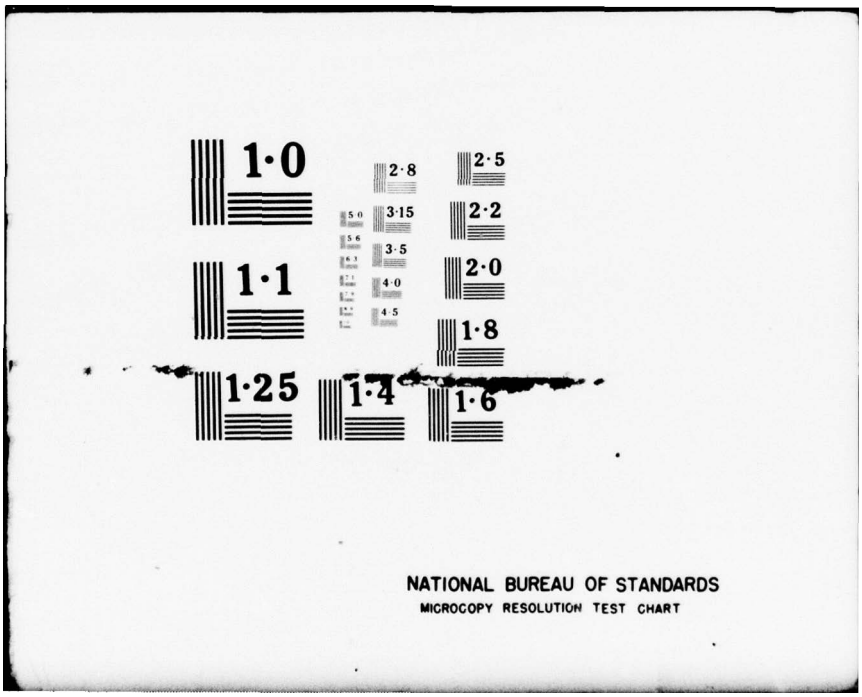
AD-A045 309 COURSEWARE INC SAN DIEGO CALIF F/G 5/9
EMPIRICAL VALIDATION OF SELECTED INSTRUCTIONAL STRATEGY DIAGNOS--ETC(U)
SEP 77 M D MERRILL, N D WOOD, M BAKER N00123-76-C-0245
UNCLASSIFIED NPRDC-TR-77-43 NL

| OF |
ADA
045309

END


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
2·8
3·15
3·5
4·0
4·5
5·0
5·6
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

NPRDC TR 77-43

September 1977

EMPIRICAL VALIDATION OF SELECTED INSTRUCTIONAL STRATEGY DIAGNOSTIC PROFILE PRESCRIPTIONS[1]

M. David Merrill
Norman D. Wood
Meryl Baker

COURSEWARE, Inc.
San Diego, California 92131

John A. Ellis
Wallace H. Wulfeck, II

[1]This research was supported in part by the Advanced Research Projects Agency of the Department of Defense and was conducted by the Navy Personnel Research and Development Center under Contract No. N00123-76-C-0245.

Reviewed by
John D. Ford, Jr.

Approved by
James J. Regan
Technical Director

Navy Personnel Research and Development Center
San Diego, California 92152

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NPRDC TR-77-43	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: EMPIRICAL VALIDATION OF SELECTED INSTRUCTIONAL STRATEGY DIAGNOSTIC PROFILE PRESCRIPTIONS.	5. TYPE OF REPORT & PERIOD COVERED: Final Report, FY77
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): M. David Merrill, Norman D. Wood, Meryl Baker (COURSEWARE, Inc.); John A. Ellis, Wallace H. Wulfeck, II (NPRDC)	8. CONTRACT OR GRANT NUMBER(s): N00123-76-C-0245
9. PERFORMING ORGANIZATION NAME AND ADDRESS: COURSEWARE, Inc., 9820 Willow Creek Road, San Diego, California 92131	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 63720N; Z0108-PN, 30A
11. CONTROLLING OFFICE NAME AND ADDRESS: Navy Personnel Research and Development Center, San Diego, California 92152	12. REPORT DATE: September 1977
	13. NUMBER OF PAGES: 48
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*	15. SECURITY CLASS. *(of this report)*: UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Instructional Strategies
Content type
Task level
Consistency
Adequacy
Presentation form
Instructional display

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

The Instructional Strategy Diagnostic Profile (ISDP), an instrument for diagnosing defects in instruction and prescribing revisions, is designed to rate instruction on two major dimensions--consistency and adequacy. In this study, three experiments were conducted to test the hypotheses underlying the ISDP's consistency and adequacy prescriptions. Navy enlisted men were assigned to 12 treatment groups--four representing remember level instruction; and eight, use level. Experiment I investigated the effects of manipulating

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

392 877

PRECEDING PAGE BLANK-NOT FILMED

consistency of test items and presentation strategies. Experiments II and III investigated the effect of manipulating adequacy of instructional materials designed to teach students to remember and use information respectively. Results provided strong support for the consistency prescription and for two of the three adequacy prescriptions for use level tasks. However, the two adequacy prescriptions for remember level tasks were not clearly supported. It was concluded that the ISDP is a valid instrument for predicting student performance and for evaluating instructional materials.

FOREWORD

The Instructional Strategy Diagnostic Profile was developed in support of Navy Decision Coordinating Paper, Education and Training Development (NDCP-Z0108-PN) under subproject P.30A, Adaptive Experimental Approach to Instructional Design and the sponsorship of the Chief of Naval Operations (OP-99). The validation described in this report was a joint effort of COURSEWARE, Inc. and this Center with funding assistance for the COURSEWARE involvement being provided by the Defense Advanced Research Projects Agency.

Appreciation is expressed to CAPT O'Malia, Mr. P. Tabara, Mr. H. Darling, and the staff at the Propulsion Engineering School, Great Lakes, Illinois. Without their assistance and cooperation, this study could not have been performed.

Results of this research are intended for use by the Chief of Naval Education and Training Support, specifically the Instructional Program Development Center, the Chief of Naval Education and Training, and the Chief of Naval Technical Training.

J. J. CLARKIN
Commanding Officer

SUMMARY

Problem

The Navy Instructional Program Development Centers, under the Chief of Naval Education and Training Support, currently are tasked with analyzing, designing, and developing a large portion of the Navy's technical training courses. To facilitate accomplishment of this task, the Instructional Strategies Diagnostic Profile (ISDP) was developed. During the initial development phase, several variables were identified that were hypothesized as affecting the consistency and adequacy of instructional materials; however, the prescriptions relating to many of these variables have not been empirically validated.

Objective

The overall objective of this study was to empirically validate some of the consistency and adequacy prescriptions of the ISDP. Specifically, it was designed to validate six hypotheses concerning the consistency and adequacy of instructional materials.

Approach

Subjects participating in the study were enlisted men waiting to begin "A" School at the Propulsion Engineering (PE) School, Great Lakes. Instructional materials developed were based on PE School curriculum but were adapted to provide for 12 experimental treatments needed to test the six hypotheses. Four of these treatments represented remember level instruction; and eight, use level instruction. After students finished their instruction, they were tested on remember level test items (labeling and listing) and use level test items (classification). All subjects had the same testing materials.

Three experiments were conducted. Experiment I tested the consistency hypothesis, which stated that performance will decrease if test items and presentation strategies are not consistent, by manipulating test items and strategies. Experiment II tested the adequacy hypotheses for remember level items, which stated that performance will increase with the use of a mnemonic and several-page distributed practice, respectively. This was done by comparing the performance of (1) the mnemonic vs. no mnemonic groups and (2) the several-page distributed practice vs. one-page massed practice groups. Finally, Experiment III tested the adequacy hypotheses for use level items, which stated that performance will increase with the use of isolated definitions, divergent examples, and attribute isolation elaboration, respectively. This was done by comparing the performance of (1) the isolated definition vs. embedded definition groups, (2) the divergent example vs. convergent example groups, and (3) the attribute isolation vs. no attribute isolation elaboration groups.

Results

1. Experiment I--The students in the use level treatment groups scored significantly higher on use level items (classification) than those in the remember level groups, and students in the remember level groups scored

significantly higher on remember level items (labeling and listing) than those in the use level groups. Thus, the consistency prescription of the ISDP is supported.

2. Experiment II--There were no significant differences in performance on the remember level test items for either the mnemonic or practice variable, but there was a significant savings of time for the massed practice condition. Thus, the two presentation adequacy prescriptions of the ISDP for remember level items were not supported.

3. Experiment III--Students in the isolation treatments scored higher on all performance measures and took less time than students in the embedded definition treatment. Students in the divergent example treatments scored higher on use test items than students in the convergent example treatment. There were no differences between students in attribute isolation and no attribute isolation elaboration treatments. Thus, only two of the three presentation adequacy prescriptions of the ISDP for use level items were supported.

Conclusions

Although the results of this study did not support all of the ISDP prescriptions, they did provide considerable evidence that the ISDP is a valid instrument for predicting student performance and for evaluating the effectiveness of existing and newly developed instructional materials.

Recommendations

1. A field test of the ISDP should be conducted to gather interrater reliability and usability data.

2. Studies correlating ISDP ratings and student performance should be performed to further validate the ISDP's predictive value.

3. Assuming that the ISDP proves to be a reliable, valid, and usable instrument, implementation should be initiated in the Instructional Program Development Centers and other evaluation groups.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Problem

The Navy Instructional Program Development Centers, under the Chief of Naval Education and Training Support, currently are tasked with analyzing, designing, and developing a large portion of the Navy's technical training courses. To facilitate accomplishment of this task, the Instructional Strategy Diagnostic Profile (ISDP), an instrument for diagnosing defects in instructional material and for prescribing revisions thereto, was developed under contract to the Navy Personnel Research and Development Center.[1] During the development phase, several variables were identified that were hypothesized as affecting the consistency and adequacy of instructional materials. However, many of the prescriptions relating to these variables have not been empirically validated.

Overview of the Instructional Strategy Diagnostic Profile

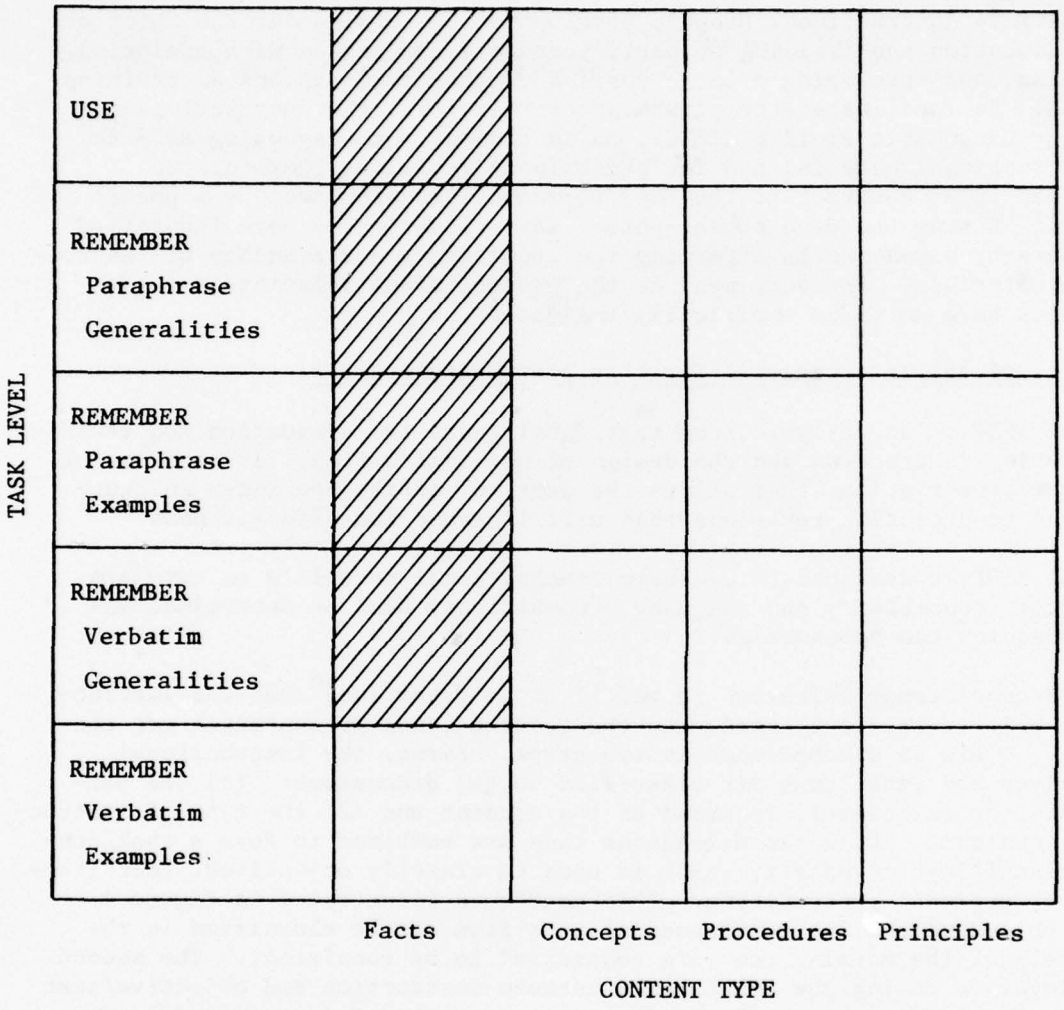
The ISDP is an analytic tool that facilitates the evaluation and revision of existing instruction and the design of new instruction. It consists of a set of prescriptions that allows the user to profile and index instruction and to prescribe revisions that will increase its effectiveness.

The ISDP is designed to evaluate instructional materials on two main criteria: consistency and adequacy. Consistency must be determined before adequacy can be assessed.

The consistency criterion is met if it is determined that the instructional objectives, test items, and the instructional presentation are consistent. This is accomplished in two steps. First, the instructional objectives and test items are classified on two dimensions: (1) the performance, or task level, required of the student and (2) the type of instructional content. These two dimensions then are combined to form a task/content classification matrix, which is used to classify objectives, test items, and instructional presentation. This matrix is illustrated in Figure 1. If an objective and its corresponding test item can be classified in the same cell of the matrix, they are considered to be consistent. The second step involves rating the consistency between instruction and objective/test items. The ISDP requires that different components of instructional presentation, called primary presentation forms, be present for different combinations of task level and content type. If the combination of primary presentation forms required for the task level and content type of each objective/test item is present, then the instruction is consistent with the objective/test items.

---

[1]See Merrill, M. D., Richards, R. E., Schmidt, R. V., & Wood, N. D. Interim Training Manual for the Instructional Strategy Diagnostic Profile (NPRDC Spec. Rep. 77-14). San Diego: Navy Personnel Research and Development Center, September 1977.



Note: Facts can be tested only at the remember verbatim level.

Figure 1. ISDP Task/Content Classification Matrix.

Once it has been determined that instructional materials are consistent, the adequacy criterion is assessed. This is done by determining whether or not the instructional presentation adequately communicates the "to-be-learned" information. Variables that are hypothesized as affecting instructional adequacy during ISDP development include the following: (1) isolation (i.e., is the relevant information separated and clearly identified?), (2) help (i.e., is explanatory or mnemonic information provided?), and (3) matching (i.e., are the examples and practice items matched?). Thus, instruction is based on these variables to obtain an adequacy index. Each primary presentation form within the instruction may be rated as more or less adequate.

In the following sections, the task/content matrix will be described in greater detail, the primary presentation forms will be discussed, and validation experiments testing the consistency and adequacy assumptions will be presented.

Task/Content Classification Matrix

As shown in Figure 1, the task dimension of the task/content classification matrix is comprised of several levels, the broadest of which consists of the strategies Use and Remember. Use is defined as the act of applying a general relationship to a specific situation where it has not been previously applied; and remember, as the act of bringing to mind something that has been previously encountered. Thus, a use item (or objective) would require the student to respond by applying a generality to a newly encountered example; that is, one that has not been previously displayed to the student as part of the instructional presentation. A remember test item (or objective) would require the student to respond by recognizing or recalling a generality or example that has been previously encountered. Generality is defined as a statement of definition or relationship that can be applied to more than one specific object or event; and example, as a specific object or event or its representation that does or could exist in the real world.

The use level cannot be divided into sublevels--it always requires newly encountered examples. The reason for this is obvious--if an example had been previously encountered, the test item or objective would be classified at the remember level. The remember level, however, can be divided into sublevels--either paraphrase or verbatim. Paraphrase means equivalent in meaning but expressed in other words; verbatim, word for word or exactly the same. Thus, a paraphrase generality means that synonyms have been substituted for the substantive words (nouns, verbs, and modifiers) of the original statements; and a paraphrase example means that the same object or event is presented but that the form or representation used to exhibit this object or event has been modified. A verbatim generality/example requires the student to recognize or restate the same words that were used previously to present the generality/example. All paraphrase and verbatim generalities and examples have been previously encountered by the student.

As shown in Figure 1, the content dimension of the matrix involves four mutually exclusive content categories: facts, concepts, procedures, and principles. Except for facts, for which there can be no generalities, all types can be tested at any of the task levels. These categories are defined as follows:

1. A fact is a one-to-one association of a symbol and a specific object or event.

2. A concept is a class of objects, events, or symbols that (a) share critical attributes, (b) can be referenced by a name or symbol, and (c) have discriminably different individual members.

3. A procedure is a series of steps required to produce an example of an outcome class. Each step may involve the temporal or spacial ordering of specific objects, events, or symbols or a branching decision, based either on a fact or the classification of an example of a concept. A procedure is often characterized as "how to do something."

4. A principle is a predictive relationship between specific examples of a concept, or among a set of related concepts, which explains why an example of a particular class is produced as a result of a particular manipulation.

Further information concerning these content categories is provided in the Interim Training Manual for the Instructional Strategy Diagnostic Profile,[2] which was designed to teach users how to classify test items and objectives according to the ISDP task/content classification matrix. (It should be noted that some of the variables identified as affecting instructional adequacy are not applicable to all content types and task levels.)

Primary Presentation Forms

The ISDP defines the instructional presentation form or display as the fundamental unit of instructional strategy. As indicated previously, the instructional presentation forms must meet consistency and adequacy requirements.

Four primary presentation forms or displays, which represent the various ways that information can be presented, have been defined:[3]

1. Tell via generality (TG), hereafter referred to as generality--A display that presents a definition of a concept, an algorithm that describes a procedure, or a proposition that expresses a principle.

2. Tell via example (Teg), hereafter referred to as example--A display that illustrates how a generality applies to a specific example.

[2,3]See footnote 1.

3. Question via generality (QG)--Not used in this research study.

4. Question via example (Qeg), hereafter referred to as practice--A display that presents an example and requires the student to respond to the example or it presents a name or generality and requires the student to respond by providing an example.

Objective

The overall objective of this research is to validate empirically some of the consistency and adequacy prescriptions of the ISDP. Six hypotheses are tested in three experiments. Experiment I addresses consistency; Experiment II, the adequacy of remember verbatim/fact level instruction; and Experiment III, the adequacy of use/concept level instruction. The rationale for each experiment and the specific hypotheses tested follow.

Experiment I - Consistency

In Experiment I, use level instruction was applied to concepts, and remember level, to facts; subjects were given both consistent and inconsistent test items. This experiment was based on the rational described below.

In responding to use level items, the student is required to classify newly encountered instances and noninstances, or to apply a procedure or principle in a new situation. The ability to respond correctly in a new situation is called transfer, which, at the concept level, is defined as the ability to abstract and identify the common attributes or characteristics that are shared by two or more illustrations (instances). To illustrate, a typical use/concept presentation consists of a combination of generality, example, and practice displays. The generality display would list the attributes or characteristics of the concept, and the example display would illustrate those attributes as applied to a specific instance. If a second example display (or a practice display) provided a second, but different instance, the student would be able to compare the two and thus distinguish between critical and irrelevant (variable) attributes. Practice with a third, but different, instance would enable him to test his ability to identify the critical attributes while ignoring the others. Thus, it appears that the most effective presentation for use/concept level items consists of a combination of generality, example, and practice displays, where the instances used in the example and practice displays differ from each other in their various attributes.

On the other hand, in remember level items, where the student is required to remember verbatim the parts or attributes of a single specific instance, no transfer is involved. The student must attend to the specific attributes rather than to their abstract qualities. Thus, for remember level items, it appears that the most effective presentation consists of a combination of example and practice displays where the instances used in the example and practice displays are identical to each other.

Neither type of presentation subsumes the other. The generality, example, practice combination for the use/concept level items does not provide sufficient repetition to allow the student to rehearse and remember the specific attributes in order to name them at the remember level. The generality display may interfere by shifting the student's attention to abstract attributes rather than to specific parts in a specific case. The different instances in the example and practice displays may also cause interference since the student may confuse the various parts because of insufficient practice with a specific case. On the other hand, repetition of a specific instance--for remember level items--distracts the student's attention from the abstract characteristics and focuses it on specific details. Thus, when he is presented with a new instance on a test (at the use/concept level), he may fail to recognize it altogether because he is oriented to the specific attributes or characteristics of a single, but different, instance.

Taken together, the above suggests that a presentation designed to teach application in new situations (use level items) may not adequately prepare a student to perform in a remember verbatim situation. Conversely, one designed to teach a student to remember verbatim (remember level items) may not prepare a student to apply the knowledge gained to new situations. While these conclusions may appear to be intuitively obvious, an examination of the instructional materials currently in use in almost all educational and training situations will indicate that, in the majority of cases, tests and instructional presentation are <u>not</u> consistent. These observations led to the following hypothesis.

<u>Hypothesis 1: A significant decrement in test performance and learning efficiency will occur when test items and presentation strategies are not consistent with each other</u>.

The ISDP consistency prescription is not based on psychological theory; rather, it is based on observations in real world instructional situations and the argument presented above concerning which presentations are most effective for use level items and remember level items. The authors are unaware of any previous research that has tested this argument.

<u>Experiment II - Adequacy, Remember Level</u>

As indicated previously, adequacy prescriptions are nested within each task level; hence, there are separate prescriptions for the remember-example and use task levels. Experiment II, at the remember level, tested the following adequacy hypotheses:

<u>Hypothesis 2: A significant increment in test performance and learning efficiency will occur when the example display for a remember level task is associated with a mnemonic</u>.

A mnemonic is defined as information that enables the student to associate the information to be learned with his existing cognitive structure in ways that facilitate his ability to remember and retrieve this new information. While this hypothesis is not new, it has seldom been tested in the context of ongoing instruction.

Hypothesis 3: A significant increment in test performance and learning efficiency will occur when the practice displays for a remember level task "chunk" the number of items to be learned on a given repetition.

This hypothesis is based on applying Miller's magic number premise (7 ± 2),[4] which has been a fundamental premise of most information processing theory, to an instructional situation. It is assumed that short-term memory can only retain a few individual items at a time. When a student attempts to remember a long list of items, he must divide the list into manageable sublists and learn a few items at a time, successively adding to the list he can remember.

Experiment III - Adequacy, Use Level

Experiment III, at the use level, tested the following hypotheses:

Hypothesis 4: A significant increment in test performance and learning efficiency will occur when the generality display for a use level task is separate and identified for the student rather than embedded in elaborative material.

The author of the instructional material obviously knows which of the sentences in a paragraph or section of material really states the generality and which are elaborative statements about the generality. However, since the student does not have this information, he must spend much of his time in learning playing instructional hide-and-seek. Thus, if the presentation clearly identifies the generality for the student, he can spend his time in learning the relationship involved rather than in trying to decide which relationship will be tested.

Hypothesis 5: A significant increment in test performance and learning efficiency will occur when the examples used for the example and practice displays for a use level task are divergent rather than convergent on variable attributes.

The argument for this hypothesis is similar to that used for the first one. If the variable characteristics of the different examples presented by the example and practice displays are very similar, then the presentation is equivalent to the repetition of the same example. Thus, to maximally prepare the student to classify a newly encountered example, the practice should consist of a set of divergent examples (i.e., those which differ in as many ways as possible). If the practice consists of only a convergent set, test performance will be adequate as long as the test example is similar to those practiced; if it is not, there is a high probability that the student will fail to recognize the instance as an example.

---

[4]Miller, G. A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Reviews, 1956, 63, 81-97.

Hypothesis 6: A significant increment in test performance and learning efficiency will occur when example displays for a use level task are associated with elaborative material that focuses the student's attention on the critical attributes, and when the practice displays are followed by feedback that includes such elaborative material regardless of whether the student responds correctly or incorrectly.

It is not always clear to a student which aspects of a given example constitute critical attributes and which are irrelevant. If the example is accompanied by attention-focusing devices that help the student to make the necessary discriminations, the example will fulfill the illustrative role for which it is intended. This elaborative material should facilitate the student's ability to compare instances and should reduce the time necessary to process the information, thus improving test performance and efficiency.

METHOD

Subjects

The subjects who participated in this study were 240 Navy enlisted men waiting to begin classes at the Propulsion Engineering School, Great Lakes, Illinois. The PE School is the Navy's "A" School for three engineering ratings: Machinist's Mate, Boiler Technician, and Engineman. The curriculum for all ratings is completely individualized and divided into self-study modules; the first 13 of which form a common core of basic knowledge and skill units that must be taken by all students.

Materials

Instructional

The instructional materials used were based on the pumps module of the common core units. However, the course materials were modified considerably to provide for 12 experimental treatments needed to test the six hypotheses. Four of these treatments represented remember level instruction; and eight, use level instruction.

The final instructional materials comprised a module of 10 segments, each relating to a particular type of pump commonly used aboard ship. The segments were presented in separate self-study workbooks, which varied in length, depending on the treatment involved. The workbooks for the remember level treatments contained *example* and *practice* displays that focused the student's attention on memorizing the material. Those for the use level treatments contained *generality*, *example*, and *practice* displays that focused the student's attention on acquiring the ability to identify previously and newly encountered displays of a particular type of pump. However, the order in which items concerning the different types of pumps were presented was the same regardless of treatment. Also, the books had identical cover pages.

Remember Level. The workbooks for the four remember level treatments were similar in that they all provided *demonstration* materials. However, they varied as to whether or not they included a *mnemonic* and as to the type of *practice* provided. The techniques provided by the workbooks for the four remember level treatments are listed in Table 1 and described below.

1. *Demonstration* materials, provided for Treatments 1 through 4, provided (a) a statement of the objective, (b) a labeled illustration (example) of the concept (diagram), and (c) directions telling the subject to study the names of the labeled parts.

2. The *mnemonic*, provided for Treatments 1 and 2, consisted of a listing of major components of a type of pump linked with a listing of familiar objects physically remembling those components. For example, "cylinder" might be linked with "can"; and "piston," with "plunger." The mnemonic would be accompanied by a description of its purpose and directions on how to use it.

3. Several-page distributed practice, provided for Treatments 1 and 3, consisted of several pages of illustrations (example) of a pump, with various parts highlighted but unlabeled. On subsequent pages, subjects were required to label an increasing number of parts. Correct answers were provided on the page immediately following the practice; directions appeared at the beginning of each practice session.

4. One-page massed practice, provided for Treatments 2 and 4, consisted of only one illustration of a pump with all of the parts unlabeled, and subjects were required to label the parts. Correct answers were provided on the page immediately following the practice problem; directions appeared at the beginning of each practice session.

Examples of these four techniques appear in the appendix.

Table 1

Techniques Provided in Instructional Booklets
For Remember Level Treatments

	Technique		
Treatment	Common	Memory Aid	Practice Type
1	Demonstration	Mnemonic	Several-page Distributed
2	Demonstration	Mnemonic	One-page Massed
3	Demonstration	No Mnemonic	Several-page Distributed
4	Demonstration	No Mnemonic	One-page Massed

Use Level. The workbooks for the use level treatments varied as to the type of definition, example set, and elaboration provided. The techniques used by the books for the eight use treatments are listed in Table 2 and described below:

1. Isolated definitions, provided for Treatments 5 through 8, consisted of a statement of the lesson's objective and a definition that specified the name and critical attributes for a particular pump, accompanied by instructions to the student telling him to study the definition. The page following the isolated definition provided an elaboration of the parts of the pump, along with an illustration.

2. Embedded definitions, provided for Treatments 9 through 12, consisted of a statement of the lesson's objective and a definition that was embedded in several paragraphs of supplementary information.

3. Divergent examples, provided for Treatments 5, 7, 9, and 11, consisted of two (or more) illustrations of the same pump that were as different as possible from each other. The divergent illustrations used in the example displays were different from those used in the practice displays.

4. Convergent examples, provided for Treatments 6, 8, 10, and 12, consisted of two (or more) illustrations of the same pump that were very similar to each other, often varying only in the orientation of the illustration. The convergent illustrations used in the example displays were also very similar to those used in the practice displays.

5. Attribute isolation elaboration, provided for Treatments 5, 6, 9, and 10, consisted of an illustration of a pump, with accompanying feedback that stated why or why not the illustration was an example of a particular type of pump.

6. No attribute isolation elaboration, provided for Treatments 7, 8, 11, and 12, consisted of an illustration of a pump, accompanied by feedback that consisted of "Yes" if it was an example of a particular pump or "No" if it was not. No additional explanation was provided.

Examples of these techniques appear in the appendix.

Table 2

Techniques Provided in Instructional Booklets For Use Level Treatments

	Technique		
Treatment	Type of Definition	Type of Example Set	Type of Elaboration
5	Isolated	Divergent	Attribute Isolation
6	Isolated	Convergent	Attribute Isolation
7	Isolated	Divergent	No Attribute Isolation
8	Isolated	Convergent	No Attribute Isolation
9	Embedded	Divergent	Attribute Isolation
10	Embedded	Convergent	Attribute Isolation
11	Embedded	Divergent	No Attribute Isolation
12	Embedded	Convergent	No Attribute Isolation

Testing

The testing materials were the same for all subjects. There were two parts, each of which was presented in a separate test booklet. Part A comprised 30 test items; and Part B, 20.

Part A included three types of items: 10 labeling, 10 encountered classification, and 10 classification. Items were arranged in the test booklet so that every third item was of a different type. One item of each type involved a different type of pump.

1. The labeling items presented the student with a diagram of a pump and required him to label all of its major components. The diagrams were the same as those previously encountered by the student during the instructional presentation. This type of item is classified by the ISDP as a remember-verbatim-example item.

2. The encountered classification items presented the student with a diagram of a pump and required him to classify it as to which type it was. The diagrams were the same as those previously encountered. These items were essentially true-false questions. For example, an item might ask: "Is this an ejector-type jet pump?" If the diagram did in fact depict this type of pump, the student would respond "Yes." However, if it was actually a different type or if an important element were missing (making the diagram essentially a "nonexample"), he would respond "No." This type of item is classified by the ISDP as an inadequate classification (use level) item, because it involves previously encountered examples.

3. The classification items were in the same format as the encountered classification items, except that the diagrams used were newly encountered; that is, they had not been displayed to the student in the instructional presentation. This type of item is classified by the ISDP as a classification (use level) item.

Part B consisted of two types of items: 10 listing items and 10 classification items. Items were arranged in the test booklet so that every other item was of a different type.

1. The listing items required the student to list the major components of each of the 10 types of pumps. This type of item is classified by the ISDP as a remember-verbatim-generality item. (Since Parts A and B of the test materials were presented in separate booklets, the students did not have access to the previously encountered diagrams in Part A while trying to label the components in Part B.)

2. The classification items were in the same format as the classification items of Part A. However, the newly encountered diagrams used were different from those used in Part A. This type of item is classified by the ISDP as a classification (use level) item.

Procedure

Students were able to complete all 10 segments of the instructional materials and both parts of the testing materials in a single experimental

session. Five such sessions were conducted, with 48 students in each. The students were randomly assigned to the 12 treatment groups so that there were four students within each group within each session. Thus, 20 students were assigned to each treatment group.

At the beginning of each session, the students were told that (1) the Navy was interested in improving the quality of its instruction, (2) several versions of the pumps module had been prepared so that a variety of instructional methods could be tested, (3) their scores would not be recorded but they should try to perform as well as they could, and (4) their study of the experimental material would help them in their other "A" School studies. They were instructed not to begin work on the materials until the direction to start was given.

The materials were distributed and each student was asked to record his social security number. They were then directed to begin. When a student had finished the instructional booklets, he gave them to the experimenter, who issued him Part A of the testing materials. When the student finished Part A, the experimenter collected it and issued the student Part B. This action was taken to prevent the student from having access to the previously encountered diagrams in Part A while he was listing the major components of each pump in Part B. When the student finished Part B, it was collected by the experimenter and the student was dismissed. The times required for the student to complete the instructional materials, Part A, and Part B were recorded.

Experimental Design

Three experiments were conducted. Experiment I was designed to investigate the effect of manipulating consistency of test items and presentation strategies. Experiments II and III were designed to investigate the effect of manipulating adequacy ratings of instructional materials designed to teach students to remember and use information respectively.

Experiment I

Experiment I was designed to test Hypothesis 1, which stated that a significant decrement in performance will occur when test items and presentation strategies are not consistent with each other. As stated above, all students were tested on three types of test items: labeling (Part A), listing (Part B), and classification (including encountered classification) (Parts A and B). Figure 2 indicates that the labeling items are consistent with instructional materials provided for Remember Level Treatments 1 through 4; and the classification items, with those for Use Level Treatments 5 through 12. The listing test items are not completely consistent with materials provided for either the remember or the use level treatments. However, since those for the remember level treatments provide more practice in recalling the parts of each particular type of pump, it is considered that the listing items are more consistent with materials for remember level treatments than with those for the use level treatments.

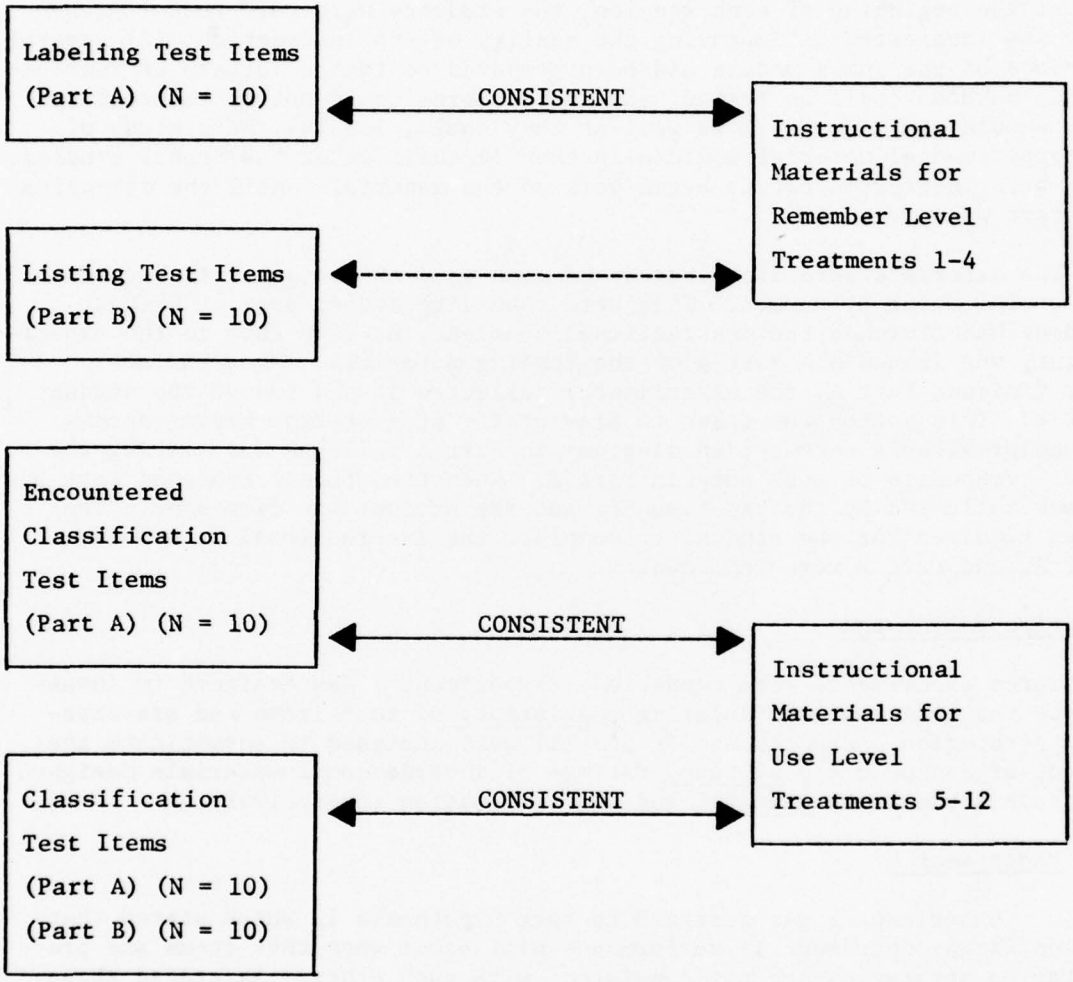


Figure 2. Test item/presentation materials consistency hypothesis.

In this experiment, Hypothesis 1 will be supported if (1) the students in the remember treatment groups perform better on the labeling and listing test items than those in the use treatment groups, and (2) the students in the use treatment groups perform better on the classification test items than those in the remember treatment groups. The hypothesis was tested using a 2 x 3 design, where one dimension is all remember level treatments (1 through 4) vs. all use level treatments (5 through 12), and the other is label, list, and classification test items. A significant disordinal interaction is necessary to support the hypothesis.

Experiment II

Experiment II was designed to test Hypotheses 2 and 3, which stated that a significant increment in performance will occur with the use of a mnemonic and several-page distributed practice, respectively. These hypotheses were tested using a 2 x 2 design, where one dimension is a mnemonic (Treatments 1 and 2) vs. no mnemonic (Treatments 3 and 4), and the other is several-page distributed practice (Treatments 1 and 3) vs. one-page massed practice (Treatments 2 and 4). Significant main effects on the labeling and listing test items are needed to support these hypotheses.

Experiment III

Experiment III was designed to test Hypotheses 4, 5, and 6, which stated that a significant increment in performance will occur with the use of isolated definitions, divergent examples, and attribute isolation elaboration, respectively. These hypotheses were tested using a 2 x 2 x 2 design with the following dimensions:

1. Isolated definitions (Treatments 5 through 8) vs. embedded definitions (Treatments 9 through 12).

2. Divergent examples (Treatments 5, 7, 9, and 12) vs. convergent examples (Treatments 6, 8, 10, and 12).

3. Attribute isolation elaboration (Treatments 5, 6, 9, and 10) vs. no attribute isolation elaboration (Treatments 7, 8, 11, and 12).

RESULTS

Experiment I

Table 3 presents the means and standard deviations for each of the dimensions in the design used to test Hypothesis 1, which stated that performance will decrease when test items and presentation strategies are not consistent. A test of the differences between all means indicated a significant interaction between the main effects: $F(2714) = 60.68$, $p < .01$.

Table 3

Means and Standard Deviations for Dimensions Used to Test the Consistency Hypothesis

		Treatment Type	
Item Type	Statistic	Use Level	Remember Level
Classification	$\bar{X}$	.748	.582
	S.D.	.014	.019
Labeling	$\bar{X}$	.695	.878
	S.D.	.014	.019
Listing	$\bar{X}$	.555	.668
	S.D.	.014	.019

Figure 3, which illustrates the results of a Tukey's HSD (for Honestly Significant Difference) test, shows that (1) the students in the use level treatment groups performed significantly better on the classification items than those in the remember level treatment groups, and (2) the students in the remember level treatment groups performed significantly better on the labeling and listing items than those in the use level treatment groups. The performance of both groups was significantly lower on the listing items than on the labeling items. Thus, the assumption that test items and instructional materials must be consistent was confirmed.

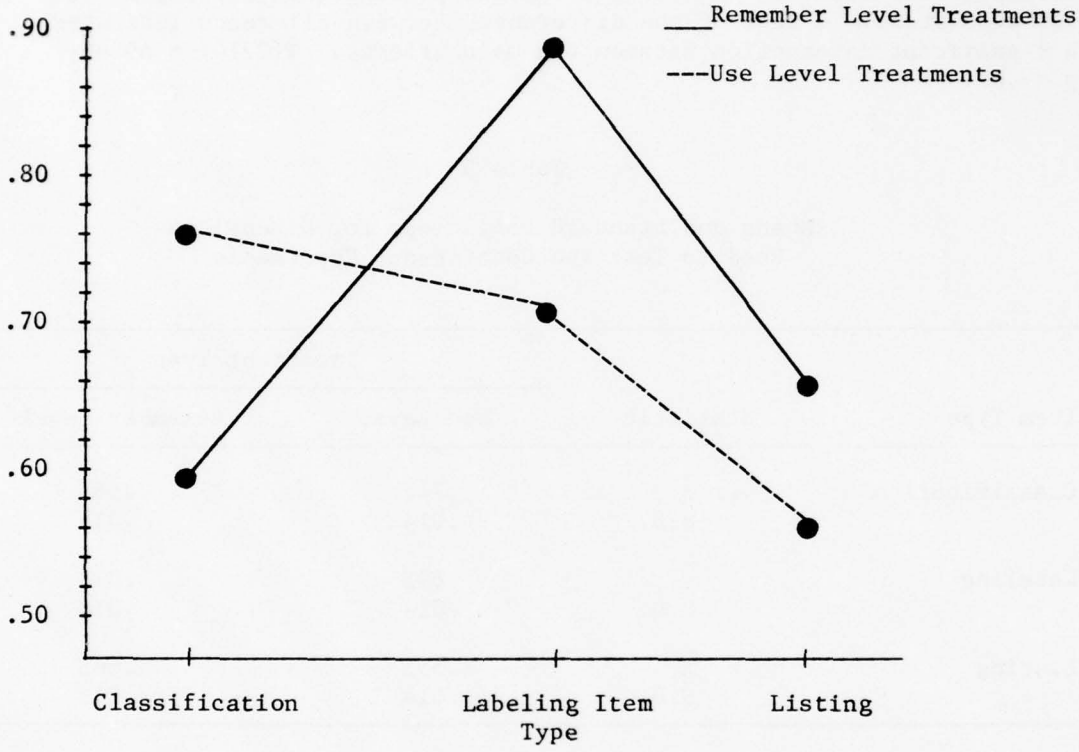


Figure 3. Two-way interaction supporting the consistency hypothesis.

Experiment II

The results of Experiment II, which tested the mnemonic and practice hypotheses (Nos. 2 and 3, respectively), are presented in Table 4. For the mnemonic vs. no mnemonic conditions (Hypothesis 2), there were (1) no significant differences for labeling test items and (2) a marginally significant difference for listing test items (this difference was judged to be marginal because of the number of univariate comparisons made). Although Hypothesis 2 only applies to the consistent remember level test items, the inconsistent classification test items were also analyzed since the data was available. The findings for these analyses were (1) no significant differences for Part A test items and (2) superior performance for subjects in the mnemonic groups for Part B test items.

Hypothesis 2 also predicted increased learning and performance efficiency. Table 5 shows the mean completion times for the instructional and test materials for the mnemonic vs. no mnemonic treatments. None of the differences were judged to be significant.

In the practice conditions (Hypothesis 3), there were no significant differences on any of the test item types. However, the time data show that learning time for the partial practice group was significantly longer than for the one-paged massed group. There were no significant differences in time on the test.

Finally, there were no significant interactions for any of the dependent variables.

Table 4

Main Effects of Mnemonic and Practice on Student Performance

Technique	Mean[a]	df	F-Ratio	P
Labeling Test Items (Part A)				
Mnemonic	.893	1,76	1.48	.228
No Mnemonic	.863			
Distributed Practice	.888	1,76	.66	.421
Massed Practice	.868			
Listing Test Items (Part B)				
Mnemonic	.726	1,76	4.76	.032
No Mnemonic	.610			
Distributed Practice	.655	1,76	.23	.632
Massed Practice	.681			
Classification Test Items				
Part A				
Mnemonic	.685	1,76	1.90	.172
No Mnemonic	.635			
Distributed Practice	.663	1,76	.02	.891
Massed Practice	.658			
Part B				
Mnemonic	.493	1,76	8.11	.006
No Mnemonic	.360			
Distributed Practice	.435	1,76	.14	.708
Massed Practice	.418			

Note: Interaction between main effects was not significant.

[a]Proportion correct on subtest type.

Table 5

Main Effects of Mnemonic and Practice on Completion Times

Technique	Mean[a]	df	F-Ratio	P
Instructional Materials (Remember Level Treatments 1-4)				
Mnemonic	48.85	1,76	.006	.935
No Mnemonic	49.30			
Distributed Practice	58.23	1,76	10.95	.001
Massed Practice	39.93			
Testing Materials				
Part A				
Mnemonic	27.13	1,76	.170	.682
No Mnemonic	28.93			
Distributed Practice	27.00	1,76	.220	.641
Massed Practice	29.05			
Part B				
Mnemonic	23.25	1,76	.040	.845
No Mnemonic	22.45			
Distributed Practice	24.48	1,76	.640	.428
Massed Practice	21.23			

Note: Interaction between the main effects was not significant.

[a]Mean number of minutes required to complete materials.

Experiment III

The results of Experiment III, which tested the definition, example, and elaboration hypotheses (Nos. 4, 5, and 6, respectively), are presented in Table 6. The findings for the isolation conditions (Hypothesis 4) are (1) no significant differences of Part A classification test items and (2) students in the isolated definition treatments scored significantly higher than students in the embedded definition treatment on Part B classification test items. Hypothesis 4 applies only to use level test items and it has already been demonstrated (Experiment 1) that there is a decrement in performance when students who receive a use treatment perform on labeling and listing test items. Nevertheless, since the data is available, it is reported here. Students in the isolated definition treatments scored significantly higher than students in the embedded treatment on the labeling test items. While the difference on the listing test items also favors the isolated treatments, it is judged to be marginal.

Hypothesis 4 also predicted increased efficiency. Table 7 shows the mean completion time on treatments, Part A, and Part B of the test. As shown, the isolated treatments took less time than the embedded groups to learn; however, this difference is of marginal significance. There are no significant differences on test time.

The data for the divergence hypothesis (Hypothesis 5) show that students in the divergent treatments scored significantly higher than those in the convergent treatments on both Part A and Part B classification items. On the inconsistent labeling and listing test items, there are no significant differences between the groups. Table 7 shows the mean completion times for the presentation and the test times. There are no significant differences between groups on the time variable.

For Hypothesis 6, the attribute isolation hypothesis, Table 6 shows that there are no significant differences between groups on either the consistency classification items or the inconsistent labeling and listing test items. Also, as shown in Table 7, there are no significant differences between groups on the time variables for this condition.

Finally, there were no significant interactions for any of the dependent variables.

Table 6

Main Effects of Definition, Example, and Elaboration on Student Performance

Technique	Type	Mean[a]	df	F-Ratio	P
		Labeling Test Items (Part A)			
Definition	Isolated	.733	1,152	9.21	.003
	Embedded	.657			
Example	Divergent	.701	1,152	.21	.647
	Convergent	.690			
Elaboration	Att. Isolation	.719	1,152	3.45	.065
	No. Att. Isol.	.672			
		Listing Test Items (Part B)			
Definition	Isolated	.592	1,152	4.23	.041
	Embedded	.517			
Example	Divergent	.559	1,152	.04	.823
	Convergent	.551			
Elaboration	Att. Isolation	.571	1,152	.86	.356
	No. Att. Isol.	.538			
		Classification Test Items			
Part A					
Definition	Isolated	.805	1,152	3.52	.063
	Embedded	.779			
Example	Divergent	.827	1,152	25.04	.001
	Convergent	.757			
Elaboration	Att. Isol.	.796	1,152	.39	.533
	No. Att. Isol.	.788			
Part B					
Definition	Isolated	.690	1,152	8.68	.004
	Embedded	.629			
Example	Divergent	.693	1,152	10.16	.002
	Convergent	.626			
Elaboration	Att. Isol.	.651	1,152	.61	.436
	No. Att. Isol.	.668			

Note: Interaction among main effects was not significant.

[a]Mean number of minutes required to complete materials.

Table 7

Main Effects of Definition, Example, and Elaboration on Completion Times

Technique	Type	Mean[a]	df	F-Ratio	P
Instructional Materials (Use Level Treatments 5-12)					
Definition	Isolated	49.76	1,152	3.71	.056
	Embedded	57.57			
Example	Divergent	52.20	1,152	.52	.470
	Convergent	55.14			
Elaboration	Att. Isol.	53.76	1,152	.002	.963
	No. Att. Isol.	53.58			
Testing Materials					
Part A					
Definition	Isolated	24.09	1,152	2.34	.128
	Embedded	28.24			
Example	Divergent	24.75	1,152	1.09	.299
	Convergent	27.58			
Elaboration	Att. Isol.	23.74	1,152	3.20	0.76
	No. Att. Isol.	28.59			
Part B					
Definition	Isolated	22.84	1,152	.80	.373
	Embedded	20.26			
Example	Divergent	20.45	1,152	.58	.446
	Convergent	22.65			
Elaboration	Att. Isol.	23.93	1,152	2.72	.101
	No. Att. Isol.	19.18			

Note: Interaction among main effects was not significant.

[a]Mean number of minutes required to complete materials.

DISCUSSION

Experiment I

The results of Experiment I clearly support the consistency prescription advocated by the ISDP: The presentation should be consistent with the type of test items on which the student will be tested for proficiency.

Experiment II

The two presentation adequacy prescriptions of the ISDP for remember level tasks--use of a mnemonic and several-page distributed practice--were not clearly supported by the results of Experiment II. Although use of a mnemonic may have helped the students' performance on the listing test items, none of the other predicted effects was demonstrated. There are several factors that may have contributed to these results. For example, the most complicated pump included in the study had only six major components to label--a number of items that are within the limitations of short-term memory. Hence, several-page distributed practice really would not be expected to contribute to the performance of this particular task. A mnemonic may have a similar function; that is, to help a student to remember a list of items that exceeds the limitations of short-term memory. Since all of the lists were short, neither of these presentation techniques may have had an adequate opportunity to demonstrate its effect.

The significant difference in time required to complete the instructional materials using several-page distributed practice vs. one-page massed practice is not surprising. The distributed practice groups had 117 pages of material to digest, compared to 44 pages for the massed practice groups. One would expect the groups with more pages to digest to take longer. Unfortunately, however, this additional practice does not seem to improve their test performance. It would seem practical to conclude that, when the number of items is within the limitations of short-term memory, a several-page distributed practice technique is actually less efficient and more costly than a single-page massed practice technique, particularly since there seems to be no gain in proficiency.

Experiment III

Two of the three presentation adequacy prescriptions of the ISDP for use level tasks--isolated definition and divergent examples--were supported by the results of Experiment III. It was demonstrated that providing the students with isolated definitions not only improves performance on the consistent classification items but also on the inconsistent labeling and listing test items. Performance on the inconsistent items probably was enhanced because students in this course are memorization-oriented. Thus, when they see an isolated definition, they probably decide that it should be memorized. However, when the definition is embedded within accompanying material, they are not so inclined to memorize it--either because they feel there is too much material or they are not sure what material should be memorized.

Providing isolated definitions also increased efficiency by decreasing the time required to complete the informational materials, although the large within-group variance makes the difference only marginally significant. It seems likely, however, that, over a longer period of time, the cumulative effect of reduced completion time would result in more significant differences.

It was also demonstrated that providing divergent examples clearly facilitates the classification of new examples on the testing materials. However, providing such examples did not contribute to performance on the inconsistent labeling and listing test items. In fact, as demonstrated by the results of Experiment I, providing divergent examples probably has a detrimental effect on the verbatim memory items.

The results of this experiment failed to demonstrate that providing attribute isolation elaboration had a facilitative effect. This may be due to several factors. First, since the representations of the pumps were simple line drawings, most of the complexity that is found in a photograph model or an actual pump may have been eliminated. Hence, the attention-focusing devices used may not have contributed anything that was not already accomplished by the simple drawings used. Second, the representations used were often not examples of other types of pumps; rather, they were "nonexamples"; that is, incomplete examples of the type of pump being taught. The attribute isolation elaboration merely pointed out the missing part, which, in many cases, was already obvious from the drawing.

CONCLUSIONS

Within the limitations imposed by the subject matter of the materials used in this study, results seem to demonstrate that the consistency and adequacy prescriptions advocated by the ISDP do, in fact, contribute to student test performance. Thus, when existing materials are manipulated via the ISDP prescriptions in a real-world setting, predicted outcomes are likely to result.

Further, while the results of this study did not provide 100 percent support for every hypothesis tested, they did provide considerable evidence that the ISDP is indeed a valid instrument for predicting student performance. In cases where hypotheses were not supported, which were explained by unique circumstances of the experimental environment, the ISDP prediction needed to be qualified.

Finally, the ISDP is considered to be a valid instrument for evaluating the effectiveness of existing and newly developed instructional materials. If such materials are revised or developed with the ISDP prescriptions as a guide, there is a much higher probability that students will be able to learn from the resulting instruction.

RECOMMENDATIONS

In view of the findings of this study, it is recommended that:

1. A field test of the ISDP be conducted to gather interrater reliability and usability data.

2. Studies correlating ISDP ratings and student performance be performed to further validate the predictive values of the ISDP.

3. Assuming that the ISDP proves to be a reliable, valid, and usable instrument, implementation be initiated in the Instructional Program Development Centers and other instructional development and evaluation groups.

BIBLIOGRAPHY

Merrill, M. D., Olsen, J. B., & Coldeway, N. A. Research support for the instructional strategy diagnostic profile (Tech. Rep. No. 3). Provo, UT: Courseware, Inc., 1976.

Merrill, M. D., & Wood, N. D. Instructional strategies: A preliminary taxonomy. Columbus, OH: Ohio State University, 1974. (ERIC Document Reproduction Service No. SE 018-771.)

Merrill, M. D., & Wood, N. D. Instructional strategies: A preliminary taxonomy (Rev. ed.) (Tech. Rep. 1R). Provo, UT: Courseware, Inc., 1975a.

Merrill, M. D., & Wood, N. D. Rules for effective instructional strategies. Instructional Design Series. Provo, UT: Courseware, Inc., 1975b.

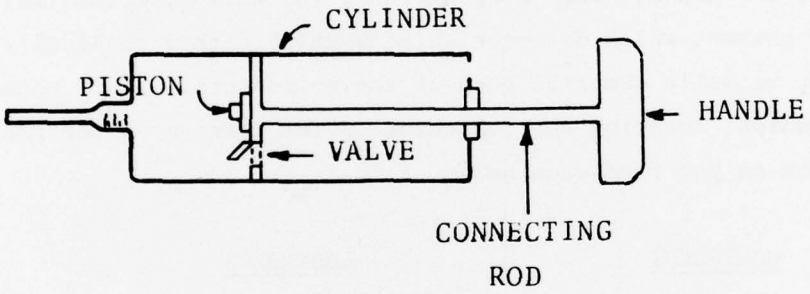
APPENDIX

EXAMPLES OF INSTRUCTIONAL TECHNIQUES PROVIDED IN MATERIALS FOR REMEMBER AND USE LEVEL TREATMENTS

I. EXAMPLES OF INSTRUCTIONAL TECHNIQUES PROVIDED IN MATERIALS FOR REMEMBER LEVEL TREATMENTS.

A. Example of a demonstration--Technique used in Treatments 1-4.

Objective:	Identify, by labeling the component, a basic reciprocating pump used to pump air into a basketball.
Fact Statement:	The major components of a basic reciprocating pump used to pump air into a basketball are highlighted in the diagram below.



Study the name associated with each component as you will be required to label, exactly as it appears in the diagram above, each of the components of the pump. Then proceed to either the Elaboration section below or to the Practice section beginning on page 5.

B. Example of a mnemonic--Technique used in Treatments 1 and 2.

Sometimes it is helpful to relate unfamiliar objects that one is required to remember to familiar objects already stored in memory. Listed below beside each of the component names of a reciprocating pump used to pump air into a basketball, you will find familiar words or phrases which describe objects which either physically resemble or verbally describe each of the components. Study these relationships, locating the component on the diagram on the previous page as you read each one.

COMPONENT	RESEMBLES
Cylinder	Can
Piston	Plunger
Connecting Rod	Rod
Valve	Shutters
Handle	Handle

Find out if this mnemonic has helped by turning the page and attempting to complete the Practice items.

II. EXAMPLES OF INSTRUCTIONAL TECHNIQUES PROVIDED IN MATERIALS FOR USE LEVEL TREATMENTS.

A. Example of isolated definition followed by illustrated elaboration--Technique used in Treatments 5-8.

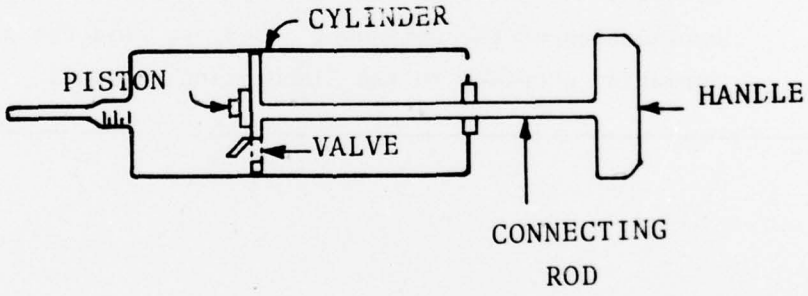
Objective:	Given diagrams of various encountered and unencountered pumps, identify those that are basic reciprocating pumps and those that are not.
Definition:	Basic reciprocating pumps consisted of the following major parts: 1. one piston 2. one connecting rod 3. one cylinder 4. one valve Your task will be to identify new instances of the concept basic reciprocating pump. Study the definition presented above. If you feel that you can identify each of the component concepts of the definition (e.g., cylinder, piston) then proceed to the Example section. If you feel that you need or want an explanation of the component concepts, read the information provided in the Elaboration section.

A. (Continued) Illustrated elaboration following isolated definition.

Elaboration: Basic reciprocating pumps consist of the following major parts:

1. A piston: Shaped like a plunger, it pushes gas (e.g., air) or liquid (e.g., water) out of the cylinder by moving back and forth (or in some cases up and down).
2. A connecting rod: Rod-shaped object which connects piston to (potential) energy source.
3. A cylinder: Provides encasement for piston and gas (e.g., air) or liquid (e.g., water).
4. Valve: Enables gas (e.g., air) to enter and escape from the cylinder.

Presented below is a diagram which illustrates the major parts of basic reciprocating pumps.



B. Example of an embedded definition--Technique used in Treatments 9-12.

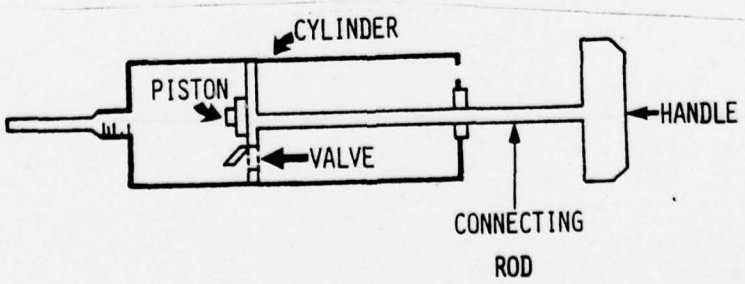
Objective: Given diagrams of various encountered and unencountered pumps, identify those that are basic reciprocating pumps and those that are not.

Pumps provide the force required to move fluids. They do this by establishing, and maintaining, a difference in pressure between the inlet and (discharge) outlet of the pump. Did you know that you carry a pump around with you? All the time? Just like your own heart, the "heart" of most fluid transfer systems is a pump.

Aboard ship, pumps are used to move water, oil, fuel, and air. These fluids and gases are moved by pumps into and out of storage tanks, piping systems, and machinery to move the ship (a weapons platform), make electricity, and keep the crew safe and comfortable. Without its pumps, a steam or diesel-powered ship couldn't even get underway.

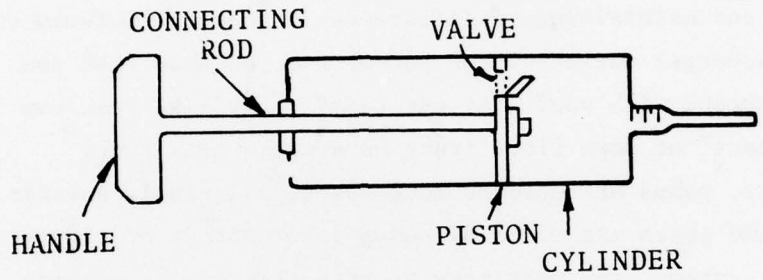
There are many different kinds of pumps. A basic reciprocating pump is a pump which is used to push air into various receptacles such as a basketball or a bicycle tire. This is accomplished by having the connecting rod (which connects the piston to an outside energy source) push the piston (plunger-shaped mechanism) down, forcing air out of the cylinder (which acts as the encasement for the piston and air) and through a valve. The purpose of the valve in a basic reciprocating pump is to enable gas (e.g., air) to enter and escape from the cylinder.

Presented below is a diagram which illustrates the major parts of basic reciprocating pumps.

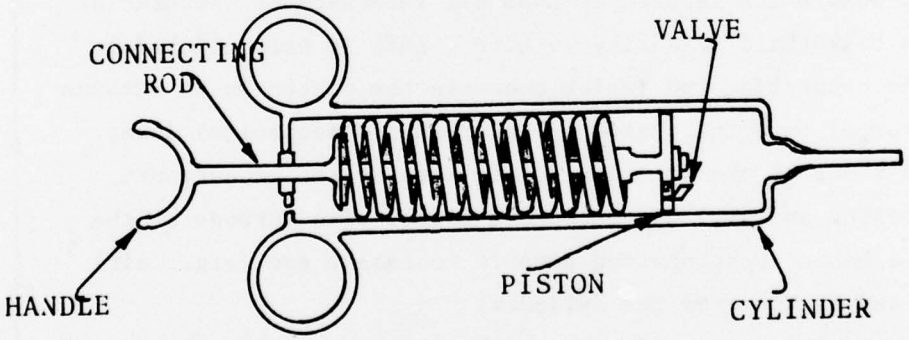


C. Example of divergent example set--Technique used in Treatments 5, 7, 9, and 11.

1. The following <u>is</u> a basic reciprocating pump.

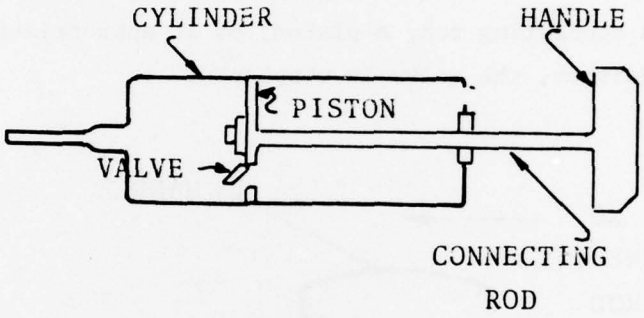


2. The following <u>is</u> a basic reciprocating pump.

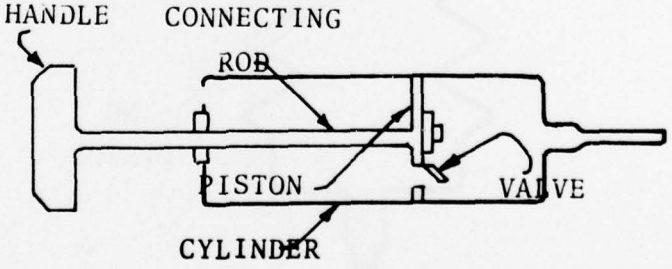


D. Example of convergent example set--Technique used in Treatments 6, 8, 10, and 12.

1. The following <u>is</u> a basic reciprocating pump.



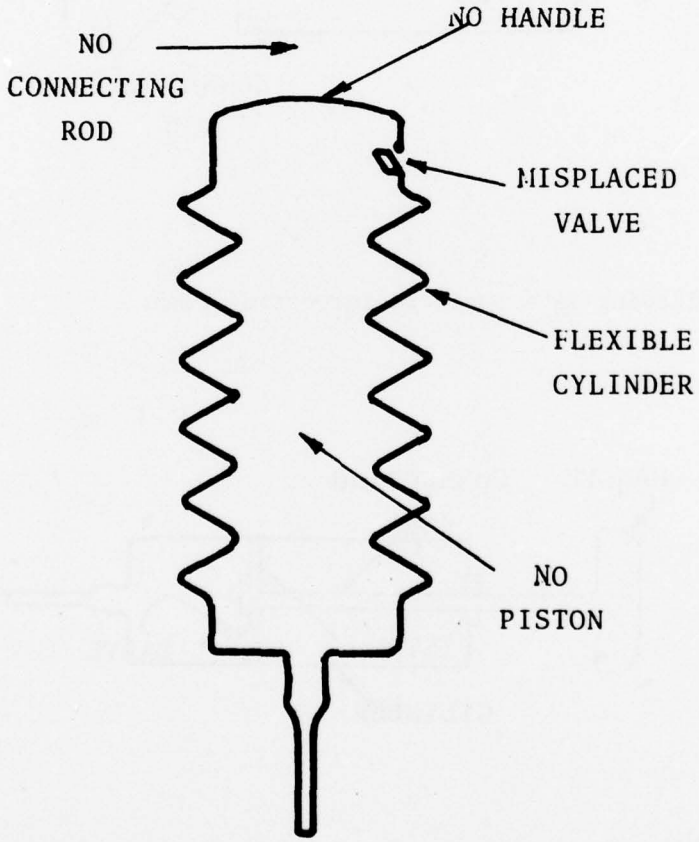
2. The following <u>is</u> a basic reciprocating pump.



E. Example of attribute isolation elaboration--Technique used in Treatments 5, 6, 9, and 10.

CORRECT ANSWER

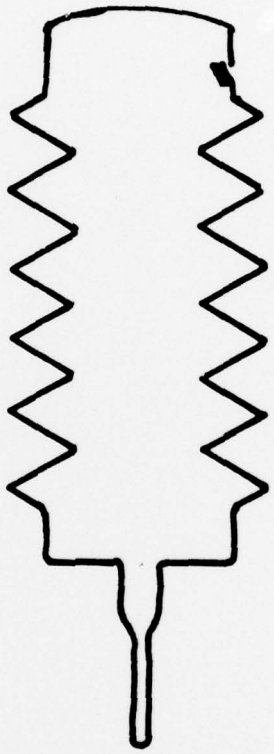
NO this is NOT a basic reciprocating pump because it doesn't have a handle, a connecting rod, a piston, or an appropriate cylinder. In addition, the valve is misplaced.



F. Example of no attribute isolation elaboration--Technique used in Treatments 7, 8, 11, and 12.

CORRECT ANSWER

NO



DISTRIBUTION LIST

Assistant Secretary of the Navy (Manpower, Reserve Affairs and Logistics)
Principal Deputy Assistant Secretary of the Navy (Manpower and Reserve Affairs)
Chief of Naval Operations (OP-987PH), (OP-991B), (OP-914), (OP-964D)
Chief of Naval Personnel (Pers-10c), (Pers-2B)
Commandant of the Marine Corps (MPI-20), (MPI-28)
Chief of Naval Education and Training (N-5) (3), (N-2), (003), (00A)
Chief of Naval Technical Training (Code 015), (Code 016)
Chief of Naval Education and Training Support
Chief of Naval Education and Training Support (01A), (N-5)
Chief of Naval Research (Code 450) (4)
Chief of Information (OI-2252)
Director of Navy Laboratories
Commander Training Command, U. S. Atlantic Fleet (Code N3A)
Commander, Naval Data Automation Command
Commanding Officer, Fleet Combat Training Center, Pacific (Code 00E)
Commanding Officer, Naval Education and Training Program Development Center
Commanding Officer, Naval Development and Training Center (Code 0120)
Commanding Officer, Naval Aerospace Medical Institute (Library Code 12) (2)
Commanding Officer, Fleet Training Center, San Diego
Commanding Officer, Naval Damage Control Training Center
Commanding Officer, Naval Education and Training Support Center, Pacific (Code N1B)
Commanding Officer, Naval Training Equipment Center (Technical Library)
Officer in Charge, Naval Education and Training Information Systems Activity, Memphis Detachment
Director, Training Analysis and Evaluation Group (TAEG)
Director, Defense Activity for Non-Traditional Education Support
Director for Acquisition Planning OASD (MRA&L)
Occupational and Manpower Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Personnel Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Technical Library, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base
Technical Training Division, Air Force Human Resources Laboratory, Lowry Air Force Base
Flying Training Division, Air Force Human Resources Laboratory, Williams Air Force Base
Defense Documentation Center (12)