐ transfer ☐	DISCRIMINATIONS (due to: similarity; No of properties; No of inputs) — hi / med / lo GENERALIZATIONS (dissimilarity; No of properties; No of inputs) — hi / med / lo	symbolic / verbal / environmental; VISUAL (real-time; reproduced/fabricated); AUDIO (real-time; reproduced/fabricated); OTHER

B.4.4

EXAMPLE OF A LEARNING ANALYSIS FOR A TERMINAL BEHAVIOR IN A "KNOWLEDGE DOMAIN"

EXAMPLES



PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A recorded analysis of the post-instructional RECALL or TRANSFER requirements involved in exhibiting the criterion behavior.*
WHAT YOU WILL WORK FROM	(1) Completed task analysis results.
WHAT YOU WILL DO	(1) Analyze and record the competency requirements for the criterion behavior.
FORMS YOU WILL USE	Right-hand side of FORM A.5(4) or FORM A.5(11) in recording results of a competency analysis.

DESCRIPTION OF Sub-STEP	B.4.5

INPUT	ACTION	OUTPUT
Completed task analysis forms xiii	Perform a competency analysis xiv	Record of post-instruction recall and transfer requirements xv

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Recall and transfer requirements . . 236, 237 -MATRIX: Conditions likely to require recall vs. transfer 238		-MATRIX: Adequacy of identification of recall and transfer requirements . . 241	A.5(4) PERFORMANCE A.5(11) KNOWLEDGE DOMAIN (right-hand side) SUMMARY OF PROCEDURES . . . 240

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Completed Forms A.5(4)-(7) or A.5(11)-(14)	B.4.3	Right-hand side of A.5(4) or of A.5(11)

Sub-STEP B.4.5

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Completed task analysis forms xiii	Perform a competency analysis xiv	Record of post-instruction recall and transfer requirements xv

All examples of INPUTS and ACTIONS are encountered during instruction xiii.a	Record of post-instruction competency requirements xiv.a	Record of: RECALL requirements xv.a
All examples of INPUTS and ACTIONS are not encountered during instruction xiii.b	Record of post-instruction competency requirements xiv.b	Record of: TRANSFER requirements xv.b

JOB PROCEDURES

B.4.5

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING COMPETENCY LEVELS REQUIRED AFTER COMPLETION OF INSTRUCTION OR TRAINING: RECALL VS. TRANSFER

COMPETENCIES	RECALL of what has been experienced in instruction	TRANSFER to what has not been experienced in instruction
CRITERIA	INPUT *A specific input or an example of a class of inputs which occurs in a criterion test situation, i.e., a post-instruction test or a post-training job setting, is presented during instruction or training* ACTION *A specific action or an example of a class of actions which occurs in a criterion test situation, i.e., a post-instruction test or a post-training job setting, is practiced during instruction or training*	INPUT *An example of a class of inputs which occurs in a criterion test situation, i.e., a post-instruction test or a post-training job setting, is not presented during instruction or training* ACTION *An example of a class of actions which occurs in a criterion test situation, i.e., a post-instruction test or a post-training job setting, is not practiced during instruction or training. (Other examples of a class are practiced.)*
INPUT EXAMPLES	(The student has to learn to recognize nouns that are plural) e.g., *the nouns: diamonds, houses, cats, and forks, are examples used in instruction; they also occur on a test in which the student has to decide whether they are singular or plural.*	e.g., *the nouns: diamonds, houses, cats, and forks, are NOT examples used in instruction; they do, however, occur on a test in which the student has to decide whether they are singular or plural.* *Other examples are used during instruction.*
ACTION EXAMPLES	(The student has to answer test questions on "forward" and "reverse" bias) e.g., *the student is trained both to define "reverse" and "forward" bias and to connect a diode to a battery producing a condition of forward and reverse bias,* *i.e., is tested for both performances.*	e.g., *the student is only trained to connect a diode to a battery producing a condition of forward and reverse bias;* *he is tested both for the connecting performance and for a definition.*

B.4.5

CRITERIA FOR IDENTIFYING RECALL AND TRANSFER REQUIREMENTS FOR A PARTICULAR PERFORMANCE "Sub-STEP" OR A PARTICULAR KNOWLEDGE DOMAIN TERMINAL BEHAVIOR

IDENTIFICATION MATRIX

REQUIREMENTS	1 INPUT RECALL + ACTION RECALL	2 INPUT RECALL + ACTION TRANSFER	3 INPUT TRANSFER + ACTION RECALL	4 INPUT TRANSFER + ACTION TRANSFER
CRITERIA	*All examples both of input and action classes appearing in criterion test situations are provided during instruction*	*See Column 1 for identification of INPUT RECALL* *See Column 4 for identification of ACTION TRANSFER*	*See Column 4 for identification of INPUT TRANSFER* *See Column 1 for identification of ACTION RECALL*	*Some examples both of input and action classes appearing in criterion test situations are not provided during instruction*
EXAMPLES	DRIVING All inputs (e.g., *traffic signals: red, yellow, green*) and associated actions (e.g., *go stop, etc.*) appear during training. In later test situations, only recall of inputs and actions is required.	ENGLISH All inputs (e.g., *all singular personal pronouns: I, she, he, and it*) are encountered during instruction. During testing, only recall of inputs is required. All actions to be associated with inputs (e.g., *verbs in the present tense*) are NOT encountered during instruction. Transfer to those actions not encountered is required.	ENGLISH All inputs (e.g., *all plural nouns*) are NOT encountered during instruction. During testing, transfer to those inputs not encountered will be required. All actions (e.g., *all forms of present and past tense of the verb "to be"--"are," "were"*) are encountered during instruction. Only recall of actions will be required.	CURRICULUM DEVELOPMENT All inputs (e.g., *varied subject matters*) and all actions associated with them (e.g., *formulating appropriate instructional strategies*) are NOT encountered during instruction (i.e., how to develop curricula). During testing, transfer to both inputs and actions not encountered will be required.

B.4.5

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING SITUATIONS IN WHICH RECALL OR TRANSFER ARE LIKELY TO BE REQUIRED

REQUIREMENTS	RECALL likely to be required	TRANSFER likely to be required
CRITERIA	*INPUTS* *-Inputs are specific (i.e., an input constitutes a class of one)* *-Inputs belong to a class of inputs which:* *·Is small (i.e., contains no more than several inputs)* *·Contains highly dissimilar inputs (the class may be large)* *ACTIONS* *-Actions are specific (i.e., a class of one)* *-Actions belong to a class which:* *·Has <u>low</u> integrative strength* *·Contains dissimilar actions (e.g., different modes of responding)*	*INPUTS* *-Inputs belong to a class of inputs which:* *·Is large (i.e., includes many inputs) AND* *·Contains highly similar inputs* *ACTIONS* *-Actions belong to a class which:* *·Has <u>high</u> integrative strength* *·Contains similar actions (e.g., same mode of responding)*

B.4.5

ILLUSTRATIONS DESCRIBING SITUATIONS IN WHICH RECALL OR TRANSFER IS LIKELY TO BE REQUIRED

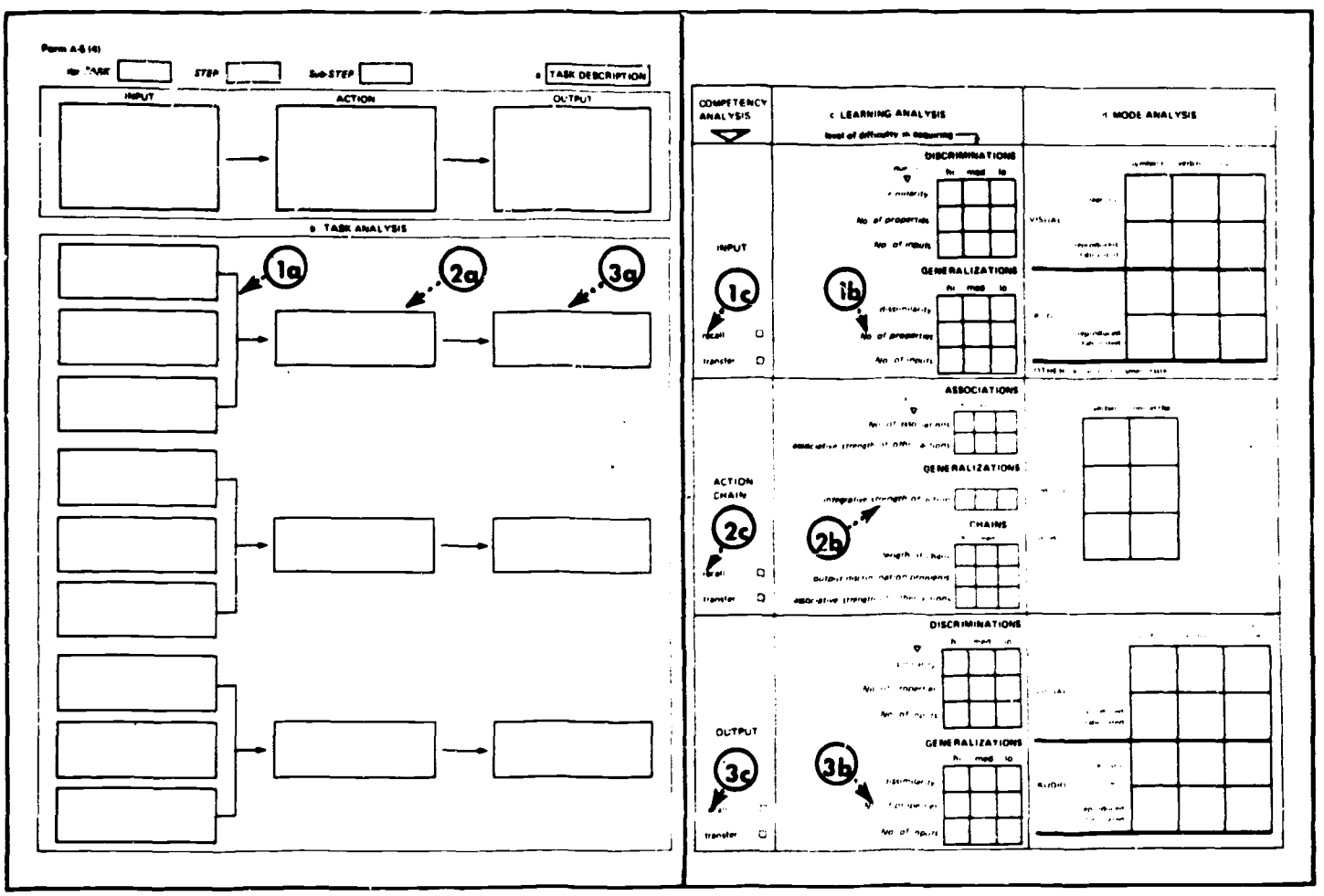
EXAMPLES

REQUIREMENTS	include all examples in training and therefore require: RECALL	Do NOT include all examples in training and therefore require: TRANSFER
INPUTS	-Specific inputs (a class of one): e.g., *a map symbol showing the specific location of a specific city; the student has to recall that location (to be able to give the name of the city)*	
	-A class of inputs which contains a small number of members e.g., *third person personal pronouns (he, she, and it); the student has to recall each of the three as a singular*	-A class of inputs which is large and contains highly similar members e.g., *plural nouns with an "s" ending; the student has to transfer to examples not encountered in training (i.e., recognize them as plurals)*
	-A class of highly dissimilar member inputs (the class may be large or small) e.g., *in "beginning" reading different type faces (lower case, capitals, script) are dissimilar and are all used in training and therefore must be recalled (later on)*	
ACTIONS	-Specific actions (a class of one): e.g., *threading a particular brand of film projector--has only one acceptable sequence; it should be practiced and then recalled*	
	-A class of actions with low integrative strength e.g., *when language facility is at low strength (in early childhood), the verbal forms in which student is expected to respond--should all be practiced and then (singly) recalled; a child would not be expected to be good at paraphrasing (for example)*	-A class of actions with high integrative strength e.g., *when language facility is at high strength (in adulthood), student need only practice "writing" answers (e.g., in script) and can be expected afterwards to transfer to printing, typing, etc.*

B.4.5

ILLUSTRATION SUMMARIZING PROCEDURES FOR PERFORMING A COMPETENCY ANALYSIS

#1	#2	#3
(a) Inspect diagrammed input generalizations, and (b) Inspect rated generalization difficulties, (c) Determine and record recall and transfer requirements	(a) Inspect diagrammed action generalizations, and (b) Inspect rated generalization difficulties, (c) Determine and record recall and transfer requirements	(a) Inspect diagrammed output generalizations, and (b) Inspect rated generalization difficulties, (c) Determine and record recall and transfer requirements



B.4.5

CRITERIA FOR DETERMINING THE ADEQUACY OF THE COMPETENCY ANALYSIS

STANDARDS MATRIX

PROPERTIES	COMPLETENESS	CROSS-REFERENCING
CRITERIA	*There is an identification of recall and transfer requirements for:* *INPUTS* *ACTION/CHAINS* *OUTPUTS*	*-Labeling is not required.* *-Entries are made on right-hand side of the task analysis forms.*

EXAMPLE

B.4.5

EXAMPLE OF A COMPETENCY ANALYSIS FOR A "PERFORMANCE" Sub-STEP

Form A 5 (4)

for TASK ____ STEP ____ Sub-STEP ____ a TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Levelness of ground where golf ball lies vi	Assumes appropriate stance (leg position) vii	Stance appropriate to terrain viii

b. TASK ANALYSIS

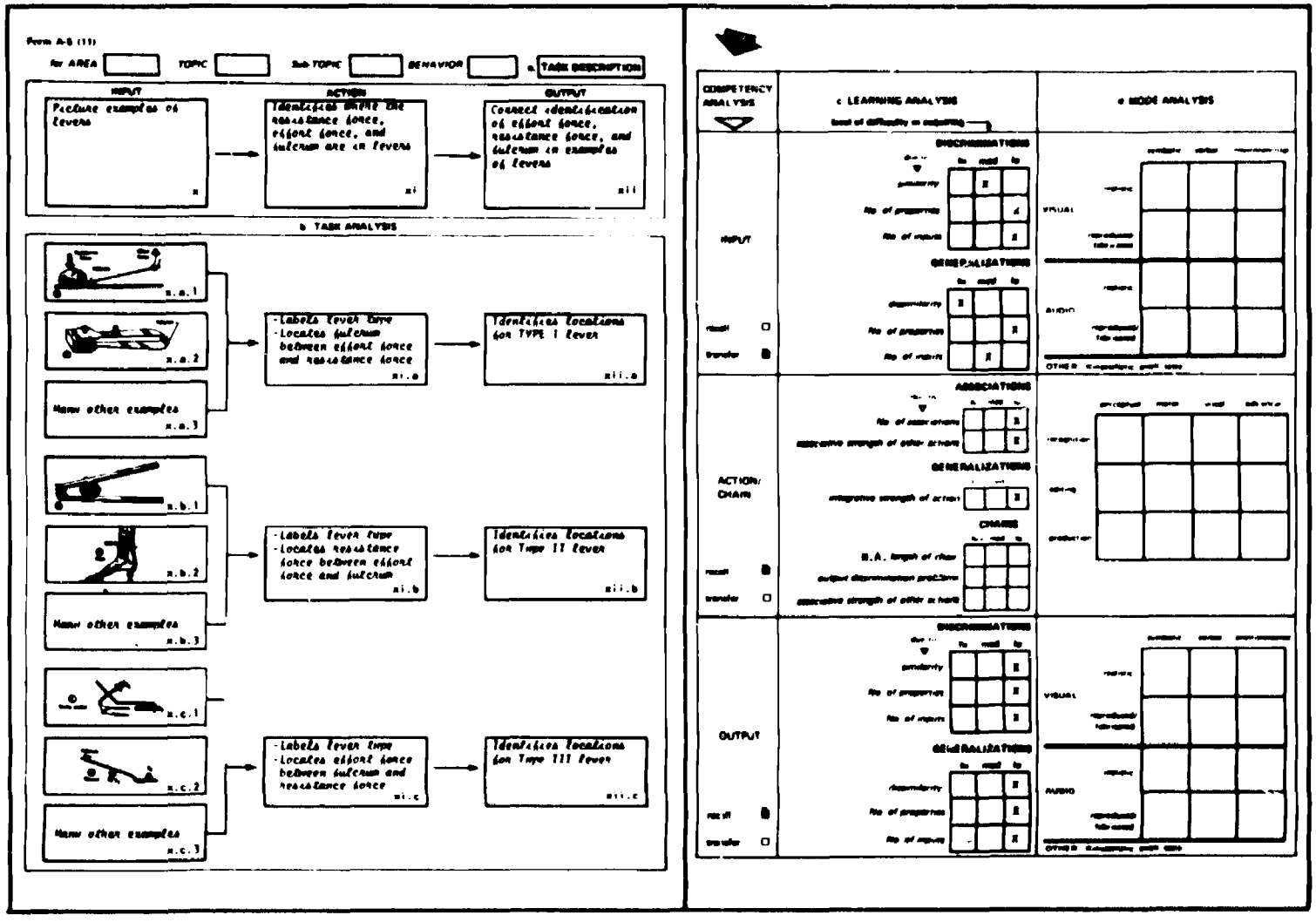
Uphill lie vi.a.1	Assumes appropriate stance (leg position) vii.a	Stance for uphill position viii.a
Other various degrees of uphill lie vi.a.=		
vi.b.1	Assumes appropriate stance (leg position) vii.b	Normal stance assumed viii.b
Flat lie		
vi.b.=		
Downhill lie vi.c.1	Assumes appropriate stance (leg position) vii.c	Stance for downhill position viii.c
Other various degrees of downhill lie vi.c.=		

COMPETENCY ANALYSIS	c. LEARNING ANALYSIS (level of difficulty in acquiring →)	d. MODE ANALYSIS
INPUT recall ☐ transfer ☒	DISCRIMINATIONS (due to ▽: similarity; No. of properties; No. of inputs) — hi / med / lo GENERALIZATIONS (dissimilarity; No. of properties; No. of inputs) — hi / med / lo	symbolic / verbal / environmental VISUAL: realistic; reproduced/ fabricated AUDIO: realistic; reproduced/ fabricated OTHER (kinesthetic, smell, taste)
ACTION/ CHAIN recall ☒ transfer ☐	ASSOCIATIONS (No. of associations; associative strength of other actions) GENERALIZATIONS (N.A.; integrative strength of action) CHAINS (N.A.; length of chain; output discrimination problems; associative strength of other actions)	perceptual / motor / vocal / sub-vocal recognition; editing; production
OUTPUT recall ☒ transfer ☐	DISCRIMINATIONS (due to ▽: similarity; No. of properties; No. of inputs) — hi / med / lo GENERALIZATIONS (dissimilarity; No. of properties; No. of inputs) — hi / med / lo	symbolic / verbal / environmental VISUAL: realistic; reproduced/ fabricated AUDIO: realistic; reproduced/ fabricated OTHER (kinesthetic, smell, taste)

B.4.5

EXAMPLE OF A COMPETENCY ANALYSIS FOR A "KNOWLEDGE DOMAIN" TERMINAL BEHAVIOR

EXAMPLES



STEP B.4

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
B.4.1		Grouped and sequenced completed task description FORMS		
B.4.2			Task analysis for each "Performance" Sub-STEP; or for each "Knowledge Domain" terminal behavior	-FORMS A.5(4)-(7) for PERFORMANCE -FORMS A.5(11)-(14) for KNOWLEDGE DOMAIN
B.4.3			Additional (lower level detail) task analysis information when necessary	-FORMS A.5(4)-(7) for PERFORMANCE -FORMS A.5(11)-(14) for KNOWLEDGE DOMAIN
B.4.4			Learning analysis information	-FORM A.5(4) for PERFORMANCE -FORM A.5(11) for KNOWLEDGE DOMAIN
B.4.5			Competency analysis information about recall and transfer requirements	-FORM A.5(4) for PERFORMANCE -FORM A.5(11) for KNOWLEDGE DOMAIN

STEP B.5

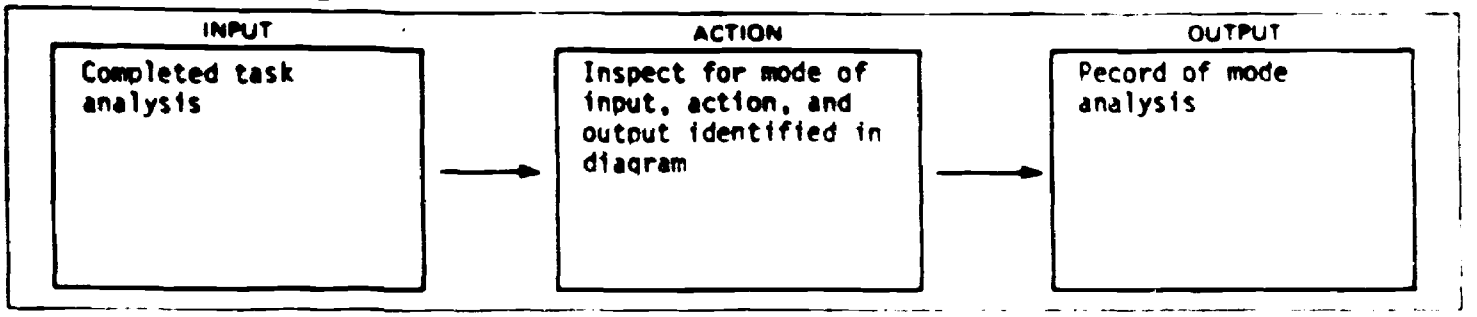
B.5* Collect information necessary to perform a mode analysis of inputs, actions, and outputs for each Sub-STEP or each criterion behavior.

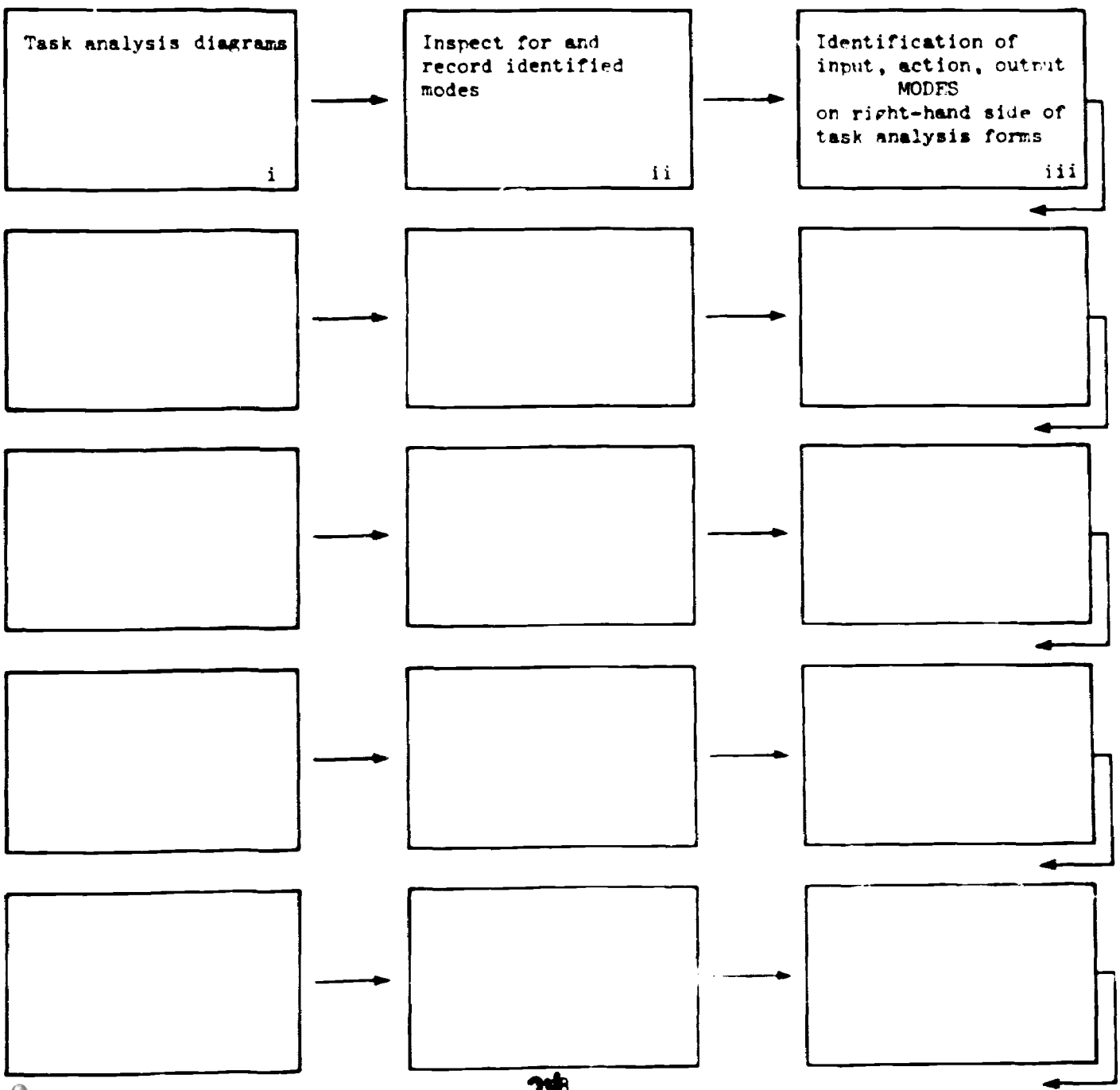
*Can be done while collecting task analysis information or at its conclusion (or started during task analysis and checked and completed afterward).

B.5.1 Inspect task analysis diagrams and classify INPUT, ACTION, and OUTPUT modes.

STEP 8.5

OVERVIEW





STEP B.5

PAGE INDEX

	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
B.5.1	-MATRIX: Input/output modes . . . . 254, 255, 257 Action modes 258		-MATRIX: Adequacy of record of mode analysis . 261	-FORM A.5(4) PERFORMANCE -FORM A.5(11) KNOWLEDGE DOMAIN SUMMARY OF PROCEDURES . . 260

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*A completed and recorded "mode analysis" identifying the mode of the INPUTS, ACTIONS, and OUTPUTS involved in the criterion behavior.*
WHAT YOU WILL WORK FROM	(1) Completed task analysis diagrams.
WHAT YOU WILL DO	(1) Inspect for and record the mode of the INPUTS, ACTIONS, and OUTPUTS involved in the criterion behavior.
FORMS YOU WILL USE	Right-hand side of FORM A.5(4) or FORM A.5(11) for recording the results of the mode analysis.

DESCRIPTION OF Sub-STEP	B.5.1

INPUT	ACTION	OUTPUT
Task analysis diagrams . i	Inspect for and record identified modes ii	Identification of input, action, output MODES on right-hand side of task analysis forms iii

Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Input/output modes . . . . 254, 255, 257 Action modes 258, 259		-MATRIX: Adequacy of record of mode analysis . 265	-FORM A.5(4) PERFORMANCE -FORM A.5(11) KNOWLEDGE DOMAIN -SUMMARY OF PROCEDURES . . 264

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Completed Forms A.5(4)-(7) or A.5(11)-(14)	B.4.3	Right-hand side of A.5(4) or of A.5(11)

Sub-STEP B.5.1

JOB DIAGRAM

INPUT	ACTION	OUTPUT
Task analysis diagrams i	Inspect for and record identified modes ii	Identification of input, action, output MODES on right-hand side of task analysis forms iii

Task analysis diagrams for INPUTS or OUTPUTS i.a	Inspect for types of modes ii.a	Identification of diagrammed modes -visual/auditory -symbolic/verbal/environmental -realistic/reproduced/fabricated iii.a
Task analysis diagrams for ACTIONS i.b	Inspect for types of modes ii.b	Identification of diagrammed modes -verbal/non-verbal -vocal/sub-vocal -perceptual/motor -recognition/editing/production iii.b

JOB PROCEDURES

B.5.1

CRITERIA FOR IDENTIFYING THREE TYPES OF INPUT/OUTPUT MODE

IDENTIFICATION MATRIX

TYPES OF INPUT/OUTPUT MODE	SYMBOLIC	VERBAL	ENVIRONMENTAL
CRITERIA	*-quantitative symbols* *-signs* *-representations*	*-language constructions*	*-people, animals, etc.* *-objects* *-events*
EXAMPLES	•numbers •addition signs, subtraction signs, etc. •musical notes •non-verbal road signs (arrows, ringing bells)	•words (spoken or printed) •sentences	•men, women, etc. •dogs, cats, etc. •bricks, houses, pens, etc. •automobile accidents, chemical reactions, etc.

B.5.1

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING THREE ADDITIONAL TYPES OF INPUT/OUTPUT MODE

TYPES OF INPUT/OUTPUT MODE	REALISTIC	REPRODUCED	FABRICATED
CRITERIA	*actual inputs*	*high-fidelity reproductions of inputs*	*moderate to low-fidelity representation of inputs*
EXAMPLES	•actual objects, people, events •live music •live speech •actual symbols (e.g., real signs)	•photographs or films of objects, people, events •recorded music •recorded speech •photographs of symbols	•drawings or animation of objects, people, or events •drawings of symbols

B.5.1

EXAMPLES ILLUSTRATING CLASSIFICATION OF INPUTS/OUTPUTS ACCORDING TO TWO SETS OF CRITERIA

EXAMPLES

TYPES ▶	SYMBOLIC	VERBAL	ENVIRONMENTAL
REALISTIC	VISUAL e.g., printed numbers e.g., non-verbal traffic signals •symbol for narrowing of lane AUDITORY e.g., clock chimes e.g., traffic bell	VISUAL e.g., printed street signs e.g., printed page AUDITORY e.g., spoken words e.g., sung words	VISUAL e.g., an actual man e.g., an actual auto AUDITORY e.g., actual sound of an engine e.g., actual sound of a crying infant
REPRODUCED	VISUAL e.g., photograph of printed numbers e.g., photograph of non-verbal traffic signals AUDITORY e.g., recorded clock chimes e.g., recorded traffic bell	VISUAL e.g., photograph of street signs e.g., slide of a printed page AUDITORY e.g., recorded spoken words e.g., recorded songs	VISUAL e.g., photograph of a man e.g., slide of an auto AUDITORY e.g., recorded sound of an engine e.g., recorded sound of a crying infant
FABRICATED	VISUAL e.g., hand-written numbers e.g., drawing of non-verbal traffic signals AUDITORY e.g., imitation of clock chimes e.g., imitation of traffic bell	VISUAL e.g., drawing of street signs e.g., sketch of a printed page	VISUAL e.g., faithful drawing of a man e.g., drawing of a stick figure AUDITORY e.g., imitated sound of an engine e.g., imitated sound of a crying infant

B.5.1

CRITERIA FOR IDENTIFYING MISCELLANEOUS TYPES OF INPUT MODES

IDENTIFICATION MATRIX

TYPES	KINESTHETIC	SMELL	TASTE
CRITERIA	-*Inputs that result from motor movements of body*	-*Inputs that result from inhaling*	-*Inputs that result from putting things in the mouth*
EXAMPLES	e.g., *sensations coming from muscle use* •*feel of a golf swing* •*weight of a held object* •*pressure exerted when using a tool*	e.g., *smell sensations* •*odors*	e.g., *taste sensations coming from drinking, eating, or holding objects in mouth* •*sweetness* •*sourness* •*hot, cold*

B.5.1

IDENTIFICATION MATRIX

CRITERIA FOR IDENTIFYING FOUR TYPES OF ACTION MODE

TYPES	PERCEPTUAL	MOTOR	VOCAL	SUB-VOCAL
CRITERIA	-*Identifications made by any of the senses:* ••*Visual* ••*Auditory* ••*Kinaesthetic* ••*Gustatory* ••*Olfactory*	-*Any behavior involving overt body movements*	-*Overt behavior involving the voice:* ••*Words* ••*Symbols* ••*Music* ••*Noise*	-*Covert behavior:* ••*Thinking* ••*Imagining* ••*Visualizing*
EXAMPLES	e.g., *identifying the make of an automobile* e.g., *identifying the taste of an herb* e.g., *identifying the style of music*	Verbal/Conceptual e.g., *writing words* e.g., *writing symbols* e.g., *drawing a map or diagram* Non-Verbal e.g., *driving a car* e.g., *swimming* e.g., *assembling a carburetor*	Verbal/Conceptual e.g., *delivering a speech* e.g., *singing a song* e.g., *speaking in a foreign language* Non-Verbal e.g., *humming a tune*	Verbal/Conceptual e.g., *solving a problem* e.g., *reading*

D.5.1

CRITERIA FOR IDENTIFYING THREE ADDITIONAL TYPES OF ACTION [illegible]

IDENTIFICATION MATRIX

TYPES	RECOGNITION	EDITING	PRODUCTION
CRITERIA	-*Selection of a response (action) or of an output from options*	-*Altering or correcting a response (action) or an output*	-*Producing a response (action) or an output*
EXAMPLES	e.g., multiple choice test items (definition of a term) e.g., selecting the right way (from two demonstrations) to operate equipment	e.g., correcting an incorrect definition of a term e.g., correcting the demonstrated wrong way to operate equipment	e.g., defining a term e.g., operating equipment

FIGURE 11 EXAMPLES ILLUSTRATING THE CATEGORIZATION OF ACTIONS ACCORDING TO THE CLASSIFICATION SYSTEM

EXAMPLES

TYPES	PERCEPTUAL	MOTOR	VOCAL	SUBVOCAL
RECOGNITION	e.g., identifying which one of four drawings represents the nitrogen atom	e.g., selecting from two or more demonstrated versions the correct way to swing a golf club	e.g., from options presented him, selects and says the form of the not "to be" appropriate for a given sentence subject	e.g., correctly selects the correct problem solution from options presented to him
EDITING	e.g., identifies a drawing of a nitrogen atom as being correct or incorrect	e.g., shown an incorrect version of a golf swing, demonstrates the correct way	e.g., box a simple option presented and labeled as incorrect, orally changes it--say from "is" to "and"	e.g., correctly edits a problem solution identified as being incorrect
PRODUCTION	e.g., correctly identifies a diagram as being that of a nitrogen atom	e.g., produces a correct golf swing	e.g., uses the correct form of the not to be by a given sentence subject	e.g., correctly thinks out a problem solution

B.5.1

TWO MAJOR PURPOSES IN CLASSIFYING MODE OF CRITERION BEHAVIOR

IDENTIFICATION MATRIX

PURPOSES	To assist in FORMULATION OF INSTRUCTIONAL STRATEGIES	To assist in SELECTION OF MEDIA
CRITERIA	*-INPUT - ACTION - OUTPUT modes are characterized in order to allow the selection of instructional strategies differentially appropriate to these modes*	*-INPUT - ACTION - OUTPUT modes are characterized in order to allow the selection of a medium (or media) capable of:* *••Displaying relevant INPUTS* *••Accommodating practice of relevant ACTIONS* *••Displaying relevant OUTPUTS*
EXAMPLES	e.g., *strategies appropriate for tasks involving verbal ACTIONS and strategies appropriate for tasks involving motor (non-verbal) ACTIONS may in part comply and in part be different*	e.g., *in driver training, a medium must be capable of displaying other moving vehicles (film, TV, or actual highways), of accommodating steering or braking (simulator or actual automobile), and of displaying the results of the action taken*

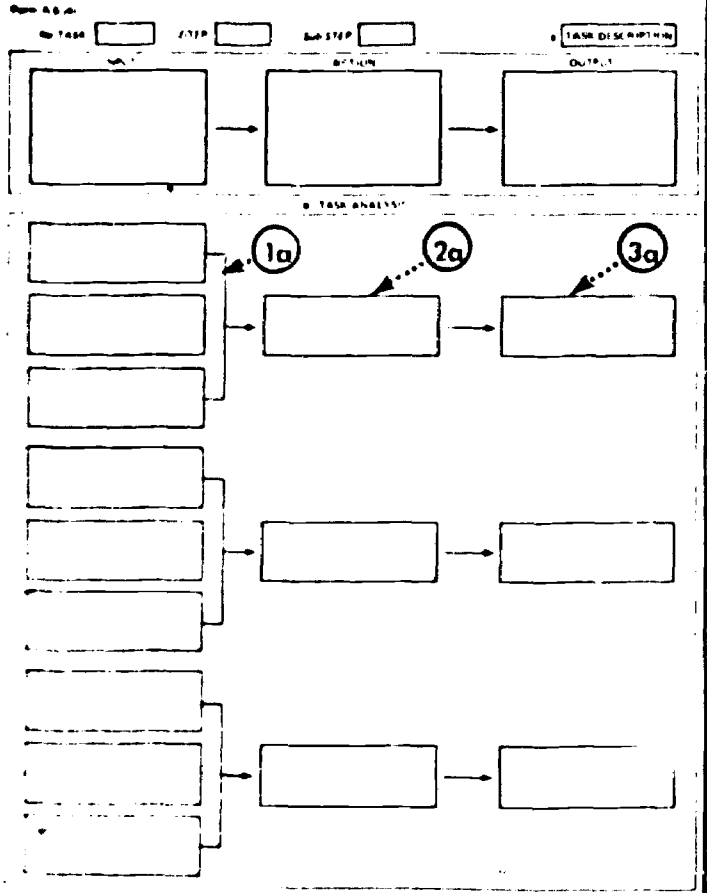
JOB PROCEDURES

B.5.1

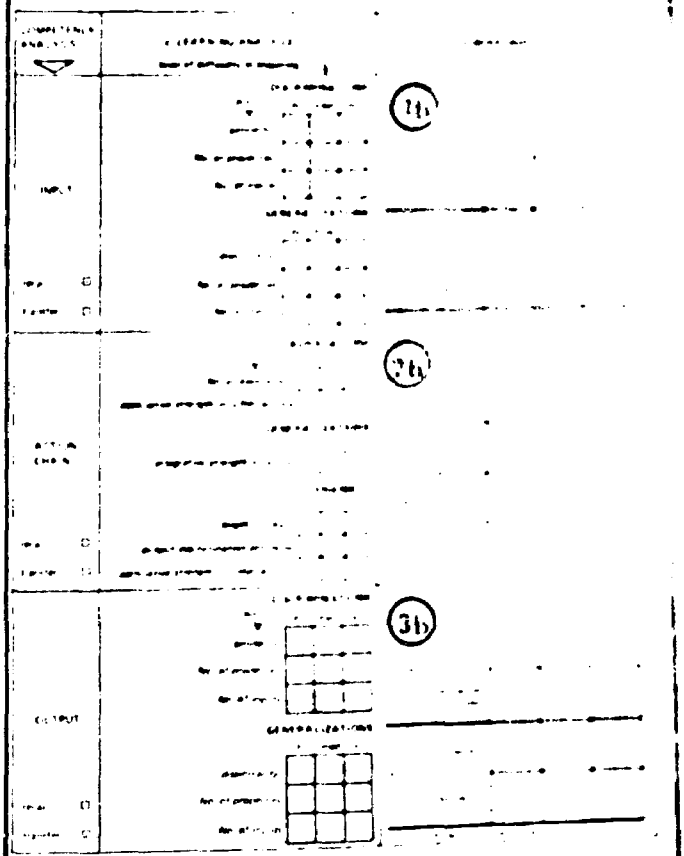
ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN CLASSIFYING INPUT, ACTION, AND OUTPUT MODES

#1	#2	#3
a. Inspect task analysis diagram for mode of INPUTS	a. Inspect task analysis diagram for mode of ACTIONS	a. Inspect task analysis diagram for mode of OUTPUTS
b. Record identified mode on right-hand side of Form A.5(4) or A.5(11)	b. Record identified mode on right-hand side of Form A.5(4) or A.5(11)	b. Record identified mode on right-hand side of Form A.5(4) or A.5(11)

FORM A.5(4) OR FORM A.5(11)



RIGHT-HAND SIDE OF FORMS A.5(4) OR A.5(11)



B.5.1

CRITERIA FOR DETERMINING THE ADEQUACY OF MODE ANALYSIS

STANDARDS MATRIX

PROPERTIES	COMPLETENESS	CROSS-REFERENCING
CRITERIA	-*A mode analysis for:* *INPUTS* *ACTIONS* *OUTPUTS*	-*No labeling is necessary* -*Entries are made on the right-hand side of the task analysis forms*

EXAMPLE

EXAMPLE OF A MODE ANALYSIS FOR A "PERFORMANCE" Sub-STEP

Form A 5 (4)

for TmSR ____ STEP ____ Sub STEP ____ a TASK DESCRIPTION

INPUT	ACTION	OUTPUT
Levelness of ground where golf ball lies vi	Assumes appropriate stance (leg position) vii	Stance appropriate to terrain viii

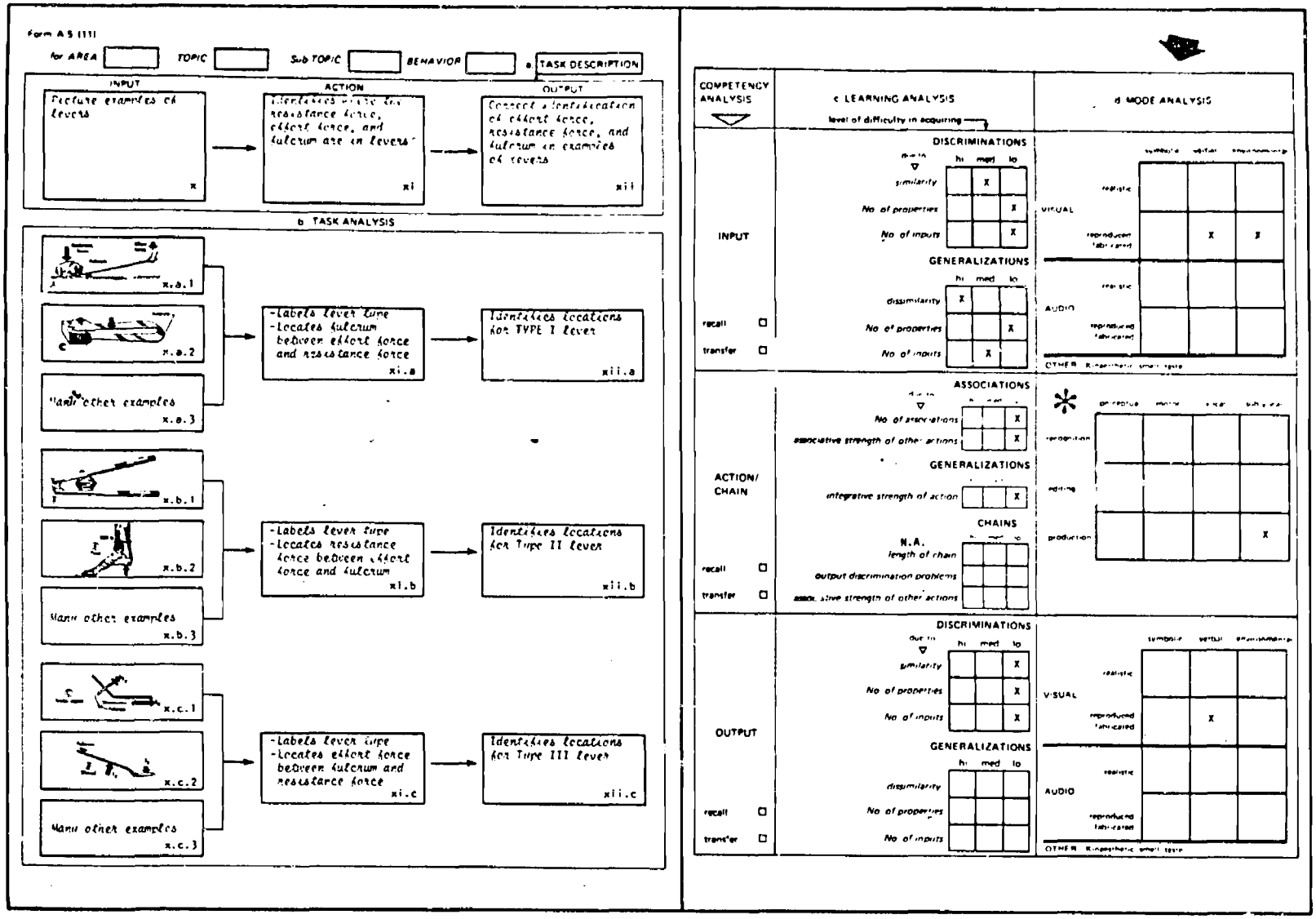
b TASK ANALYSIS

Uphill lie vi.a.1	Assumes appropriate stance (leg position) vii.a	Stance for uphill position viii.a
Other various degrees of uphill lie vi.a.=		
vi.b.1	Assumes appropriate stance (leg position) vii.b	Normal stance assumed viii.b
Flat lie		
vi.b.=		
Downhill lie vi.c.1	Assumes appropriate stance (leg position) vii.c	Stance for downhill position viii.c
Other various degrees of downhill lie vi.c.=		

COMPETENCY ANALYSIS*	c LEARNING ANALYSIS (level of difficulty in acquiring)	d MODE ANALYSIS
INPUT recall ☐ transfer ☐	DISCRIMINATIONS (due to): similarity; No of properties; No of inputs — hi / med / lo GENERALIZATIONS: dissimilarity; No of properties; No of inputs — hi / med / lo	VISUAL / AUDIO / OTHER — symbolic, verbal, environmental; real time; reproduced (after event)
ACTION CHAIN recall ☐ transfer ☐	ASSOCIATIONS: No of associations; associative strength of other actions GENERALIZATIONS: N.A.; integrative strength of action CHAINS: N.A.; length of chain; output discrimination problems; associative strength of other actions	recognition; editing; production; major, minor, sub-unit
OUTPUT recall ☐ transfer ☐	DISCRIMINATIONS (due to): similarity; No of properties; No of inputs — hi / med / lo GENERALIZATIONS: dissimilarity; No of properties; No of inputs — hi / med / lo	VISUAL / AUDIO / OTHER — symbolic, verbal, environmental; real time; reproduced (after event)

EXAMPLE OF A MODE ANALYSIS FOR A "KNOWLEDGE DOMAIN" TERMINAL BEHAVIOR

EXAMPLES



* *Because the student produces the action covertly, it will be necessary for "record" purposes to require an overt response of some kind (verbal or motor), i.e., spoken or written.*

STEP B.5

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
5.1			A mode analysis	Right-hand side of Form A.5(4) for "PERFORMANCE" or Form A.5(11) for "KNOWLEDGE DOMAIN"