A Comparison of the Implications of Educational Set and Subsumption for Sequencing of Receptive Instructional Materials.

Claudia Elisabeth Mcdde  

*Louisiana State University and Agricultural & Mechanical College*

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation

https://digitalcommons.lsu.edu/gradschool_disstheses/2680

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
INFORMATION TO USERS

This material was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or “target” for pages apparently lacking from the document photographed is “Missing Page(s)”. If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in “sectioning” the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value; however, a somewhat higher quality reproduction could be made from “photographs” if essential to the understanding of the dissertation. Silver prints of “photographs” may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

5. PLEASE NOTE: Some pages may have indistinct print. Filmed as received.

Xerox University Microfilms
300 North Zeib Road
Ann Arbor, Michigan 48106
McDADE, Claudia Elisabeth, 1948-
A COMPARISON OF THE IMPLICATIONS OF
EDUCATIONAL SET AND SUBSUMPTION FOR SEQUENCING
OF RECEPITIVE INSTRUCTIONAL MATERIALS.

The Louisiana State University and Agricultural
and Mechanical College, Ph.D., 1974
Psychology, general

Xerox University Microfilms, Ann Arbor, Michigan 48106

THIS DISSERTATION HAS BEEN MICROFILMED EXACTLY AS RECEIVED.
A COMPARISON OF THE IMPLICATIONS OF EDUCATIONAL SET AND SUBSUMPTION FOR SEQUENCING OF RECEPTIVE INSTRUCTIONAL MATERIALS

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy in

The Department of Psychology

by

Claudia McDade
B.A., Louisiana State University, 1970
M.A., Louisiana State University, 1972
August, 1974
ACKNOWLEDGMENTS

The author wishes to express her sincerest appreciation to Dr. Laurence Siegel, Committee Chairman, whose original research stimulated her thinking and whose continued enthusiasm and guidance aided her designing and executing this study. The writer is very grateful to Drs. Robert Coon, James Finnberg, Nathan Gottfried, David Yang, and A. G. Young for their time and services as committee members and faithful critics.

The author is indebted to Mr. Jerome Schmidt, Mrs. Marjory Waldrop, and Ms. Sydney Parker who served as instructors in the study and to Mr. Don Callaway, Ms. Mickey Stevens, Mr. Ralph McDade, Sr., and Ms. Ann Meehan who served as proctors. The researcher would also like to thank Dr. Kenneth L. Koonce for his statistical assistance in designing this study.

A special note of thanks goes to the many friends and the family of the author who helped her suffer through the design, execution, and composition of this dissertation. Only through their persistent and faithful support was this study ever completed.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>TITLE</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>11</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>METHOD</td>
<td>10</td>
</tr>
<tr>
<td>RESULTS</td>
<td>15</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>20</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>23</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>24</td>
</tr>
<tr>
<td>VITA</td>
<td>138</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Division of ESS Scores</td>
<td>11</td>
</tr>
<tr>
<td>2. Analysis of Covariance for Test 1</td>
<td>16</td>
</tr>
<tr>
<td>3. Analysis of Covariance for Test 2</td>
<td>17</td>
</tr>
<tr>
<td>4. Analysis of Covariance for Test 3</td>
<td>18</td>
</tr>
<tr>
<td>5. Analysis of Covariance for Test 4</td>
<td>19</td>
</tr>
</tbody>
</table>
ABSTRACT

The purpose of this study was to consider sequencing of receptive lecture materials at the college level, so as to enhance student learning and retention. Ausubel's theory of school learning emphasizes sequencing material according to the principle of subsumption, from the most general concepts to the most specific details. Siegel and Siegel's construct of educational set, an academic cognitive style, suggests that students predisposed to learn concepts and theories (those who are "conceptually set") would learn and retain more material if taught from the most general to the most specific; likewise, students predisposed to learn facts (those who are "factually set") should learn and retain more information if taught from the most specific to the most general.

University undergraduates enrolled in educational psychology were taught in alternating sequences by four instructors on four separate occasions. Sequence A consisted of a conceptually oriented lecture followed by a factually oriented self-study; Sequence B, factual self-study followed by a conceptual lecture. An objective examination covering the material followed each session. Every student was taught in each sequence twice, so that four exam scores were obtained.

The subsumption principle predicts superior performance by students in Sequence A with no interaction apparent between instructional sequence and educational set. In contrast, the educational set literature predicts an interaction between sequence and set such that
conceptually set students would perform better when they were in Sequence A and factually set students, in Sequence B. Results were closer to the predictions derived from the educational set position than from the subsumption position.
INTRODUCTION

Review of Relevant Literature

A current issue within the field of applied human learning concerns the proper sequencing of educational materials for optimal student learning and retention. With the trend towards individualised instruction, many academic subjects at all levels of the educational system are being taught with highly structured materials. In most instances, these materials are devised on the basis of internal logic of the subject-matter. Little concern is given to the psychological organisation of the information.

Does there exist a proper sequencing of instructional materials that parallels learning and knowledge organisation functions of the human nervous system? Conflicting notions are suggested by two lines of evidence.

According to David Ausubel's cognitive-structure theory of school learning (1963, 1967, 1968), the most psychologically efficient teaching strategy is the presentation of subject-matter in a hierarchical sequence from general, inclusive concepts to specific details and illustrations. This implication follows from subsumption, the presumed nervous system process of knowledge organisation. New information is related to (i.e., subsumed under) an existing cognitive category or concept.

Thus, according to Ausubel, meaningful verbal learning occurs when potentially meaningful material is related to the individual's existing knowledge in a substantive, non-arbitrary way. Material is potentially meaningful if it can be converted into symbols and absorbed into an individual's cognitive structures. In contrast,
rote material can be related to one’s cognitions only in an arbitrary manner.

Ausubel suggests that meaningful verbal learning is more characteristic of classroom learning than is rote verbal learning, although much confounding of the two exists. Meaningful materials are often taught and their retention evaluated as if they were rote in character. Without presentation in a subsumptive hierarchy, potentially meaningful material hardly can be attached to the learner's existing cognitive structures and their potential meaning translated into idiosyncratic meaning for the individual.

Ausubel's theory leads to several implications for effective instruction in terms of increased student comprehension and retention. In any academic discipline, the unifying concepts with the greatest explanatory power, inclusiveness, and generalizability should be presented to the students. In order for the discipline's concepts to be understood and retained, both derivative and correlative subsumption should be enhanced. Derivative subsumption refers to relating examples to the existing concept; it can be stimulated by the use of relevant analogies and concrete, empirical data. Correlative subsumption is the clarification, extension, or elaboration of an accepted concept. By using adequate definitions which confer precise meaning in non-technical language and by encouraging reformulation of the concept into other terms, correlative subsumption can be strengthened.

An academic discipline can be taught more effectively if the sequence of subject-matter presentation and the construction of the subject's internal logic are controlled. In determining the order
of presentation of academic material, the cognitive maturity of both the student and the subject area must be considered. A student's cognitive maturity is related to his intellectual maturity. As he develops his thinking, the learner proceeds from the concrete to the abstract. If pressured to understand the abstract when he is still functioning in the concrete, the student will fail to grasp the material. Cognitive maturity of content refers to the concrete-abstract dimension of the material. The student should study material with the level of concreteness-abstractness associated with his cognitive development on that dimension. For example, students typically study biology before physics; this is a successful progression because the logically simple laws of the physical sciences are psychologically more abstract, while the logically complex laws of the biological sciences resemble more closely concrete, empirical experience.

By manipulating antecedent learning experiences, subsequent learning can be maximally facilitated. If material is introduced through organizers, proactive facilitation is enhanced and proactive inhibition, reduced (Ausubel & Fitzgerald, 1961; Ausubel, Stager, & Gaite, 1968). Advance organizers, introductory material with a high level of abstractness, generality, and inclusiveness, provide ideational scaffolding when new information is totally unfamiliar to the student. They also discriminate new information from similar, conflicting, established concepts by providing optimal anchorage at optimal inclusiveness. From an overview of the two concepts, an advanced set can be stimulated in the learner, so he will perceive similarities and differences between the new and old material.
Through the use of a hierarchical series of organisers in descending order of inclusiveness, the instructor can aid student comprehension and retention.

Another implication for instruction provided by Ausubel's theory involves the utility of repetition. Initial contact with new information sensitizes the learner to its meanings when he encounters them again. Not only does the student recognize the second time what he missed the first, he is able to further differentiate repeated material from other concepts.

Implications for optimal sequencing of subject-matter to enhance educational outcomes can also be derived from the concept of educational set (Siegel & Siegel, 1965, 1966, 1967). This construct refers to the cognitive style with which a learner approaches new instructional material based on his past encounters with such material. Educational set is defined by a continuum from a preference to learn factually oriented material to a preference to learn conceptually oriented material. A factually set learner would prefer to learn factual content for its own sake without any strong desire to interrelate the facts into a more complex cognitive framework. A conceptually set learner accepts factual content only as elements to be interrelated or subsumed into a broader contextual whole. He would rather learn principles, concepts, theories, and relationships.

Educational set is measured by a forced-choice, objectively scored group inventory, the Educational Set Scale (ESS). An example of the triads into which the ESS is divided follows:
Items 70—72. Assume you are enrolled in a natural science course and must learn about the following. Which will interest you most? Which least? In which do you have intermediate interest?

<table>
<thead>
<tr>
<th>Score</th>
<th>Most</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>70.</td>
<td>71.</td>
</tr>
<tr>
<td>0</td>
<td>71.</td>
<td>72.</td>
</tr>
<tr>
<td>+1</td>
<td>72.</td>
<td>70.</td>
</tr>
</tbody>
</table>

70. The names of the elements in the "halide" group.
71. Statement of Newton's Third Law of Motion.
72. The significance of a pH of 6.

Research with educational set has shown that it appears to be relatively independent of the cognitive functions assessed by the ACT (r = .22); Guilford's Consequences (Remote: r = .09; Obvious: r = -.09), Alternate Uses (r = .01), Pertinent Questions (r = .05), and Cattell "g" score (r = .32) (Siegel & Siegel, 1965; Stidham, 1967).

It has also been demonstrated that conceptually set learners are more likely than factually set ones to learn both factual and conceptual material. Although students tend to attempt learning according to teacher expectations, the Siegels found that conceptually set learners are adversely affected in their acquisition when factually oriented material is emphasized by the instructor. Factually set learners are also adversely affected by emphasis on conceptual content.

In an extrinsically oriented setting, the student will look toward the instructor for indications of desired subject-matter acquisition. The learner will perform best when he perceives the instructor's course objectives as corresponding with his educational set. Without any indications from the instructor, the student will learn as his educational set directs him.

The construct of educational set reveals implications for sequencing of subject-matter presentation that vary from those of
Ausubel's theory. The subsumption principle ought to facilitate learning and retention for conceptually set learners, but not for factually set ones. From the educational set literature, it follows that a deductive sequence of presentation would benefit the conceptually set learner, but it would hinder the factually set one. Most efficient learning should occur for the factually set learner if he is presented material in an inductive, hierarchical arrangement from specifics to principles and concepts.

The Problem

The conflict between the constructs of educational set and subsumption was investigated in a classroom situation by varying the sequence of subject-matter presentation and measuring student retention in terms of pre-established educational objectives. One group of students received a conceptually oriented lecture, based on the principles of Ausubel's theory of school learning, followed by a factually oriented self-study. These students were taught in a sequence from inclusive, general concepts toward specific details in accordance with the principle of subsumption. A second group of students participated in a factual self-study, followed by a conceptually oriented lecture, so that they received a sequence from specific details toward more general concepts.

The lecture format was used for the conceptual, integrative function of each sequence because it was considered a more appropriate mode for such a function. The presentation of factural material was judged more appropriate to the self-study format.
Although the subject-matter was largely identical, regardless of the sequence of presentation, the varying orientations necessitated different procedures and objectives for each sequence. An outline of the principles that regulated each sequence follows. A committee of judges (n = three faculty members and the experimenter) evaluated the application of these principles to the sequence outlines for each topic before each was presented to the students.

Criteria for Conceptual Lecture: Sequence A

I. Advance Organizer

A. Appropriate introductory material at a high level of abstraction, generality, inclusiveness

B. Purposes of advance organizers

1. to provide ideational anchorage or scaffolding for completely unfamiliar material
2. to provide optimal anchorage at optimal level of inclusiveness
3. to increase discriminability of information from analogous and conflicting ideas when material is a variant of older, related concepts
4. to provide the learner with a generalized overview of major similarities and differences between two bodies of ideas before he encounters new concepts individually in more detailed form
   a. to create an advance set in the learner to perceive the similarities and differences of new and old material
   b. to encourage the learner to make his own differentiations in terms of his own particular source of confusion

C. Use of organizers in lecture

1. begin with most general organizer
2. supplement each lecture with a hierarchical series of organizers in descending order of inclusiveness
II. Subject-matter Presentation
   A. Sequential presentation
      1. begin with concepts, propositions, principles with the
         widest explanatory power, inclusiveness, generality,
         integrative power
      2. work toward instances, examples, illustrations, empirical
         evidence
   B. Definitions
      1. present a definition of each new key word as it is discussed
   C. Self-study
      1. mention use of self-study cases as illustrative of
         principles involved

Criteria for Factual Self-Study: Sequence A

I. Subject-matter Presentation
   Sequence presentation of summaries from most conceptual, general
   to most factual, detailed.

II. Questions to Accompany Self-Study
   Sequence questions from the most conceptual requiring answers
   not directly given in the self-study to the most factual
   requiring comprehension and knowledge of the material as it is
   presented.

Criteria for Conceptual Lecture: Sequence B

I. Subject-matter Presentation
   A. Incremental presentation
      1. begin with individual studies, examples, illustrations
         a. use as many separate examples as possible
      2. work toward generalisations, principles, concepts,
         propositions
         a. use logical, inductive order
   B. Use of separate topics
      1. compartmentalise particular ideas or topics within lecture
2. segregate topically homogeneous materials without reference to other topics in lecture
3. fully explain each topic or idea independently from others in lecture
C. Definitions
1. define all new key words at the beginning of lecture
D. Summary
1. presentation of principles, concepts, propositions that follow inductively from the specifics recently presented
2. integration of previous information into principles, concepts
3. rely on repetition, condensation, selective emphasis on central concepts of lecture and self-study

Criteria for Factual Self-Study: Sequence B

I. Subject-matter Presentation
Sequence presentation of summaries from the most factual, detailed to the most general, conceptual.

II. Questions to Accompany Self-Study
Sequence questions from factual requiring comprehension and knowledge of the material as it is presented to conceptual requiring answers not directly given in the self-study.
METHOD

Subjects

Students in Psychology 56 (Educational Psychology), a three hour night class taught at Louisiana State University in the Spring semester, 1973-74 served as subjects. When the study began, 90 students were enrolled in the course.

Initially, sex, ACT, and ESS scores were recorded for each student. Presumably, the ACT score provides a measure of ability; the ESS, a measure of cognitive style. A distribution of students according to their educational sets was constructed; it was trichotomized by arbitrarily designating subjects scoring within the lower and upper thirds of the ESS distribution as "factually" and "conceptually" set, respectively. Table 1 presents descriptive statistics for the ESS distribution.

Procedure

All students were divided randomly into two instructional sections with the restriction that each contained approximately equal numbers of factually and conceptually set male and female students. Within each section, then, the critical subjects fell into four groups:

<table>
<thead>
<tr>
<th></th>
<th>Section I</th>
<th>Section II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual</td>
<td>M F</td>
<td>M F</td>
</tr>
<tr>
<td>Conceptual</td>
<td>4 8</td>
<td>4 10</td>
</tr>
<tr>
<td></td>
<td>n = 4 8</td>
<td>n = 5 9</td>
</tr>
</tbody>
</table>

A night class is composed of a heterogeneous population with a higher population of older students than is typical in undergraduate student bodies. Since Ausubel's theory and the educational set
<table>
<thead>
<tr>
<th></th>
<th>Conceptually set</th>
<th>Factually set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>+42...+16</td>
<td>+2...-17</td>
</tr>
<tr>
<td>Mean</td>
<td>+24.11</td>
<td>-5.46</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>7.18</td>
<td>4.86</td>
</tr>
<tr>
<td>$n_{males}$</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>$n_{females}$</td>
<td>19</td>
<td>17</td>
</tr>
</tbody>
</table>
literature were established with adolescents, there exists no evidence as to whether their conclusions hold for older adults. Thus, no subject over thirty years of age was included in the pool of critical subjects.

Random assignment to sections assumes relative equalization of such variables as motivation, prior knowledge of subject-matter, prior performance, etc., which conceivably could affect classroom learning and retention. I.D. numbers were used in assigning students to instructional sections; the students were informed that they were participating in dissertation research.

The two instructional sections were created in order to permit implementation of alternative instructional sequences, hereafter designated Sequence A and Sequence B. Sequence A consisted of a conceptually oriented lecture followed by a factually oriented self-study, while Sequence B consisted of a factual self-study followed by a conceptual lecture. The same instructor delivered both lectures, which covered largely identical subject-matter; the sequence of presentation of information, as previously outlined, differentiated the two lectures.

A proctor assisted in the self-study session. Again, the material was identical between sequences, composed primarily of summaries of research evidence supporting points made in the lecture. Summaries were studied in an order corresponding to their appearance in the accompanying lecture. Sets of questions following each summary further differentiated the two self-study sessions, as previously outlined.
Each half of the sequence took approximately seventy minutes; the remainder of the period was used to test students for subject-matter retention. One examination administered to both sections provided data to determine if one sequence was more effective in fostering overall performance. Each dependent measure consisted of twenty multiple-choice questions, approximately half of which were judged by a committee (n = three faculty members and the experimenter) to be "factual" in content. These questions tested information directly given by the lecture or self-study. The remaining exam questions were judged to be "conceptual" in content, covering material not directly stated in the lecture or the self-study.

It was necessary to take the dependent measure immediately after the manipulation, rather than the following week, to eliminate potentially contaminating effects of study habits, note exchanges among students, etc. Students were told that the dependent measure contributed to their final grade in Psychology 56.

The procedure was implemented on four separate nights in a design diagrammed below:

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
<th>Section</th>
<th>Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher Characteristics</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>Creativity</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>Theories of Learning</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Applied to the Classroom</td>
<td>II</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>Discovery Learning</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II</td>
<td>A</td>
</tr>
</tbody>
</table>

In this manner four separate dependent measures were taken; this design allowed the last two sessions to act as a replication for the
first two. Four separate graduate students lectured for each of the four
sessions. The topics chosen represented a broad range of difficulty
from material easily related to students' existing cognitive categories
in the session on teacher characteristics to material less easily
subsumed into existing structures in the sessions on learning.

Statistical procedure

Analyses of covariance were performed for each dependent variable
with sex, sequence, educational set as independent variables and ACT
as a covariate. All analyses of covariance performed used a least
squares approach, since unequal numbers of subjects filled each cell.
Four such analyses, one for each dependent variable score, were
required to analyze results from the four instructional sessions.
RESULTS

Descriptive statistics for Tests 1—4 are as follows:

<table>
<thead>
<tr>
<th>Session/Test</th>
<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
<td>66.34</td>
<td>9.51</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>53.13</td>
<td>10.27</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>70.66</td>
<td>9.67</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>66.52</td>
<td>15.69</td>
</tr>
</tbody>
</table>

The analyses of variance summaries and subgroup means for each of the four sessions are presented in Tables 1—4. For Session 1 the interaction between sequence and educational set was significant beyond the .001 level. The source table and corresponding means for Test 1 shown in Table 1 indicate that conceptual subjects showed superior performance in Sequence A and factual subjects, in Sequence B.

Session 2 data reveal a significant main effect for sequence ($p < .05$) and a significant interaction between sequence and educational set ($p < .05$). It is clear that the significant main effect reflects the performance of conceptually set students but not that of factually set students.

Analysis of Session 3 responses found no significant main effects, but a highly significant interaction between educational set and sex ($p < .001$). Here factual females outperformed conceptual females, while conceptual males outperformed factual males.

Although no significant main effects or interactions were evident in Session 4 data, the source table and means in Table 4 are consistent with the directions indicated in Sessions 1 and 2.
### TABLE 2

**ANALYSIS OF COVARIANCE FOR TEST 1**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>prob., F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>1</td>
<td>2.03</td>
<td>2.03</td>
<td>2.24</td>
<td>0.144</td>
</tr>
<tr>
<td>ESS</td>
<td>1</td>
<td>1.86</td>
<td>1.86</td>
<td>2.05</td>
<td>0.161</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>2.29</td>
<td>2.29</td>
<td>2.54</td>
<td>0.121</td>
</tr>
<tr>
<td>ACT (Covariate)</td>
<td>1</td>
<td>3.69</td>
<td>3.69</td>
<td>4.08</td>
<td>0.052</td>
</tr>
<tr>
<td>Seq * ESS</td>
<td>1</td>
<td>12.67</td>
<td>12.67</td>
<td>14.01</td>
<td>0.0007**</td>
</tr>
<tr>
<td>Seq * Sex</td>
<td>1</td>
<td>0.37</td>
<td>0.37</td>
<td>0.41</td>
<td>0.529</td>
</tr>
<tr>
<td>ESS * Sex</td>
<td>1</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
<td>0.794</td>
</tr>
<tr>
<td>Seq * ESS * Sex</td>
<td>1</td>
<td>0.09</td>
<td>0.09</td>
<td>0.10</td>
<td>0.752</td>
</tr>
<tr>
<td>Error</td>
<td>32</td>
<td>28.95</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Seq</th>
<th>ESS</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>C</td>
<td>71.34</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>F</td>
<td>54.44</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>C</td>
<td>64.32</td>
</tr>
<tr>
<td>10</td>
<td>B</td>
<td>F</td>
<td>71.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Seq</th>
<th>Sex</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>A</td>
<td></td>
<td>62.89</td>
</tr>
<tr>
<td>19</td>
<td>B</td>
<td></td>
<td>67.72</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>F</td>
<td>69.22</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>M</td>
<td>66.23</td>
</tr>
</tbody>
</table>
### TABLE 3

ANALYSIS OF COVARIANCE FOR TEST 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>prob., F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td></td>
<td>5.30</td>
<td>5.30</td>
<td>5.02</td>
<td>0.032*</td>
</tr>
<tr>
<td>ESS</td>
<td></td>
<td>1.43</td>
<td>1.43</td>
<td>1.36</td>
<td>0.253</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td>0.38</td>
<td>0.38</td>
<td>0.36</td>
<td>0.555</td>
</tr>
<tr>
<td>ACT (Covariate)</td>
<td></td>
<td>3.97</td>
<td>3.97</td>
<td>3.77</td>
<td>0.061</td>
</tr>
<tr>
<td>Seq * ESS</td>
<td></td>
<td>4.82</td>
<td>4.82</td>
<td>4.57</td>
<td>0.041*</td>
</tr>
<tr>
<td>Seq * Sex</td>
<td></td>
<td>1.79</td>
<td>1.79</td>
<td>1.70</td>
<td>0.202</td>
</tr>
<tr>
<td>ESS * Sex</td>
<td></td>
<td>1.13</td>
<td>1.13</td>
<td>1.07</td>
<td>0.308</td>
</tr>
<tr>
<td>Seq * ESS * Sex</td>
<td></td>
<td>0.13</td>
<td>0.13</td>
<td>0.12</td>
<td>0.727</td>
</tr>
<tr>
<td>Error</td>
<td>31</td>
<td>32.69</td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Means

<table>
<thead>
<tr>
<th>Seq * ESS</th>
<th>Seq</th>
<th>% correct</th>
<th>Seq</th>
<th>% correct</th>
<th>Seq * Sex</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Seq</td>
<td>ESS</td>
<td>% correct</td>
<td>N</td>
<td>Seq</td>
<td>% correct</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>C</td>
<td>58.05</td>
<td>20</td>
<td>A</td>
<td>56.62</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>F</td>
<td>55.18</td>
<td>20</td>
<td>B</td>
<td>48.91</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>C</td>
<td>43.07</td>
<td>13</td>
<td>B</td>
<td>F</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>F</td>
<td>54.74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 4

**ANALYSIS OF COVARIANCE FOR TEST 3**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>prob.* F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>1</td>
<td>1.91</td>
<td>1.91</td>
<td>2.05</td>
<td>0.163</td>
</tr>
<tr>
<td>ESS</td>
<td>1</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>0.845</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>0.14</td>
<td>0.14</td>
<td>0.15</td>
<td>0.703</td>
</tr>
<tr>
<td>ACT (Covariate)</td>
<td>1</td>
<td>1.11</td>
<td>1.11</td>
<td>1.19</td>
<td>0.285</td>
</tr>
<tr>
<td>Seq * ESS</td>
<td>1</td>
<td>1.61</td>
<td>1.61</td>
<td>1.72</td>
<td>0.199</td>
</tr>
<tr>
<td>Seq * Sex</td>
<td>1</td>
<td>2.75</td>
<td>2.75</td>
<td>2.95</td>
<td>0.097</td>
</tr>
<tr>
<td>ESS * Sex</td>
<td>1</td>
<td>10.84</td>
<td>10.84</td>
<td>11.60</td>
<td>0.002*</td>
</tr>
<tr>
<td>Seq * ESS * Sex</td>
<td>1</td>
<td>0.98</td>
<td>0.98</td>
<td>1.05</td>
<td>0.314</td>
</tr>
<tr>
<td>Error</td>
<td>29</td>
<td>27.01</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Means**

<table>
<thead>
<tr>
<th>Seq * ESS</th>
<th>Seq</th>
<th>ESS * Sex</th>
<th>% correct</th>
<th>N</th>
<th>Seq</th>
<th>% correct</th>
<th>ESS</th>
<th>Sex</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>A</td>
<td>C</td>
<td>70.77</td>
<td>18</td>
<td>A</td>
<td>67.82</td>
<td>C</td>
<td>F</td>
<td>63.73</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>F</td>
<td>64.87</td>
<td>20</td>
<td>B</td>
<td>73.38</td>
<td>C</td>
<td>F</td>
<td>78.30</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>C</td>
<td>71.27</td>
<td>10</td>
<td>F</td>
<td>75.99</td>
<td>C</td>
<td>F</td>
<td>78.30</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>F</td>
<td>75.50</td>
<td>7</td>
<td>F</td>
<td>64.38</td>
<td>C</td>
<td>F</td>
<td>78.30</td>
</tr>
</tbody>
</table>
## TABLE 5

**ANALYSIS OF COVARIANCE FOR TEST 4**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>prob., F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>1</td>
<td>2.46</td>
<td>2.46</td>
<td>0.99</td>
<td>0.327</td>
</tr>
<tr>
<td>ESS</td>
<td>1</td>
<td>0.76</td>
<td>0.76</td>
<td>0.31</td>
<td>0.585</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.64</td>
<td>1.64</td>
<td>0.66</td>
<td>0.423</td>
</tr>
<tr>
<td>ACT (Covariate)</td>
<td>1</td>
<td>3.86</td>
<td>3.86</td>
<td>1.57</td>
<td>0.223</td>
</tr>
<tr>
<td>Seq * ESS</td>
<td>1</td>
<td>6.05</td>
<td>6.05</td>
<td>2.46</td>
<td>0.130</td>
</tr>
<tr>
<td>Seq * Sex</td>
<td>1</td>
<td>3.55</td>
<td>3.55</td>
<td>1.44</td>
<td>0.242</td>
</tr>
<tr>
<td>ESS * Sex</td>
<td>1</td>
<td>0.58</td>
<td>0.58</td>
<td>0.24</td>
<td>0.631</td>
</tr>
<tr>
<td>Seq * ESS * Sex</td>
<td>1</td>
<td>2.50</td>
<td>2.50</td>
<td>1.02</td>
<td>0.324</td>
</tr>
<tr>
<td>Error</td>
<td>24</td>
<td>59.11</td>
<td>2.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Means

<table>
<thead>
<tr>
<th>Seq * ESS</th>
<th>N</th>
<th>Seq</th>
<th>ESS</th>
<th>% correct</th>
<th>N</th>
<th>Seq</th>
<th>ESS</th>
<th>% correct</th>
<th>N</th>
<th>ESS</th>
<th>Sex</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>A</td>
<td>C</td>
<td>69.35</td>
<td>17 A</td>
<td>A</td>
<td>66.18</td>
<td></td>
<td></td>
<td>13</td>
<td>C</td>
<td>F</td>
<td>66.46</td>
</tr>
<tr>
<td>9</td>
<td>A</td>
<td>F</td>
<td>63.00</td>
<td>16 B</td>
<td>B</td>
<td>72.67</td>
<td></td>
<td></td>
<td>6</td>
<td>C</td>
<td>M</td>
<td>68.54</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>C</td>
<td>65.65</td>
<td>8  F</td>
<td>F</td>
<td>67.14</td>
<td></td>
<td></td>
<td>6</td>
<td>F</td>
<td>M</td>
<td>75.56</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>F</td>
<td>79.70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

To clarify the pedagogical debate over sequencing of subject-matter materials for enhancing learning and retention this study was concerned with the interaction between a student's educational set and the instructional sequence by which he was taught. Two contrasting sets of predictions concerning this interaction follow logically from the positions taken by two instructional theorists: Ausubel, who emphasizes the structure of the material to be learned; and Siegel and Siegel, who emphasize the moderating effects of learner characteristics. While Ausubel predicts that subsumptive sequencing will be efficacious for all learners, Siegel and Siegel predict that such sequencing will benefit only learners whose educational sets are congruent with subsumptive sequencing.

If Ausubel's principle of subsumption actually parallels nervous system function, students taught with material sequenced accordingly (i.e., Sequence A: Conceptual lecture/Factual self-study) should have performed better on an examination covering the material than those students taught in the opposite sequence (i.e., Sequence B: Factual self-study/Conceptual lecture). The principle of subsumption does not, by itself, anticipate a significant interaction between educational set and sequence, since Ausubel does not regard learner variables as moderators of sequence effects.

If the construct of educational set can account for some of the individual differences in receptivity to instructional materials, then sequencing of subject-matter presentation should have differentially
affected student retention according to student set. Instruction sequenced from the general to the specific should have enhanced performance for conceptually set students, while factually set students should have profitted from the specific to the general sequence. Results of the retention tests ought to have revealed better performance by those students whose educational sets were consistent with the sequence of presentation they received. That is, conceptually set students should have performed better in Sequence A; factually set students, in Sequence B.

Taken together the four dependent measures lend more support to the predictions from the educational set literature. Significant interactions between educational set and sequence were seen in Tests 1 and 2, and definite, but non-significant, trends in the predicted direction were obtained in Tests 3 and 4. The failure to obtain statistical significance in the latter two trials may have reflected one or more artifacts of the experimental design.

First is the possibility that certain topics in psychology are not amenable to sequencing in clearcut inductive or deductive fashion, despite the experimenter's diligent efforts to arrange them. Briefly, the intended design may have failed on trials 3 and 4.

Secondly, assuming successful implementation of the design, the data may reflect an adaptation phenomenon. By the time the students submitted to trials 3 and 4, the effects of the experimental manipulation were muted.

Although adaptation is a tenable explanation for the non-significant findings in the latter two trials, it seems somewhat unlikely in view of the rather large, albeit non-significant, interactive differences in
the predicted direction on trial 4. The most likely explanation for non-significance in this trial, at least, is statistical artifact. Attrition reduced the size of the subgroup \( n_s \) to the point where even substantial differences in the predicted direction failed to attain statistical significance.

An interesting interaction appeared in Session 3 test data between educational set and sex. However, no apparent explanation is available for the superior performance by conceptually set males and by factually set females on a test covering learning theory applied to the classroom.

The results emphasize the necessity of considering individual differences among students both in designing curricula and in investigating instructional procedures. The classroom situation is multivariate, rich with differences among students, instructors, environments, and curricula, any of which could affect educational outcomes.

The growing movement toward individualized instruction can gain support from these results. Student learning and retention can be encouraged when individual differences in students, such as cognitive styles, can be utilized in designing instructional strategies.
References


APPENDIX

I. Session 1: Teacher Characteristics
   Lecture Outlines: Sequences A and B
   Definitions
   Self-study Materials
   Questions to Accompany Self-study: Sequences A and B
   Session 1 Examination

II. Session 2: Creativity
   Lecture Outlines: Sequences A and B
   Definitions
   Self-study Materials
   Questions to Accompany Self-study: Sequences A and B
   Session 2 Examination

III. Session 3: Theories of Learning Applied to the Classroom
   Lecture Outlines: Sequences A and B
   Definitions
   Self-study Materials
   Questions to Accompany Self-study: Sequences A and B
   Session 3 Examination

IV. Session 4: Discovery Learning
   Lecture Outlines: Sequences A and B
   Definitions
   Self-study Materials
   Questions to Accompany Self-study: Sequences A and B
   Session 4 Examination
SEQUENCE A: Teacher Characteristics

I. Advance Organizer
   A. Teacher variables which ought to affect learning process
      1. comprehension of subject matter
      2. teaching ability
         a. organization of subject-matter presentation
         b. explanation of concepts
         c. manipulation of variables affecting learning
      3. communication skills—ability to translate information into
         a form appropriate for students' degree of cognitive
         maturity and subject-matter sophistication
      4. personality characteristics
         a. degree of commitment to or ego-involvement in intellectual
            development of students
         b. ability to generate intellectual excitement and
            intrinsic motivation for learning
   B. Actually, very little is known about which characteristics of
      teachers enhance success in the teaching-learning process
   C. Invalid assumption: ideal type of teacher exists who is
      equally effective with all groups
      1. teacher effectiveness—function of personality variables
         interacting between instructor and learner

II. Roles of Teachers
   A. Most important, distinctive role of teacher: director of
      classroom learning activities
   B. Consider scope of role of modern teacher—vastly expanded be-
      yond original instructional core
      1. parent surrogate
      2. friend & confidante
      3. counselor & adviser
      4. representative of adult culture; transmitter of approved
         cultural values
      5. facilitator of personality development
   C. Viewed in retrospect by students, teachers are not impressively
III. Cognitive Abilities of Teachers

A. Intelligence as a factor in teaching ability
   1. intuitively, it would appear that intelligence of teachers should be highly related to success in teaching
   2. teacher effectiveness, as measured by pupil gains in achievement and by principals' and supervisors' ratings—only negligibly related to teachers' intelligence (Barr and others, 1958; Marsh & Wilder, 1954)

B. Subject-matter knowledge
   1. obvious that teacher cannot furnish adequate feedback to students or clarify ambiguities and misconceptions without meaningful, adequately organised grasp of subject-matter
   2. no really adequate measures of teachers' grasp of subject-matter in terms of
      a. comprehension, stability, precision of concepts
      b. integration of relationships between component aspects of field
      c. awareness of significant theoretical issues & underlying philosophical assumptions
      d. appreciation of methodological, epistemological problems
   3. subject-matter preparation inferred from
      a. GPA
      b. amount of work taken in major field
      c. achievement test scores
   4. degree & quality of teachers' academic preparation
      a. bears low, positive relationship to pupil learning outcomes & supervisor ratings of teaching success
      b. may reflect superficiality, low intrinsic validity of student & teacher measures of subject-matter mastery
      c. academic preparation may influence effectiveness when it is below a critical level (as intelligence does)
C. Organization of learning activities

1. intuitively, it would appear that teachers who display skill, imagination, sensitivity in organizing learning activities and in manipulating learning variables should promote superior student learning outcomes

2. sparse research evidence
   a. positive relationship between orderliness in teachers and reading achievement in students (Spaulding, 1963)
   b. students who judge teacher as orderly, systematic in classroom management & arrangement of learning activities report greater accomplishment of work than those who judge teacher less favorably (Cogan, 1958)
   c. teachers who are adept at diagnosing learning difficulties and at appreciating the relevance of specific instructional materials for acquisition of specific learnings—more successful than less adept teachers in terms of student achievement (Fattu, 1963)

3. no research evidence available about relationship between teacher's effectiveness & ability to adapt communication of ideas to students' level of intellectual maturity and subject-matter sophistication

IV. Personality Characteristics

A. Volumes of literature exist on teacher personality
   1. little indicates what characteristics are associated with successful teaching
   2. personality of teachers has been studied in terms of aspects that influence personality development of students—not learning outcomes

B. In general, teachers' personality characteristics--not highly correlated with effectiveness in teaching

C. Principal exceptions: warmth & understanding; tendency to be stimulating, imaginative
   1. teachers who are warm & understanding tend to gratify the affiliative drive of their students
      a. very important in elementary school where teacher
serves as parent surrogate
b. less important as students become older
c. warm teacher provides emotional support to students
   1) sympathetic
   2) accepts students as human beings
   3) uses much praise
   4) relatively unauthoritarian
   5) sensitive to students' feelings
d. teacher warmth is significantly related to
   1) amount of work performed by students (Cogan, 1958)
   2) pupils' interest in science in a general science course (Reed, 1961)
   3) productiveness of student behavior in elementary school (Ryans, 1961)
   4) creative student achievement (Sears, 1963)

2. teachers who are lively, stimulating, imaginative, enthusiastic about their subject
   a. judged more successful by principals, experienced observers (Ryans, 1960)
   b. promote greater student gains in comprehension (Solomon, Rosenberg, & Bezdek, 1964)

D. Perhaps most important personality characteristic—personal commitment to intellectual development of students
SEQUENCE B: Teacher Characteristics

I. Roles of Teachers

A. Teachers are not impressively effective in any of their roles according to the retrospective judgement of their students (Allport, 1964)

B. What are some of the roles of teachers?
   1. parent surrogate
   2. friend & confidante
   3. counselor & adviser
   4. representative of adult culture; transmitter of approved cultural values
   5. facilitator of personality development

C. Roles—vastly expanded beyond original instructional core
   1. director of classroom learning activities
      a. most important, distinctive role of teacher

II. Cognitive Abilities of Teachers

A. Intelligence as a factor in teaching ability
   1. teacher effectiveness
      a. measured by student achievement gains & principals' and supervisors' ratings
      b. negligibly related to teachers' intelligence (Barr and others, 1958; Marsh & Wilder, 1954)
   2. teacher intelligence may not be significantly related to learning outcomes by students beyond certain minimal level
      a. thus, intelligence appears to be a limiting factor
      b. intelligence is not highly related to teaching success, as one might expect intuitively

B. Subject-matter knowledge
   1. measurement of subject-matter knowledge
      a. inferred from GPA, amount of work taken in major field, achievement test scores
      b. no really adequate measures of teachers' grasp of subject-matter in terms of
         1) comprehension, stability, precision of concepts
2) integration of relationships between component aspects of field
3) awareness of significant theoretical issues underlying philosophical assumptions
4) appreciation of methodological, epistemological problems

2. degree & quality of teachers' academic preparation
   a. bears low, positive relationship to student learning outcomes and supervisor ratings of teacher success
   b. may reflect superficiality, low intrinsic validity of student & teacher measures of subject-matter mastery
   c. academic preparation may influence effectiveness when it is below a certain level (as intelligence does)

3. even though it is obvious that teacher cannot furnish adequate feedback to students or clarify ambiguities & misconceptions without meaningful, adequately organized grasp of subject-matter, no current measures of subject-matter grasp exist

C. Organization of learning activities
   1. no research evidence available about the relationship between teacher's effectiveness & ability to adapt communication of ideas to students' level of intellectual maturity and subject-matter sophistication
   2. positive relationship between orderliness in teachers and reading achievement in students (Spaulding, 1963)
   3. students who judge teacher as orderly, systematic in classroom management & arrangement of learning activities report greater accomplishment of work than those who judge teacher less favorably (Cogan, 1958)
   4. teachers who are adept at diagnosing learning difficulties and at appreciating the relevance of specific instructional materials for acquisition of specific learnings—more successful than less adept teachers in terms of student achievement (Fattu, 1963)
   5. thus, although it would appear that teachers who display skill, imagination, sensitivity in organizing learning
activities & in manipulating learning variables should promote student learning outcomes, there is little research to support this assumption

III. Personality Characteristics of Teachers

A. Teachers who are warm and understanding tend to increase
   1. amount of work performed by their students (Cogan, 1958)
   2. pupils' interest in science in a general science course (Reed, 1961)
   3. productiveness of student behavior in elementary school (Ryans, 1961)
   4. creative student achievement (Sears, 1963)
   5. gratification of students' affiliative drive
      a. very important drive in elementary school
      b. less important as students become older
      c. warm teacher provides emotional support to students
         1) sympathetic
         2) accepts students as human beings
         3) uses much praise
         4) relatively unauthoritarian
         5) sensitive to students' feelings

B. Teachers who are lively, stimulating, imaginative, enthusiastic about their subject
   1. judged more successful by principals, experienced observers (Ryans, 1960)
   2. promote more productive student behavior in both elementary & secondary schools (Ryans, 1961)
   3. promote greater student gains in comprehension (Soloman, Rosenberg, & Bezdak, 1964)

C. With these exceptions, teacher personality characteristics are generally not correlated highly with teaching effectiveness
   1. personality of teachers has been studied in terms of aspects that influence personality development of students --not learning outcomes
   2. little of the volumes of literature on teacher personality
characteristics indicates what characteristics are associated with successful teaching.

D. Perhaps most important personality characteristic—personal commitment to intellectual development of students.
IV. Summary

A. Teacher variables which ought to affect learning process
   1. comprehension of subject-matter
   2. teaching ability
      a. organization of subject-matter presentation
      b. explanation of concepts
      c. manipulation of variables affecting learning
   3. communication skills—ability to translate information
      into a form appropriate for students' degree of cognitive
      maturity & subject-matter sophistication
   4. personality characteristics
      a. degree of commitment to or ego-involvement in intellec-
      tual development of students
      b. ability to generate intellectual excitement & intrinsic
      motivation for learning

B. Actually, very little is known about which characteristics of
   teachers enhance success in the teaching-learning process

C. Invalid assumption: ideal type of teacher exists who is
   equally effective with all groups
   1. teacher's effectiveness—function of personality variables
      interacting between instructor and learner
DEFINITIONS: Teacher Characteristics

Sequence A: Present as each word is discussed in lecture
Sequence B: Present at beginning of class, before lecture

surrogate—substitute
teaching effectiveness—teaching success judged by some criteria, such
as student-based criteria (e.g., student achievement test scores,
grades in other classes, subsequent success in high school and
college)
validity—refers to how well a test measures what it proports to
measure
affiliative drive—desire to please a significant person to develop
and maintain an emotionally close relationship.
authoritarian—personality characteristic associated with rigidity,
prejudice, conventionalism.
SELF-STUDY MATERIALS: Teacher Characteristics

Sequence A

1. Allport, G. W. Crises in normal personality development. 

   and other factors affecting classroom interaction and teaching 
   Summarized.

3. Zax, M. Outstanding teachers: Who are they? *Clearing House*, 45, 

4. Ryans, D. G. Characteristics of teachers: Their description, 
   comparison, and appraisal. Washington, D. C.: American 

Sequence B

1. Ryans article

2. Zax article

3. Jansen, Jensen, & Mylov article

4. Allport article
QUESTIONS TO ACCOMPANY ALLPORT ARTICLE: Sequence A

1. Evaluate Allport's notion of adolescent crises for approaching student problems.

2. Which of the following statements is implied by the article?
   a) Teachers should not try deliberately to influence their students, since their influence tends to be casual.
   b) The teacher who wants to influence students should teach at the secondary level.
   c) An advisor should approach a student problem in terms of the idiosyncratic development of the student.
   d) Teacher influence only occurs when the student is in a crisis period in his personality development.

3. Why is the group vision orientation an inefficient approach to student problems?

4. According to Allport, most students who return to college several years after dropping out successfully complete college. How would you account for this?

5. Students appeared to remember secondary school teachers better than primary ones. How can this observation be interpreted? How did Allport explain it?

6. What implications does the crisis view of adolescence have for teachers and counselors?

7. Explain the crisis of college, according to Allport.

8. How deliberate is the teacher's influence on his students?

9. A teacher seems to influence strongly how many of his students?
10. How many primary and secondary school teachers were remembered by college students?
QUESTIONS TO ACCOMPANY ALLPORT ARTICLE: Sequence B

1. How many primary and secondary school teachers were remembered by college students?

2. At which level did students best remember their teachers?

3. A teacher seems to strongly influence how many of his students?

4. How deliberate is the teacher's influence on his students?

5. Explain the crisis of college according to Allport.

6. What implications does the crisis view of adolescence have for teachers and counselors?

7. Allport explained students' differential remembering of their teachers in terms of the crisis view. In what other ways could this observation be explained?

8. According to Allport, most students who return to college several years after dropping out successfully complete college. How would the crisis period view of adolescence account for this?

9. Why is the group vision orientation an inefficient approach to student problems?

10. Which of the following statements is implied by the article?
   a) Teachers should not try deliberately to influence their students, since their influence tends to be casual.
   b) The teacher who wants to influence students should teach at the secondary level.
   c) An advisor should approach a student problem in terms of the idiosyncratic development of the student.
   d) Teacher influence only occurs when the student is in a crisis period in his personality development.
11. Evaluate Allport's notion of adolescent crises for approaching student problems.
1. Criticize the two major types of research studies on teacher characteristics.

2. What variables not mentioned in this article could be associated with teaching behavior?

3. How could Pfeiffer's results (1967) be accounted for?

4. Analyze the differences between the two major types of research on teacher characteristics.

5. How could a teacher benefit in a given classroom situation from Klein's observations (1970)?

6. Discuss the relationship between students' socio-economic status and their academic achievement described in this article.

7. What is the relationship between a teacher's use of praise and a) his prior expectations of his class? b) students' vocational aspirations?

8. What was Ryan's main objective in the Teacher Characteristics Study (1960)?

9. Describe two major types of research investigating teacher characteristics associated with teaching behavior.
QUESTIONS TO ACCOMPANY JANSEN, JENSEN, & MYLOV ARTICLE: Sequence B

1. Describe two major types of research investigating teacher characteristics associated with teaching behavior.

2. What was Ryan's main objective in the Teacher Characteristics Study (1960)?

3. What is the relationship between a teacher's use of praise and
   a) his prior expectations of his class?
   b) students' vocational aspirations?

4. Discuss the relationship between students' socio-economic status and their academic achievement described in this article.

5. How could a teacher benefit in a given classroom situation from Klein's observations (1970)?

6. Analyze the differences between the two major types of research on teacher characteristics.

7. How could Pfeiffer's results (1967) be accounted for?

8. What variables not mentioned in this article could be associated with teaching behavior?

9. Criticize the two major types of research studies on teacher characteristics.
QUESTIONS TO ACCOMPANY ZAX ARTICLE: Sequence A

1. How practical is a composite picture of outstanding teachers for the development of effectiveness in an individual teacher?

2. What is the relationship between these teachers' self-assessment of their effectiveness and their failure to reach some students?

3. Why do you expect subject-matter competency is missing from Zax's composite picture of the outstanding teacher?

4. What problems exist if outstanding teachers are identified in comparison to a composite picture of other outstanding teachers?

5. Discuss the relationship between these teachers' independence in their classrooms and their dependence on their colleagues and supervisors.

6. Discuss the major problem associated with identifying outstandingness in teachers.

7. In the composite picture of outstanding teachers, how did the subjects view
   a) change in their classrooms?
   b) non-teaching duties?
   c) their failure to affect certain students?

8. Zax concluded that the best method of selecting outstanding teachers is to ask whom?
QUESTIONS TO ACCOMPANY ZAX ARTICLE: Sequence B

1. Zax concluded that the best method of selecting outstanding teachers is to ask whom?

2. In the composite picture of outstanding teachers, how did the subjects view
   a) change in their classrooms?
   b) non-teaching duties?
   c) their failure to affect certain students?

3. Discuss the major problem associated with identifying outstandingness in teachers.

4. Discuss the relationship between these teachers' independence in their classrooms and their dependence on their colleagues and supervisors.

5. What problems exist if outstanding teachers are identified in comparison to a composite picture of other outstanding teachers?

6. Why do you expect subject-matter competency is missing from Zax's composite picture of the outstanding teacher?

7. What is the relationship between these teachers' self-assessment of their effectiveness and their failure to reach some students?

8. How practical is a composite picture of outstanding teachers for the development of effectiveness in an individual teacher?
QUESTIONS TO ACCOMPANY RYANS ARTICLE: Sequence A

1. Why is it "not surprising to find that, in general, teachers who demonstrated friendly and warm, organized and businesslike, and stimulating and surgent behavior were judged to be more effective teachers?"

2. How could a school administrator use the Teacher Characteristics Study in hiring teachers?

3. How could an elementary school teacher use the Teacher Characteristics Study to assess his effectiveness in teaching?

4. How could a secondary school student teacher use the Teacher Characteristics Study?

5. What could account for differential intercorrelations of Patterns $X_0$, $Y_0$, $Z_0$ between elementary and secondary school teachers? That is, why are Patterns $X_0$, $Y_0$, $Z_0$ highly intercorrelated among elementary school teachers, but less highly intercorrelated among high school teachers?

6. What could account for women mathematics teachers' being highest in Pattern $Y_0$?

7. Teachers who are low in classroom behavior associated with effectiveness tend to be older. What could possibly account for this observation?

8. What is the relationship between teacher punitiveness and student behavior?

9. More traditional viewpoints toward education tend to be held by which teachers?
10. Teachers who exhibit classroom behavior associated with effectiveness
   a) are married
   b) prefer teacher-directed learning situations
   c) are superior in verbal intelligence
   d) prefer student-centered learning situations
   e) come from culturally above-average backgrounds

11. Characterize the personality characteristics of effective teachers.

12. Characterize the classroom behavior associated with teaching effectiveness.

13. What extracurricula activities do effective teachers enjoy?
QUESTIONS TO ACCOMPANY RYANS ARTICLE: Sequence B

1. What extracurricula activities do effective teachers enjoy?

2. Characterize the classroom behavior associated with teaching effectiveness.

3. Characterize the personality characteristics of effective teachers.

4. Teachers who exhibit classroom behavior associated with effectiveness
   a) are married
   b) prefer teacher-directed learning situations
   c) are superior in verbal intelligence
   d) prefer student-centered learning situations
   e) come from culturally above-average backgrounds

5. More traditional viewpoints toward education tend to be held by which teachers?

6. What is the relationship between teacher punitiveness and student behavior?

7. Teachers who are low in classroom behavior associated with effectiveness tend to be older. What could possibly account for this observation?

8. What could account for women mathematics teachers' being highest in Pattern \( Y_0 \)?
9. What could account for differential intercorrelations of Patterns $X_0$, $Y_0$, $Z_0$ between elementary and secondary school teachers? That is, why are Patterns $X_0$, $Y_0$, $Z_0$ highly intercorrelated among elementary school teachers, but less highly intercorrelated among high school teachers?

10. How could a secondary school student teacher use the Teacher Characteristics Study?

11. How could an elementary school teacher use the Teacher Characteristics Study to assess his effectiveness in teaching?

12. How could a school administrator use the Teacher Characteristics Study in hiring teachers?

13. Why is it "not surprising to find that, in general, teachers who demonstrated friendly and warm, organized and businesslike, and stimulating and surgent behavior were judged to be more effective teachers?"
SESSION 1 EXAMINATION: Teacher Characteristics

1. Why is a teacher's personal commitment to the intellectual development of his students one of the most important personality characteristics associated with teaching effectiveness?
   a) Commitment affects whether an instructor will expend the necessary effort to teach for gains in intellectual growth.
   b) A committed teacher is more adept at the formal motions of teaching behavior.
   c) A teacher's professional motivation is derived largely from the feelings he has toward individual students.
   d) If a teacher is committed, variables of warmth and imagination are not as necessary for effectiveness.

2. A plausible explanation of the decreasing effectiveness of the affiliative drive as a motivator as students grow older is that
   a) the praise, attention, and emotional support of peers become increasingly more important than that from adults.
   b) teachers no longer serve as parent surrogates.
   c) students become increasingly motivated by acquired status and increasingly motivated by derived status.
   d) the threat of withdrawal of approval for poor performance becomes less effective with continued use.
3. Generally, teachers' personality characteristics are not highly correlated with effectiveness in teaching. Which of the following is the most plausible reason for this?
   a) Personality characteristics of the teacher have little to do with his ability to enhance student learning.
   b) If a teacher is warm and stimulating, other personality characteristics are only peripherally related to effectiveness.
   c) Not enough research on teacher personality has been conducted to determine the strength of this generalization.
   d) Teacher effectiveness is the interaction of the personalities of both teacher and student, which is difficult to pin down for scientific analysis and generalization.

4. According to Allport, the average teacher
   a) strongly influences less than one student in ten.
   b) affects about one-third of his students.
   c) "gets through" to only a few students over his teaching career.
   d) modifies the intellectual development of about one student per year.

5. Allport states that the teacher who strongly affects the intellectual or personality development of a student is so casual in his effect that he probably doesn't realize his influence. What implication does this have for a teacher?
   a) The teacher should attempt to be casual and friendly with students if he wants to influence them.
   b) There is no reason to try to influence the development of students, since there is no way for the teacher to know how he is affecting his students.
   c) The interaction between teacher and student is complex and idiosyncratic; at the present time, the teacher does not know enough about the processes at work to control them.
   d) The teacher should work hard at influencing all of his students; he should not expect to see his influences immediately because his effect will be long-term with most students.
6. When teachers were observed in several classes of different ability level, Pfeiffer found that
   a) teachers spent more time with each student in the high ability classes.
   b) teachers did not change their vocabulary in teaching various ability groups.
   c) teachers adjusted the difficulty of their methods to suit each ability level.
   d) teachers preferred to teach at the intermediate ability level.

7. Your task is to design a competency examination for teachers to be given for re-certification every ten years. From your study of teacher characteristics, you might conclude that such a test should
   a) ask for a teacher's college grades.
   b) contain interest and personality characteristics items.
   c) use trained observers to judge a teacher's communication skills.
   d) ask the instructor how he would explain certain concepts.

8. A composite picture of effective teachers, such as Zax's picture of teachers chosen by their principals as outstanding, could be useful for
   a) administrators who might want to award raises to those teachers who answer similarly on a questionnaire of their attitudes toward teaching.
   b) student teachers who might want to aim at developing the same attitudes and characteristics.
   c) retiring teachers who might want to evaluate their effectiveness by comparison of attitudes and characteristics.
   d) researchers who might want to evaluate the differences in attitudes between effective and less effective teachers.
9. When college students were asked about their former teachers, they remembered more secondary than primary teachers. Allport suggested that this was because
   a) it is easier to remember acquaintances from a few years ago than those from many years ago.
   b) adolescents are influenced more significantly by adults outside the family than children are.
   c) secondary teachers are associated with a single subject-matter about which the student has definite feelings.
   d) secondary teachers are more closely associated with their students outside of class through extra-curricula activities.

10. The personal qualities of the combined group of elementary and secondary teachers judged to be high in classroom behaviors associated with successful teaching include
   a) generous in appraisals of others; directive in teaching.
   b) preferences for lecture method, the arts, social services.
   c) sociable, non-directive, cultured.
   d) superior personality organization with moderate to high expression of aggression.

11. Apparently, teachers use more praise in classes where
   a) students are of the same ability level, and the instructor anticipates high performance from them.
   b) students aspire to professional vocations, and the instructor expects to like the students as individuals.
   c) students are allowed to evaluate the instructor, and the teacher expects poor ratings from them.
   d) students are low achievers of high socio-economic status, and the teacher expects better performance of them.
12. What is the relationship between Zax's outstanding teachers' self-assessments of their effectiveness and their failure to reach some students?
   a) Outstanding teachers seem to feel they can always improve their teaching effectiveness.
   b) Effective teachers work hard at communicating, but they fear that students who constitute perennial problems are beyond reach.
   c) Outstanding teachers appear to assess their effectiveness in terms of the normal students, regarding the problem students as exceptions.
   d) Effective teachers judge their effectiveness by student reactions; receiving adverse student responses reduces a teacher's effectiveness by reducing his self-image.

13. Zax's composite picture of outstanding teachers indicates that they
   a) feel positively toward all their students.
   b) express negative feelings for those students misplaced ability-wise.
   c) interact positively with the high-achievers but not the low-achievers.
   d) understand students who exemplify perennial problems.

14. According to the crisis period view of adolescence, the group vision approach to student problems is inefficient because
   a) it sees students' problems as no different from general problems of adolescence
   b) it does not view each student problem as unique
   c) it does not consider the environmental stresses that lead to the problems
   d) it sees each student as a minor deviation from a master design
15. From the study of teacher characteristics, one can conclude that
   a) effective teaching is an art which does not lend itself to the
      scientific study and isolation of component elements.
   b) no amount of training or education can produce the ideal
      teacher; only time, experience, and seasoned judgment can do
      that.
   c) the study of teaching effectiveness is elusive because a given
      teacher might interact with some students favorably enough to
      enhance learning but not enough to enhance learning in others.
   d) component elements of effective teaching have not yet been
      isolated because little research has been done on the problem
      thus far.

16. In general, the relationship between student learning outcomes
    and teachers' intelligence is characterized by
    a) a strong, positive correlation.
    b) an extremely low, positive correlation.
    c) a moderately low, negative correlation.
    d) a high, negative correlation.

17. What problems exist in the interpretation of the Teachers Charac-
    teristics Study?
    a) A teacher who does not appear high in warmth, enthusiastic
       behavior, or organization can still be an excellent teacher.
    b) It eliminates from the rank of effective teachers a majority of
       secondary school teachers, since low intercorrelations among
       Patterns X₀, Y₀, Z₀ were found.
    c) The study eliminates from consideration all those teachers who
       fall between high and low in classroom behaviors associated
       with successful teaching.
    d) The study did not establish any definite interrelationship
       between personality traits and future teaching behavior.
18. More traditional viewpoints toward education tend to be held by
   a) elementary teachers who were judged to be warm and understanding in their classroom behavior,
   b) teachers at both levels who were judged to be stimulating and enthusiastic in their classroom behavior,
   c) secondary teachers who are judged to be friendly and surgent in their classroom behavior,
   d) teachers at both levels who are judged to be business-like and systematic in their classroom behavior.

19. What could account for the low intercorrelations at the secondary level among the behavior patterns, TCS Patterns X₀, Y₀, Z₀?
   a) Specialization—a good typing teacher may show businesslike, systematic teaching behavior, while a good science teacher may be stimulating and imaginative.
   b) Teachers at the secondary level tend to be less warm and understanding, less responsible and systematic, less stimulating and surgent than teachers at the elementary level.
   c) Heterogeneity—secondary teachers vary more than elementary teachers on such variables as sex, subject field, years of experience, college grades, I.Q. scores, and marital status.
   d) The behavior patterns, TCS Patterns X₀, Y₀, and Z₀, do not reflect adequate criteria of teaching effectiveness at the secondary level where the situation is more complex and requires a more sophisticated analysis.

20. The major problem associated with identifying outstandingness in teachers is
   a) validity of the criteria
   b) reliability of student ratings
   c) biases of observers and principals
   d) measurement errors
SEQUENCE A: Creativity

I. Advance Organiser

A. Creativity as a term

1. one of vaguest, most ambiguous, most confused terms in psychology and education
   a. particularly unfortunate since “teaching for creativity” is current fad in education

2. semantic confusion over use of term

B. Failure to distinguish between creativity as a trait and the creative person

1. creativity as a trait—inclusive of a wide and continuous range of individual differences

   creative individual—a unique individual possessing a rare degree of the trait

2. analogous to difference between intelligent behavior and intelligent individual

   a. a monkey or a retardate can show intelligent behavior
   b. only those as one extreme of the distribution of I.Q. are highly intelligent individuals

3. creative behavior varies along a continuum

   creative individual—rare person who makes significant contribution to art, science, literature, music

   a. much rarer than intelligent person
   b. not rare because he lacks appropriate experience to develop creative potential, but because he is at such an extreme point in the distribution of creative potentialities that he is qualitatively discontinuous from those of lower creativity

C. Failure to distinguish between creativity as a specific capacity and creativity as a general constellation of supportive abilities

1. between creativity as a highly particularised and substantive ability and as a group of supporting intellectual abilities, personality variables, problem-solving traits
2. genuinely creative talent—particularised intellectual-personality capacity related to substantive content of a given field
   a. not a set of general, content-free intellectual and personality traits
   b. commonly measured "creative abilities"—supportive intellectual-personality functions which help implement expression of creativity (Walloch, 1970)
   1) Alternate Uses Test: "List as many uses as you can for a newspaper." (measures ideational fluency)
   2) Ideational Fluency Test: "List solids which float."
   3) Consequences Test: "What would be the effect if people could no longer read?" (Originality—only "remote" as opposed to "obvious" consequences scored)

   c. by definition, a test of general creativity is impossible
      1) assessments of creative potentiality based only on expert judgments of actual work output

II. Creativity, Intelligence, and Academic Achievement (Walloch and Kogan, 1965)

A. Relationship between creativity and intelligence
   1. exceedingly complex, complicated by problem of measurement
   2. most commonly used batteries of creativity actually measure supportive creative abilities
      a. measure cognitive abilities not reliably different from intelligence
      b. this accounts for positive correlations between scores on creativity tests and academic achievement
   3. more important than relationship between supportive measures of creativity and intelligence is relationship between true, substantive creativity and intelligence
      a. intelligence—like other supportive cognitive traits
makes possible the expression of creativity
b. a certain critical level of intelligence is necessary for the creative individual to function
1) creative individuals in art, science, literature, music are more intelligent than noncreative individuals
2) above this critical level the relationship between creativity and intelligence is approximately zero

B. Relationship between creativity and academic achievement
1. research—contradictory
2. many tests of creativity—actually tests of supportive abilities—correlate positively with academic achievement
   a. probably because creativity tests measure cognitive abilities not reliably different from intelligence
   b. intelligence is highly related to academic achievement
3. on deductive grounds, it seems unlikely that creativity should be related to academic success
   a. mastery of a subject-matter discipline does not presuppose a capacity to make a certain contribution to that discipline
   b. since creative students tend to be nonconforming and disruptive, some negative relationship between school and grades can be expected

III. Personality Correlates of Creativity (Cattell, 1963; Taylor and Barron, 1963)
A. Considerable research has been conducted on the characteristics of persons who have been rated by competent judges as creative in art, literature, science
B. Cognitive traits: creative individuals tend to be
   1. original, perceptive, insightful, independent in judgment, open to new experience (especially, from within), skeptical, verbally facile
   2. flexible, open-minded, tolerant of ambiguity, wide-
ranging interests, prefer complexity, less interested in small details and in the practical and in the concrete than in theoretical ideas
3. delight in paradoxes, in reconciling opposites
C. Personality traits: creative individuals tend to be
1. ambitious, achievement-oriented, dominant, sense of destiny about themselves
2. emotionally mature, venturesome, self-sufficient, emotionally and aesthetically sensitive
3. self-image: inventiveness, determination, industry, independence, individualism, enthusiasm
4. higher ego-strength and self-acceptance, introspectiveness, femininity
D. Relations with others: creative persons tend to be
1. unconventional, rebellious, disorderly, self-centered, exhibitionistic, prone to retreat to role of observer

IV. Identification of Creative Potentialities
A. Measures do not exist which can predict whether an individual will become a creative individual
B. Shortcomings of tests of divergent thinking
1. no evidence that what they measure is actually a separate ability from general intelligence
2. scores are contaminated by factors such as verbal fluency, impulsivity, lack of self-critical ability
3. measures have not been validated against creative output in later life (i.e., measures have not been given to creative individuals)
4. deductively, these measures cannot possibly have high predictive validity because they do not measure creativity, but supportive cognitive traits
C. Only feasible approach—expert judgments of actual work products, taking into account inexperience

V. Fostering Creativity in the School
A. Much sentimentality underlies the popular educational objective
of making every child a creative thinker
1. unique creativity—it is alleged—is not the exclusive property of the rare genius, but a tender, catalytic influence of sensitive, imaginative teaching to coax it into bloom
2. based on untenable propositions
   a. every child is potentially a creative individual if he is not stifled
   b. even if a child has no creative potential, inspired teaching can make up for missing genes
   c. all creativity is qualitatively equal
   d. supportive creative abilities = substantive creativity

B. How reasonable is the goal of "teaching for creativity?"
1. training possibilities—extremely limited
2. research on training for originality
   a. very limited success
   b. little transfer
      1) when transfer does occur, it is to very similar tasks
   c. training is with supportive cognitive traits—not with creativity itself
3. school can help in realisation of existing creative potentialities
   a. by providing opportunities for spontaneity, initiative, individualised experience
   b. by making room in the curriculum for tasks that are sufficiently challenging for creative students
   c. by rewarding creative achievement
4. school cannot actualise potentialities for unique creativity if these potentialities are not there in the first place

C. How important is it to identify pupils with true creative potential?
1. the school ought to offer the same training to all students without need to identify creative potential
2. since school is somewhat limited in what it can do for the
creative individual

3. since the actual help in realising creative potential which the school can give is certainly not going to hurt any student
SEQUENCE B: Creativity

I. Who is the creative individual?
   A. Research on the characteristics of individuals rated by competent judges as creative in art, literature, and science (Cattell, 1963; Taylor and Barron, 1963)
   B. Cognitive traits: creative individuals tend to be
      1. original, perceptive, insightful, independent in judgment, open to new experience (especially from within), skeptical, verbally facile
      2. flexible, open-minded, tolerant of ambiguity, wide-ranging interests, prefer complexity, less interested in small details and in the practical and concrete than in theoretical ideas
      3. delight in paradoxes, in reconciling opposites
   C. Personality traits: creative individuals tend to be
      1. ambitious, achievement oriented, dominant, sense of destiny about themselves
      2. emotionally mature, venturesome, self-sufficient, emotionally and aesthetically sensitive
      3. self-image: inventiveness, determination, industry, independence, individualism, enthusiasm
      4. higher ego-strength and self-acceptance, introspectiveness, femininity
   D. Relations with others: creative individuals tend to be
      1. unconventional, rebellious, disorderly
      2. self-centered, exhibitionistic
      3. prone to retreat to role of observer
   E. Differentiation between creative person and creativity as a trait
      1. creativity--inclusive of a wide and continuous range of individual differences
         a. varies along a continuum as intelligence
      2. creative individual
         a. a unique individual possessing a rare degree of creativity
makes a significant contribution to art, science, literature, etc.

c. much rarer than intelligent person because he is at an extreme point in the distribution which is qualitatively-ly discontinuous from those of lower creativity

II. Identification of Creative Potentialities

A. Guilford-type tests of creativity (Wallach, 1970)

1. Alternate Uses Test
   a. "List as many uses as you can for a newspaper." 
   b. measures ideational fluency

2. Ideational Fluency Test
   a. "List solids which float." 
   b. measures ideational fluency

3. Consequences Test
   a. "What would be the effect if people could no longer read?"
   b. measures originality
   i) "remote" as opposed to "obvious" consequences scored as original

B. Shortcomings of tests of divergent-thinking

1. there is little evidence that what tests measure is actually a separate ability from general intelligence

2. scores are contaminated by factors such as verbal fluency, impulsivity, lack of self-critical ability

3. measures have not been validated against creative output in later life (i.e., measures have not been given to creative individuals)

C. Tests of divergent-thinking measure a general constellation of supportive abilities which help implement the expression of creativity as opposed to the specific capacity of creativity

1. the commonly measured "creative abilities"—supportive intellectual abilities, personality variables, problem-solving traits

2. genuinely creative talent—a particularised intellectual-personality capacity related to substantive content of a given field
a. not a set of general, content-free intellectual and
personality traits
b. by definition, a test of general creativity is
impossible
D. Measures do not exist which can predict whether an individual
will become a creative individual
E. Only feasible approach--expert judgments of actual work pro-
ducts, taking into account inexperience

III. Creativity, Intelligence, and Academic Achievement.
A. Relationship between creativity and academic achievement
   1. most tests of creativity are positively correlated with
      academic achievement
   2. however, most tests of creativity measure cognitive
      abilities not reliably different from intelligence
      a. intelligence is highly related to academic achievement
   3. the research is somewhat contradictory
   4. mastery of a subject-matter discipline does not presuppose
      a capacity to make a creative contribution to that disci-
      pline
      a. creative students tend to be nonconforming and disrup-
      tive
      b. therefore, some negative relationship between the
         creative student and grades can be expected
B. Relationship between creativity and intelligence
   1. most commonly used batteries of creativity actually
      measure supportive cognitive abilities not separate from
      intelligence
   2. issue is complicated by more important question of rela-
      tionship between true, substantive creativity and intelli-
      gence
      a. a certain level of intelligence is necessary for ex-
         pression of creativity
      1) creative individuals in arts, science, literature--
         --more intelligent than noncreative ones
      b. above this critical level, the relationship between
creativity and intelligence is approximately zero
3. therefore, intelligence, like other supportive cognitive traits, makes possible the expression of creativity

IV. Fostering Creativity in the School

A. Educational objective of making every child a creative thinker
1. based on several propositions
   a. every child is potentially a creative individual if he is not stifled by the school system
   b. even if a child has no creative potential, inspired teaching can make up for missing genes
   c. all creativity is qualitatively equal
   d. supportive creative abilities = substantive creativity
2. unique creativity— it is alleged—is not the exclusive property of the rare genius, but a tender bud that resides within each child, requiring only the gentle catalytic influence of sensitive, imaginative teaching to coax it into bloom
3. of course, these are untenable propositions associated with much sentimentality

B. How reasonable is the goal of “teaching for creativity?”
1. research on training for originality
   a. training is with supportive cognitive traits—not with creativity itself
   b. very little transfer
      1) when there is transfer, it is to very similar tasks
   c. very limited success
2. school can help in realisation of existing creative potentialities
   a. by providing opportunities for spontaneity, initiative, individual expression
   b. by making room in the curriculum for tasks that are challenging to the creative student
   c. by rewarding creative achievement
3. overall, school is limited in training possibilities
4. school cannot actualise potentialities for unique creativ-
ity when they do not exist in the first place.

C. How important is it to identify students with true creative potential?

1. since the school is somewhat limited in what it can do for the creative individual

2. since the actual help in realising creative potential which the school can give is certainly not going to hurt any student

3. the school ought to offer the same training to all students without need to identify creative potential
V. Summary

A. Creativity is a vague, ambiguous term

B. Much semantic confusion over the use of the term
   1. failure to differentiate between creativity as a trait and the creative individual
   2. failure to differentiate between creativity as a specific capacity and creativity as a general constellation of supportive abilities

C. Research on creativity is confused by the use of tests of divergent thinking which actually measure the general constellation of supportive abilities
   1. relationship between creativity and academic achievement
      a. typical creativity tests correlate positively with academic achievement
      b. probably the truly creative individual is not an "A" student
   2. relationship between creativity and intelligence
      a. a certain minimal level of intelligence is necessary for the expression of creativity
      b. above that level, the relationship between creativity and intelligence is zero

D. No real way to judge creative potential
   1. best method is probably expert judgments of actual work production

E. Not a good deal the school can do to foster actual, substantive creativity
   1. since it cannot identify those students who will become creative individuals, it should treat all students as potentially creative
DEFINITIONS: Creativity

Sequence A: Present as each word is discussed in lecture
Sequence B: Present at beginning of class, before lecture

creative person—an individual possessing a rare and singular degree of creativity or originality in some field of human endeavor that sets him off qualitatively from most other persons in this regard

creative abilities, general—a general constellation of supportive intellectual traits, personality variables, and problem-solving skills that help implement the expression of creative potential

creative behavior—an extreme form of problem-solving which involves the application of knowledge to uniquely novel or remotely related problems in terms of the individual's own life history. It differs from common problem solving in that the individual must draw upon his background knowledge which lies outside a defined relevant set and must proceed to a solution without the aid of a well-defined strategy

ideational fluency—the ability to generate a large number of ideas in response to a given task constraint

transfer—the utilization of learning acquired in one contest in another context
SELF-STUDY MATERIALS: Creativity

SEQUENCE A


SEQUENCE B

1. Cattell article

2. Taylor & Barron article

3. Wallach & Kogan article

4. Wallach article
QUESTIONS TO ACCOMPANY WALLACH ARTICLE: Sequence A

1. Choose at least one item on each of the three Guilford tests and answer it.

2. Evaluate the Guilford tests as tests of general creativity (as analogous to tests of general intelligence).

3. Evaluate the Guilford tests as identifiers of creative individuals. What kind of predictive validity would these tests exhibit?

4. Account for the fact that unique ideas are more likely to occur later in a sequence of responses to a given task.

5. Evaluate the role of evaluation in divergent production. What effect does evaluation have on "brainstorming?"

6. What effect does a large vocabulary have on the expression of originality? Why?

7. Describe the structure of the intellect model associated with J. P. Guilford. Name the five processes of thinking.

8. What is the difference between cognition and memory?

9. What is the difference between convergent and divergent thinking?

10. Describe two specific divergent-thinking subprocesses.

11. What evidence indicates that these subprocesses are actually different from the subprocesses involved in convergent-thinking?
QUESTIONS TO ACCOMPANY WALLACH ARTICLE: Sequence B

1. Describe the structure of the intellect model associated with J. P. Guilford. Name the five processes of thinking.

2. What is the difference between cognition and memory?

3. What is the difference between convergent and divergent thinking?

4. Describe two specific divergent-thinking subprocesses.

5. What evidence indicates that these subprocesses are actually different from the subprocesses involved in convergent thinking?

6. What effect does a large vocabulary have on the expression of originality? Why?

7. Choose at least one item on each of the three Guilford tests and answer it.

8. Account for the fact that unique ideas are more likely to occur later in a sequence of responses to a given task.

9. Evaluate the Guilford tests as tests of general creativity (as analogous to tests of general intelligence).

10. Evaluate the Guilford tests as identifiers of creative individuals. What kind of predictive validity would these tests exhibit?

11. Evaluate the role of evaluation in divergent production. What effect does evaluation have on "brainstorming?"
QUESTIONS TO ACCOMPANY WALLACH & KOGAN ARTICLE: Sequence A

1. When the high creative, high intelligence group was compared with the low creative, high intelligence group, students of the latter group received higher grades. Considering the behavioral characteristics of each type of student, how can you account for the difference in grades?

2. Why do you think that a playful, permissive attitude toward producing responses on a creativity test is important to the valid measurement of creativity?

3. What effect does eliminating time limits have on the validity of creativity tests?

4. Compare and contrast students in each of the four groups differentiated by creativity and general intelligence on the following:
   a) social adjustment
   b) cognitive development
   c) classroom behavior

5. Name three ways that Wallach and Kogan's test battery of creative abilities differs from Guilford's test battery.

6. How do Wallach and Kogan define the creative process?
QUESTIONS TO ACCOMPANY WALLACH & KOGAN ARTICLE: Sequence B

1. How do Wallach and Kogan define the creative process?

2. Name three ways that Wallach and Kogan's test battery of creative abilities differs from Guilford's test battery.

3. Compare and contrast students in each of the four groups differentiated by creativity and general intelligence on the following:
   a) social adjustment
   b) cognitive development
   c) classroom behavior

4. What effect does eliminating time limits have on the validity of creativity tests?

5. Why do you think that a playful, permissive attitude toward producing responses on a creativity test is important to the valid measurement of creativity?

6. When the high creative, high intelligence group was compared with the low creative, high intelligence group, students of the latter group received higher grades. Considering the behavioral characteristics of each type of student, how can you account for the difference in grades?
QUESTIONS TO ACCOMPANY TAYLOR & BARRON ARTICLE: Sequence A

1. How can a study of the personality characteristics of individuals who have made original contributions to science shed any light on the study of creativity?

2. How do you account for Barron's statement that the creative individual is "both more primitive and more cultured; more destructive and more constructive; crazier and saner than the normal individual?"

3. Why does the rejection of conventional morality often accompany the expression of originality?

4. What is the difference between the creative individual and the original individual?

5. How does Barron define originality? Where is it best expressed?

6. Describe the characteristics of the original individual.

7. How does Barron define the creative individual?

8. Describe the personality characteristics of the creative individual.
QUESTIONS TO ACCOMPANY TAYLOR & BARRON ARTICLE: Sequence B

1. How does Barron define originality? Where is it best expressed?

2. Describe the characteristics of the original individual.

3. How does Barron define the creative individual?

4. Describe the personality characteristics of the creative individual.

5. What is the difference between the creative individual and the original individual?

6. Why does the rejection of conventional morality often accompany the expression of originality?

7. How do you account for Barron's statement that the creative individual is "both more primitive and more cultured; more destructive and more constructive; crazier and saner than the normal individual?"

8. How can a study of the personality characteristics of individuals who have made original contributions to science shed any light on the study of creativity?
QUESTIONS TO ACCOMPANY CATTELL ARTICLE: Sequence A

1. Evaluate Cattell's recommendation for stimulating creativity in the schools.

2. Why is a creative individual usually creative in only one field rather than in the arts, the sciences, and the humanities?

3. Evaluate the extent to which each of the personality characteristics of the creative researcher contribute to his expression of creativity.

4. How does knowledge of the personality characteristics of the average researcher aid in understanding the personality of the creative researcher?

5. How does the personality of the average researcher differ from that of the average man?

6. How does the personality of the average researcher differ from that of others of equal general intelligence and education who have made a name in teaching or administration rather than in research?

7. How does the personality of the successful researcher differ from that of the average college undergraduate?

8. Compare the personality of the successful researcher with that of the successful artist.

9. Compare the creative researcher with the scholar.
QUESTIONS TO ACCOMPANY CATTELL ARTICLE: Sequence B

1. How does the personality of the average researcher differ from that of the average man?

2. How does the personality of the average researcher differ from that of others of equal general intelligence and education who have made a name in teaching or administration rather than in research?

3. How does the personality of the successful researcher differ from that of the average college undergraduate?

4. Compare the personality of the successful researcher with that of the successful artist.

5. Compare the creative researcher with the scholar.

6. How does knowledge of the personality characteristics of the average researcher aid in understanding the personality of the creative researcher?

7. Evaluate the extent to which each of the personality characteristics of the creative researcher contribute to his expression of creativity.

8. Evaluate Cattell's recommendation for stimulating creativity in the schools.

9. Why is a creative individual usually creative in only one field rather than in the arts, the sciences, and the humanities?
SESSION 2 EXAMINATION: Creativity

1. You are teaching high school English and you discover a student you judge to be creative in his compositions. To encourage the expression of the student's creativity, you might
   a) assign the student a term paper comparing writing styles of 20th century novelists.
   b) attempt to enroll the student in a college composition course while he is still in high school.
   c) involve the student with others who appear creative in the production of a student literary publication.
   d) send the student to a state rally or similar contest that might award his creative output.

2. Much of the literature on creativity is misleading because of a failure to distinguish between the creative individual and creativity as a trait. Which of the following sheds light on this distinction?
   a) Any individual has the potential to become a creative individual if he has the opportunity to create without being stifled.
   b) As with intelligence, the creative individual is at an extreme point in the distribution of creative potentialities.
   c) Creative behavior is only shown by the unique individual who possesses a rare degree of creativity.
   d) Creative individuals vary along a continuum of creative production.
3. What use is knowledge of personality traits of creative individuals to the study of creativity?
   a) It provides data for developing tests to identify creative potential.
   b) Such knowledge is helpful in designing programs to encourage the fulfillment of existing creative potentialities.
   c) It is helpful to an understanding of the bizarre behavior exhibited by creative individuals.
   d) Such knowledge contributes to the understanding of creativity as a trait.

4. How can the creative person in science be compared with the creative person in the arts?
   a) Each could probably be as creative in the other's field if he spent the time learning the necessary background information.
   b) Each is distinctively different since creativity is a particularized intellectual-personality capacity related to the substantive content of a field.
   c) Although each chose to put his talents to work in his respective field, there are some common traits shared by each, such as an introspective nature.
   d) Both are emotionally sensitive, anxious, radical, intelligent, schizothyme, and assertive.
5. When Wallach and Kogan's high creative, high intelligent fifth grader's were compared on academic achievement with their low creative, high intelligent peers, the latter students received higher grades. Considering the behavioral characteristics of each type of student, how can this difference be explained?

a) Low creative, high intelligent students tend to be disruptive in the classroom.
b) High creative, high intelligent students tend to be a threat to teachers who are usually less creative and less intelligent.
c) Low creative, high intelligent students tend to be a challenge for the teacher.
d) High creative, high intelligent students tend to be self-confident and impulsive, a combination which leads to carelessness in their work.

6. "What would be the results if humans no longer held their group feeling to the extent that they all preferred to live alone?"
Which of the following would be scored as the most "remote" consequence, and hence, the most creative?

a) no more cities
b) no more families
c) no more psychologists
d) no more babies

7. The relationship between creativity and intelligence is such that

a) a certain critical level of intelligence is necessary for the expression of creativity.
b) creativity and intelligence are independent.
c) an individual can be creative for his level of intelligence regardless of what that level is.
d) creativity and intelligence are positively correlated.
8. Which of the following would be least helpful in the realization of creative potential?
   a) emphasis on individual expression
   b) awarding grades for creative achievement
   c) providing sufficiently challenging tasks
   d) reinforcing spontaneity

9. Another source of semantic confusion in creativity literature is the failure to distinguish between creativity as a specific capacity and as a general constellation of supportive abilities. Which of the following shed light on this distinction?
   a) Geniuinely creative talent can be assessed through measuring a set of general, content-free intellectual and personality traits.
   b) Creative potentiality can be assessed by a test of general creativity.
   c) Creative ability can be measured by a test of specific situations within a given field in which the individual is given an opportunity to formulate a unique set of answers.
   d) An individual's specific creative capacity is best assessed by expert judgments of his actual work output which take into consideration his inexperience.

10. Guilford-type creativity tests measure
   a) creativity as a specific capacity.
   b) creative potential.
   c) creative production in the arts and the humanities.
   d) the supportive intellectual-personality functions of creativity implementation.
11. Which answer would be scored as most "creative" to the task of naming solids that are generally used as food that are sweet tasting?
   a) saccharine
   b) honey
   c) rock candy
   d) sugar

12. "List as many possible uses for a WOODEN PENCIL as you can."
Which answer would be scored as most "creative?"
   a) a weapon
   b) a straight edge
   c) a tent stake
   d) a stirrer

13. Guilford postulated originality as a subprocess of divergent thinking. Research later revealed that part of originality associated more with convergent than with divergent thinking is dependent on
   a) the uniqueness of ideas generated.
   b) a plentiful flow of ideas.
   c) sheer cleverness of verbal expression.
   d) ideational fluency.

14. Cattell’s picture of the creative scientific researcher includes characteristics of
   a) high intelligence, high anxiety, high ego-strength, high adaptability.
   b) surgent, unconventional, dominant, assertive behavior.
   c) emotional sensitivity, humility, self-sufficiency, paranoia, inhibition.
   d) low level of emotional stability and anxiety; high level of resource and forebearance.
15. According to Barron, originality flourishes when
a) the individual values integration.
b) suppression is at a minimum.
c) it is valued by society.
d) conventional prohibitions are tolerated.

16. How does divergent thinking fit into Guilford's structure of the intellect model?
a) as process.
b) as contents.
c) as products.
d) as evaluation.

17. Which of the following is a plausible explanation for the fact that the creative individual is associated with socially undesirable traits?
a) Creative, original thinking is a higher level of human cognition which demands a higher level of social organization.
b) Creativity cannot function in an atmosphere with even a minimum of restraint or tradition; by definition, it is innovative.
c) The creative individual is more impulsive and more open to new and varied experiences than the normal person.
d) Because society treats the creative individual as special, people in the creative fields can get away with exhibiting such traits.
18. Wallach and Kogan added a "permissive, playful task attitude" to the definition of the creative process. This is important because
a) it reduces the evaluation of ideas, causing more ideas to be generated.
b) creative output should always be associated with fun—not work.
c) it adds a dimension to the Guilford structure of the intellect model; whether the dimension is valid to creative expression has not yet been determined.
d) creative thinking is highly correlated with a childish attitude toward work and adult roles and responsibilities.

19. Barron's picture of the creative individual is one who is
a) compulsive, disorderly, reflective, and cultured.
b) a poor observer, but an excellent thinker.
c) individual in his cognitions and capable of comparing ideas.
d) simple in his tastes, but complex in his fantasies.

20. Wallach and Kogan developed a battery of creativity tests which were administered in a manner that would maximize the subjects' opportunity to generate ideas. One way they assured this was to
a) liberalize time limits compared with those on the Guilford tests.
b) develop simpler tasks, more common to everyday experience.
c) reduce the evaluative connotations associated with the battery.
d) use verbal tasks, as the subject did not become bored with writing his answers.
SEQUENCE A: Meaningful Learning: A Cognitive-Structure Theory of School Learning (David Ausubel)

I. Advance Organizer
A. What is learning?
   1. A relatively permanent change in behavior as a result of reinforced practice.
   2. Human learning can be relatively simple or rather complex (Gagne, 1965)
      a. from simple, classical conditioning in which the learner's behavior changes incidentally, usually without his knowledge
      b. to complex problem solving in which the learner actively applies principles he already knows to generate a possible solution
   
B. Learning in the classroom
   1. Most classroom learning is of the higher-order varieties in which the learner is actively attempting to change his behavior and the teacher is actively attempting to enhance the process
   2. Classroom learning varies on two dimensions
      a. reception learning vs. discovery learning
      b. meaningful learning vs. rote learning
   3. reception learning
      a. the principal content of what is to be learned is presented to the learner by the teacher or a textbook in more or less final form
      b. the learner is required to comprehend the material and to incorporate it into his cognitive structure, so that it is available for reproduction, related learning, or problemsolving at some future date
   4. discovery learning
      a. only a portion of what is to be learned is presented to the learner in its final form
      b. the rest must be identified independently by the learner
      c. this information is then integrated into the existing
cognitive structure

5. reception learning vs. discovery learning
   a. most classroom learning—especially with pupils who can read—is receptive—not discovered

6. meaningful learning
   a. symbolically expressed ideas are related in a non-arbitrary, substantive fashion to what the learner already knows

7. rote learning
   a. symbolically expressed ideas are internalized in an arbitrary, verbatim fashion
   b. rote learning occurs if the learner attempts to memorize the material

8. meaningful learning vs. rote learning
   a. meaningful learning is superior to rote learning for the processing and storing of information
   b. meaningfully learned material is learned better because it is hooked onto previously gained knowledge

9. Conditions for the four kinds of learning
   a. meaningful reception learning
      1) new, logically organized material is presented in its final form
      2) the learner relates it to his existing knowledge
   b. rote reception learning
      1) material of any kind is presented in its final form
      2) the learner memorizes it
   c. meaningful discovery learning
      1) the learner arrives at the solution to a problem or other outcome independently
      2) he relates it to his existing knowledge
   d. rote discovery learning
      1) the solution is arrived at independently
      2) the learner memorizes it

II. Psychological Accretion and Organization of Knowledge
   A. Learning
1. process of acquiring meanings from potential meanings presented in learning material
2. of making them available for use

B. Retention
1. process of maintaining the availability of acquired meanings

C. Forgetting
1. a decrement in availability
2. later availability—partly a function of initial availability

D. Subsumption
1. individual's cognitive structure—pyramidal
   a. most general theories or concepts forming the apex
   b. the greater number of less general subconcepts forming the middle level
   c. the large amount of specific information forming the base
2. as one acquires knowledge in several subject-matter fields, he develops a cognitive structure related to each
3. principal way to get new information into the cognitive structure—to assimilate it as part of the existing structure thru process of subsumption
   a. nervous system is organized so that new information can be meaningfully learned and retained only to the extent that more inclusive, appropriately relevant concepts are available in the cognitive structure to provide ideational anchorage or a subsuming role
4. subsumption of new information gives it stability or resistance to forgetting
   a. when first encountered, a new idea is anchored through subsumption to a superordinate concept which provides the mechanism for retention
   b. as long as the characteristics of the new idea and the old idea are clearly distinct or dissociable, they can be recalled
   c. with the passage of time, the two concepts become less
distinct if they are not used
1) the two concepts may blend together into the more
   superordinate, general concept
d. individual can recall for some time what he has learn-
ed if he is not using it
1) later he can recognize it from among alternatives
   but he cannot recall it
2) still later he can neither recall nor recognize
   it, though he can relearn it in less time than
   originally

III. The Conditions for Meaningful Learning

A. What is meaning?
   1. an idiosyncratic product of the meaningful learning pro-
      cess in which potential meaning inherent in symbols is
      converted into a differentiated cognitive content within
      a given individual

B. Essence of meaningful learning process
   1. symbolically expressed ideas are related in a non-arbi-
      trary, substantive fashion to the learner’s existing
      cognitive structure
   2. presupposes both a meaningful learning set and potential
      meaning to the individual learner
      a. a meaningful learning set—a disposition on the part
         of the learner to relate the new material nonarbi-
         trarily and substantively to his cognitive structure
      b. potential meaning to the learner—material is relatable
         to his structure of knowledge in a non-arbitrary
         and nonverbatim basis

C. Superiority of meaningful learning for processing and storing
   information
   1. meaningful material can be anchored to established ideas
      already in the cognitive structure
      a. existing knowledge is exploited as an ideational
         matrix for interpreting new information
   2. learner can avoid the interfering effects of rote informa-
3. humans can only process and remember about seven independent items of information at one time
   a. because information is related to older knowledge in meaningful learning, more information can be processed and retained at one time

IV. Implications of the Cognitive Structure Theory for Teaching
   A. Use of unifying concepts and propositions with the widest explanatory power, inclusiveness, generalizability, relatability to subject-matter content
   B. Employ suitable principles of ordering the sequence of subject-matter, constructing its organization, and arranging practice trials
   C. Manipulate content, arrangement of antecedent learning experiences, so subsequent learning experiences are maximally facilitated
SEQUENCE B: Meaningful Learning: A Cognitive-Structure Theory of School Learning (David Ausubel)

I. Types of Learning
   A. Learning is not a unitary phenomenon; many qualitatively different types of learning exist
      1. human learning consists of several types
         a. from classical conditioning in which the learner's behavior changes incidentally, usually without his knowledge
         b. to problem solving in which the learner actively applies principles he already knows to generate a possible solution
      2. human learning can be relatively simple or rather complex (Gagne, 1965)
   B. Learning can be defined as a relatively permanent change in behavior as a result of reinforced practice

II. Classroom Learning
   A. Most of classroom learning consists of the higher order types in which the learner is actively trying to change his behavior and the teacher is actively attempting to enhance the process
      1. concept learning
      2. principle learning
      3. problem solving
   B. Classroom learning may be rote
      1. the learner attempts to memorize the information
      2. symbolically expressed ideas are internalized in an arbitrary, verbatim fashion
      3. rote learning is an inefficient method of processing and storing information
         a. humans can only process and remember about seven items of information at one time
         b. memorizing material internalizes it without connecting it with any existing knowledge
         c. interfering effects of rote information
d. thus, memorized elements of information are easily forgotten

4. unless the material is made meaningful to the learner and he has developed a meaningful learning set, rote learning will occur

5. rote learning can occur with received content or with discovered content

a. reception learning

   1) the principal content of what is to be learned is presented to the learner by a teacher or a textbook in more or less final form

   2) the learner is required to comprehend the material and to incorporate it into his cognitive structure, so that it is available for reproduction, related learning, or problem solving at a future date

   3) most classroom learning—especially with pupils who can read—is receptive—not discovered

b. rote reception learning

   1) material is presented in more or less final form

   2) the learner memorizes it

c. discovery learning

   1) only a portion of what is to be learned is presented to the learner in its final form

   2) the rest must be identified independently by the learner

   3) the information is then integrated into existing cognitive structures

d. rote discovery learning

   1) solution is arrived at independently

   2) learner memorizes it

C. Classroom learning may be meaningful

1. if the material has potential meaning for the learner

   a. if the material is relatable to the learner's existing knowledge on a non-arbitrary, nonverbatim basis

   b. meaning is an idiosyncratic product of the meaningful
learning process
1) potential meaning inherent in symbols is converted into a differentiated cognitive content within a given individual

2. if the learner exhibits a meaningful learning set
   a. a disposition to relate the new material non-arbitrarily and substantively to his cognitive structure

3. essence of meaningful learning process
   a. the learner relates the new information to what he already knows
   b. symbolically expressed ideas are related in a non-arbitrary, substantive fashion to the learner's existing cognitive structure

4. meaningful learning is superior to rote learning for processing and storing information
   a. meaningful learned material is learned better because it is hooked onto previously gained knowledge
   b. the learner's existing knowledge is exploited as an ideational matrix for interpreting new information
   c. meaningful learning is less susceptible to forgetting than rote learning

5. both reception learning and discovery learning can be meaningful
   a. meaningful reception learning
      1) new, logically organized material is presented to the learner in its final form
      2) the learner relates it to his existing knowledge
   b. meaningful discovery learning
      1) the learner arrives at the solution to a problem or other outcome independently
      2) he relates it to his existing knowledge

III. The Psychological Accretion and Organization of Knowledge
   A. Subsumption
      1. as one develops his knowledge in several subject-matter fields, he acquires a cognitive structure related to each
2. principal way to get new information into the cognitive structure—to assimilate it as part of the existing structure to provide ideational anchorage or a subsuming role

3. individual's cognitive structure—pyramidal
   a. most general theories or concepts forming the apex
   b. the greater number of less general subconcepts forming the middle level
   c. the large number of specific information forming the base

B. Learning
   1. process of acquiring meanings from potential meanings present in learning material
   2. of making them available for use

C. Retention
   1. process of maintaining the availability of acquired meanings

D. Forgetting
   1. a decrement in availability
   2. later availability—partly a function of initial availability
   3. subsumption of new information gives it stability or resistance to forgetting
      a. when first encountered, a new idea is anchored through subsumption to a superordinate concept which provides the mechanism for retention
      b. as long as the characteristics of the new idea and the old idea are clearly distinct or dissociable, they can be recalled
      c. with the passage of time, the two concepts become less distinct if they are not used
         1) two concepts may blend together into the more superordinate, general concept
      d. individual can recall for some time what he has learned if he is not using it
         1) later he can recognize it from among alternatives,
but he cannot recall it

2) still later he can neither recall nor recognize it, though he can relearn it in less time than originally

IV. Implications of the Cognitive-Structure Theory for Teaching
   A. Use unifying concepts and propositions with the widest explanatory power, inclusiveness, generalizability, relatability to subject-matter content
   B. Employ suitable principles of ordering the sequence of subject-matter, constructing its organization, and arranging practice trials
   C. Manipulate content, arrangement of antecedant learning experiences, so subsequent learning experiences are maximally facilitated

V. Summary
   A. Learning is a relatively permanent change in behavior as a result of reinforced practice
   B. Classroom learning varies on two dimensions
      1. meaningful learning and rote learning
      2. reception learning and discovery learning
   C. Meaningful learning in the classroom
      1. learner is presented with material that has potential meaning for him
      2. learner has a meaningful learning set, a disposition to relate his new information to his old knowledge
      3. meaningful learning occurs when symbolically expressed ideas are related in a non-arbitrary, substantive way to the learner's existing cognitive structure
   D. Teaching and subsumption
      1. new information is best related to cognitive structure if older, inclusive concepts are already in the cognitive structure
      2. in teaching new material, organizers serve the function of providing inclusive concepts if they are not in the
cognitive structure
DEFINITIONS: Meaningful Learning in the Classroom

Sequence A: Present as each word is discussed in lecture
Sequence B: Present at beginning of class, before lecture

substantiveness or nonverbatimness—that property of a learning task that permits the substitution of synonymous terms without change of meaning or significant alteration in the content of the task itself

cognitive structure—the total content and organization of a given individual's ideas; or the content and organization of his ideas in particular area of knowledge

subordinate or subsumptive learning—learning the meaning of a new concept or proposition that can be subsumed under a relevant, more inclusive, particular idea in the cognitive structure

superordinate learning—learning the meaning of a new concept or proposition that can subsume relevant and less inclusive particular ideas in cognitive structure

interference—the competing effect of similar material for the retention of new information
SELF-STUDY MATERIALS: Meaningful Learning

Sequence A:

Sequence B:
1. Gagne article
2. Ausubel article
QUESTIONS TO ACCOMPANY AUSUBEL ARTICLE: Sequence A

1. Why does Ausubel's theory emphasize prior knowledge or existing cognitive structure?

2. Why should the teacher begin with concepts with the widest inclusiveness, generalizability, and integrative power?

3. What is ideational scaffolding or anchorage?

4. Why does Ausubel stress consolidation?

5. Why is motivated learning more important in Ausubel's theory than in other theories of learning?

6. Why is intellectual curiosity an important goal of education?

7. What is cognitive drive?

8. What use is repetition and practice in Ausubel's theory?

9. What is an advanced organizer?

10. In what ways is an advanced organizer different from a typical textbook introduction or summary?

11. What effect did prior knowledge of Christianity have on students studying Buddhism?

12. What effect does an advanced organizer have on students whose prior relevant knowledge is unstable or unambiguous?

13. How can a hierarchical series of organizers in descending order of inclusiveness aid in student comprehension and retention?

14. What is cognitive maturity of content? of the student?
15. What effect does cognitive maturity have on the structure and organization of learning material?

16. Why do students usually study biology before physics?

17. Name four ways in which the instructor can enhance comprehension of concepts.
QUESTIONS TO ACCOMPANY AUSUBEL ARTICLE: Sequence B

1. Why should the teacher begin with concepts with the widest inclusiveness, generalizability, and integrative power?

2. Name four ways in which the instructor can enhance comprehension of concepts.

3. What is cognitive maturity of content? of the student?

4. What effect does cognitive maturity have on the structure and organization of learning material?

5. Why do students usually study biology before physics?

6. What is an advanced organizer?

7. What effect did prior knowledge of Christianity have on students studying Buddhism?

8. What effect does an advance organizer have on students whose prior relevant knowledge is unstable or ambiguous?

9. In what ways is an advance organizer different from a typical textbook introduction or summary?

10. How can a hierarchical series of organizers in descending order of inclusiveness aid in student comprehension and retention?

11. What use is repetition and practice in Ausubel's theory?

12. What is cognitive drive?

13. Why is motivation more important in Ausubel's theory than in other learning theories?
14. Why is intellectual curiosity an important goal of education?

15. What is ideational anchorage or scaffolding?

16. Why does Ausubel stress consolidation?

17. Why does Ausubel's theory emphasize prior knowledge or existing cognitive structure?
1. Explain the relationship among Gagne's eight types of human learning.

2. What is the effect of previous learning to any type of learning in the Gagne hierarchy?

3. Match the following examples with their corresponding type of learning:
   a) recitation of the Star-Spangled Banner
   b) reading
   c) fear
   d) tennis
   e) a baby's first words

4. How could an adult teach the concept "German shepherd" to a young child?

5. Why does a child make mistakes in learning a concept?

6. How could an adult teach the concept of "Centigrade scale" to a teenager?

7. What use is verbal instruction in concept learning? Is it more useful in teaching a concept to a child or to an adult? Why?

8. How does the instructor discover whether the student has learned a concept?

9. What do the abstract properties of stimuli have to do with concept learning?

10. What use are varying stimulus situations in concept learning?

11. The simplest type of learning which frees man from concrete
objects in the environment, allowing him to internalize a symbolic representation of them is ____________________.

12. Why is knowledge of concepts necessary before knowledge of principles?

13. Principles are......

14. Why do children have difficulty learning principles?

15. Must principles be discovered by the learner?

16. What use are verbal instructions to principle learning?

17. What disadvantage to principle learning are verbal instructions?

18. How can the teacher test whether a student has learned a principle?

19. If learning is defined as a relatively permanent change in behavior as a result of reinforced practice, then why is problem solving considered learning?

20. What use is knowledge of principles to problem-solving?

21. Problem solving is......

22. Discuss the steps involved in problem solving. What conditions are essential for problem solving?

23. What effect does repetition have on problem solving?

24. Discuss forgetting and problem solving.

25. What is a stimulus situation? What is a response?
QUESTIONS TO ACCOMPANY GAGNE ARTICLE: Sequence B

1. What is a stimulus situation? What is a response?

2. The simplest type of learning which frees man from concrete objects in the environment, allowing him to internalize a symbolic representation of them is ________________.

3. What do the abstract properties of stimuli have to do with concept learning?

4. How does the instructor discover whether the student has learned a concept?

5. What use are varying stimulus situations in concept learning?

6. Why does a child make mistakes in learning a concept?

7. What use are verbal instructions in concept learning? Is it more useful in teaching a concept to a child or to an adult? Why?

8. How can an adult teach the concept "German shepherd" to a young child?

9. How could an adult teach the concept of "Centigrade scale" to a teenager?

10. Principles are ....

11. Why do children have difficulty learning principles?

12. Why is knowledge of concepts necessary before knowledge of principles?

13. Must principles be discovered by the learner?
14. What use are verbal instructions to principle learning?

15. What disadvantage to principle learning are verbal instructions?

16. How can the teacher test whether a student has learned a principle?

17. Problem solving is.....

18. What use is knowledge of principles to problem-solving?

19. Discuss the steps involved in problem solving? What conditions are essential for problem solving?

20. What effect does repetition have on problem solving?

21. Discuss forgetting and problem solving.

22. If learning is defined as a relatively permanent change in behavior as a result of reinforced practice, then why is problem solving considered learning?

23. Match the following examples with their corresponding type of learning:
   a) recitation of the Star-Spangled Banner
   b) reading
   c) fear
   d) tennis
   e) a baby's first words

24. What effect is previous learning on any type of learning in the Gagne hierarchy?

25. Explain the relationship among Gagne's eight types of human learning.
SESSION 3: Learning in the Classroom

1. Most classroom learning is
   a) rote.
   b) concrete.
   c) discovered.
   d) receptive.

2. Forgetting occurs when
   a) the individual can recognize a piece of information, but he
t      cannot recall it.
   b) time passes.
   c) once the characteristics of new and old ideas become clearly
distinct or dissociable.
   d) there is a decrement in availability of information.

3. Humans can process and remember about _____ independent items of
   information at one time.
   a) 3
   b) 7
   c) 12
   d) 15

4. Learning is meaningful if
   a) the learner has a disposition to relate the new material to his
      existing cognitive structure in a nonverbatim fashion.
   b) the material has potential meaning for the learner.
   c) ideas expressed in symbols are meaningful to the individual and
      are hooked into his existing cognitive structure on a non-
      arbitrary basis.
   d) symbolically expressed ideas are related in an arbitrary,
      verbatim fashion to the learner's existing knowledge.
5. To enhance comprehension of concepts an instructor can
   a) require the student to redefine the ideas in his own words.
   b) use conflicting, abstract examples.
   c) begin with imprecise definitions and work toward more technical
      language.
   d) present several concepts at one time to provide comparisons.

6. Meaningful learning is superior to rote learning for the processing
   and storing of information because
   a) meaningful learning depends on interference from similar,
      established knowledge.
   b) old knowledge is used to anchor new information, allowing more
      material to be internalized.
   c) existing knowledge does not interfere with new information.
   d) the new information forms an ideational matrix in meaningful
      learning.

7. An advance organizer to introduce material on the causes of the
   Civil War might consist of
   a) a historical introduction to the slavery issue.
   b) a summary of the Abolition Movement.
   c) a comparison of pre-Civil War social conditions with the social
      conditions of the 1960s.
   d) an overview of political issues of the 18th and 19th centuries.

8. "All dogs are animals" is an example of
   a) a concept.
   b) an S-R connection.
   c) a stimulus chain.
   d) a principle.
9. Problem solving is considered a form of learning because
   a) the learner changes his behavior by applying his former knowledge to a new situation.
   b) the learner has learned to make a precise response to a discriminated stimulus.
   c) the learner changes his behavior by internalizing the stimulus situation and manipulating it symbolically.
   d) the learner manipulates the stimulus situation to determine an appropriate response.

10. Why is cognitive drive a more powerful source of motivation than grades?
    a) Intellectual curiosity is the highest objective of education.
    b) Intrinsically desiring knowledge promotes the pursuit of knowledge beyond the requirements of school.
    c) Grades lose their value for the individual student as he develops long-range goals beyond academia.
    d) No extrinsic motivator, such as grades, can make a student want to do any more work than is necessary.

11. Why is it important for a student to study material with the level of concreteness-abstractness associated with his cognitive development on that dimension?
    a) to increase initial comprehension of the subject-matter
    b) to increase consolidation of the subject-matter
    c) to guarantee retention of the subject-matter
    d) to decrease forgetting of the subject-matter
12. Ausubel's theory suggests that existing cognitive structures are important for adequate learning. This implies that a teacher should
a) use advance organizers regardless of the students or the subject-matter being taught,
b) proceed with new material until the student manifests confusion, lack of comprehension, or ambiguous meanings.
c) try to discover whether the student's prior knowledge is clear and unambiguous before proceeding with new information,
d) attempt to ascertain the child's previous knowledge through discussions with his parents and his former teachers.

13. The principle of subsumption implies that
a) learning occurs from the specific to the general,
b) the organization of subject-matter is too important to be left to the teacher—it should be designed by curriculum experts.
c) learning from the general to the specific is most successful.
d) the sequence of subject-matter presentation is less an important variable than practice and repetition.

14. A high school physics student works a lab exercise in mechanical "cookbook" fashion, following each step in the directions to arrive at the lab manual's predetermined conclusion. In all probability, the student engaged in
a) rote reception learning,
b) rote discovery learning,
c) meaningful reception learning,
d) meaningful discovery learning.

15. To teach the concept "Roman numerals" to a sixth-grader one would
a) parallel the gradual acquisition of the concept "number."
b) relate the new concept to the established concept of "number."
c) first teach the symbols for each Roman numeral.
d) discuss the history of numbering systems.
16. A child has learned the concept "cat" when he
   a) calls all animals, "Kitty."
   b) calls his cat, "Kitty."
   c) responds to all domestic cats as "cat."
   d) responds to all members of the feline family as "cat."

17. Unmotivated learning is inefficient because
   a) very little learning can occur without motivation,
   b) an undisciplined mind will not deal efficiently with academic
      material,
   c) it is passive, rather than an active attempt to integrate new
      information with old,
   d) the learner cannot consolidate old material.

18. In teaching a unit on intelligence, the subsumption principle
    suggests the following sequence would be most advantageous for
    efficient learning:
    a) perennial questions regarding IQ scores---the distribution of
       IQ scores
    b) intelligence as a multiple factored ability---types of IQ
       tests---intelligence as a predictor of academic achievement
    c) intelligence scores as a predictor of academic achievement---
       developmental changes in intelligence
    d) Wechsler vs. Binet tests---sex differences in intelligence

19. To assure that an individual has learned a principle a teacher
    might
    a) ask the student to define each concept involved.
    b) require the learner to make a verbal statement of the principle.
    c) ask the student to demonstrate one or more concrete examples of
       the principle.
    d) require the learner to differentiate the stimuli involved.
20. **Advance organizers should not be confused with ordinary introductory overviews which**

   a) provide a generalized overview of the major similarities and differences between two bodies of ideas.

   b) increase the discriminability of new information from analogous, conflicting, older ideas.

   c) achieve their effect through creating an advance set in the learner to make the information more meaningful to him.

   d) are typically written at the same level of abstraction, generality, and inclusiveness as the learning material.
SEQUENCE A: Learning by Discovery

I. Advance Organizer
   A. Learning by discovery has its proper place in the repertoire of accepted pedagogic techniques
   B. Discovery learning
      1. principle content of what is to be learned must be discovered by the individual before he can incorporate it meaningfully into his cognitive structure
      2. student must rearrange information, integrate it with his existing cognitive structure, reorganize the integrated combination in such a way as to generate the desired end product
      3. meaningful discovery learning—more complex than meaningful reception learning
         a. involves antecedent problem solving stage
         b. before meaning can emerge and be internalized
      4. large bodies of subject-matter—acquired through reception learning
      5. everyday problems of living—solved by discovery
      6. discovery learning—hardly an efficient means of transmitting the content of academic discipline
   C. Learning by discovery has been extrapolated from its legitimate uses to areas where it is ill-suited because of
      1. misconceptions about intellectual development
      2. outmoded ideas about the relationship between thought and language
      3. sentimental fantasies about education and children
      4. uncritical acceptance of research evidence
   D. Aim of this lecture—to sort out legitimate and illegitimate uses of discovery method of learning

II. Historical antecedents of discovery learning
   A. "Partly as a result of the superstitious faith of educators in the magical efficacy of problem solving and laboratory methods, we have produced in the past four decades millions of high
school and college graduates who never had the foggiest notion of the meaning of a variable, a function, calculus, an exponent, molecular structure, electricity, but who have done all of the prescribed laboratory work and have successfully solved an acceptable percentage of the required problems in differential and integral calculus, in logarithms, in molar and normal solutions, and in Ohm's law."

B. Problem solving in and of itself does not guarantee meaningful discovery
1. problem solving may also be rote
2. even the best program of problem solving is no substitute for a minimally necessary amount of appropriate instruction

III. Psychological and Educational Rationale of the Discovery Method
A. Defensible uses and palpable advantages of learning by discovery
1. in the early, unsophisticated stages of learning any abstract subject-matter—particularly prior to adolescence—discovery method is extremely helpful
2. for teaching scientific method, effective problem solving skills
3. for testing meaningfulness of knowledge
4. for increasing meaningfulness of material presented primarily by expository methods
5. various cognitive and motivational factors enhance learning, retention, transferability of potentially meaningful ideas learned by discovery

B. Elaboration of defensible uses of discovery method
1. occasionally useful when the child is functioning in concrete operational stage of development
   a. simple verbal exposition with concrete, empirical props or a semi-autonomous type of discovery accelerated by the use of prompts, hints—adequate for teaching simple and relatively familiar ideas
   b. when learning task is more difficult, autonomous
discovery probably enhances intuitive meaningfulness
1) intensifies, personalizes concreteness of experience and operations of abstracting, generalizing from empirical data
2) time-cost disadvantage of discovery learning—less serious because use of concrete, empirical props takes time anyway

2. same rationale applies to adolescents and adults who are relatively unsophisticated in the basic concepts, terminology of a given discipline
   a. however, older individual will benefit from greater cognitive sophistication and experience relating abstractions to each other without concrete, empirical props
   b. he will move through the intuitive, subverbal stage of understanding faster than the child

3. evaluating learning outcomes, problem solving techniques, appreciation of the scientific method
   a. no better way to develop effective skills in hypothesis making and testing
   b. to develop desirable attitudes toward learning and independent problem solving
   c. major rationale for laboratory work
   d. independent problem solving—feasible way to test whether student understands ideas he can verbalize

4. greater effort, motivation, excitement, vividness associated with independent discovery lead to greater learning, retention, transferability

C. Crucial issue
   1. Discovery method is far more costly in both time and money than the receptive method
   2. Are discovery methods worth the extra cost with students who are capable of learning concepts and principles meaningfully without them?

IV. Research Evidence
A. Organizer

1. Professional literature on learning by discovery regrettably exemplifies the often hollowness of the phrase, "research shows..."

2. In this instance, examination of what research shows leads to three conclusions
   a. Most articles cited in the literature as supporting discovery techniques actually report no findings, but consist mainly of theoretical discussions of the superiority of discovery learning.
   b. Most well-designed, well-controlled studies report neutral or negative findings.
   c. Most studies reporting positive results (i.e., that discovery methods are superior)—poorly designed, poorly controlled, poor use of statistical analysis.

3. Examination of research literature allegedly supporting learning by discovery reveals
   a. Valid evidence—virtually nonexistent.
   b. Enthusiasts of discovery learning—support each other by citing one another's opinions as evidence and by generalizing extravagantly from questionable findings.

B. Long-term studies

1. Various curriculum reform movements—failed to yield research evidence in favor of discovery method
   a. Not that evidence is negative.
   b. There simply isn't any evidence.

2. Sponsors of some of these projects—not concerned with proving the superiority of their programs—they were convinced from the beginning
   a. Often no attempts to obtain comparable achievement test data from matched control groups.
   b. Rare effort to prevent operation of the "Hawthorne effect".

3. Number of long-term curriculum studies from the older literature
   a. Compared drill and generalization methods with second
and fourth graders

b. drill—emphasized rote rules

c. generalization--emphasized meaningful perception of relationships and derivations of generalizations

d. generalization method—found superior

1) except in situations calling for immediate, automatic recall of knowledge in same form as presented to the learner

e. finding due to rote--meaningful distinction--not to discovery-reception factor

f. however, it is in this stage of entrance into concrete operations that children benefit most from the discovery method, when they are unsophisticated in a new, abstract subject-matter

C. Short-term studies

1. a series of studies with varying amounts of guidance furnished to different groups of subjects in problem-solving situations

2. Stacy (1949)

a. effect of directed vs. independent discovery on solving a group of simple meaningful problems, each of which required the subject to identify one item in a set of five that did not belong

b. active participation and self-discovery--more beneficial for learning than passive participation involving only recognition of information

c. no transfer differences seen between groups

3. Craig (1956)

a. results—even less favorable for discovery methods

b. college students

c. directed group--received brief explanation of principles

1) learned and retained more principles than the independent group

d. independent group--no help whatsoever in training situation
e. no difference between groups on transfer test

4. Kittell (1957)
   a. results—still more damaging to discovery methods
   b. "intermediate group"—received explanation of principles plus organization of materials—superior in learning, retention, transfer to groups receiving more or less direction

5. therefore, evidence supports conclusion that in this type problem solving, guidance (i.e., providing information about underlying principles) facilitates learning, retention, and sometimes transfer more than provision of less guidance or furnishing specific rules for each problem

D. Conclusion

1. issue of reception learning vs. independent discovery in learning, retention, and transfer—still very much in doubt
   a. non-comparability of various studies
   b. serious deficiencies in research design
   c. failure to take into account other variables
      1) rote-meaningful distinction
      2) inductive-deductive sequencing
      3) verbalization
      4) ability level
      5) cognitive maturity and subject-matter sophistication
      6) motivation

2. generally, providing guidance to learner in the form of explanation of underlying principles—facilitates learning and retention and sometimes transfer

3. most beneficial type of guidance (guided discovery)
   a. variant of receptive teaching similar to Socratic questioning
   b. demands learner's active participation
   c. requires learner to formulate his own generalizations and to integrate his knowledge in response to carefully programmed, leading questions
d. more structured than most discovery methods
I. Research Evidence
   A. Long-term studies
      1. number of long-term curriculum studies from the older literature
         a. compared drill and generalization methods with second and fourth graders
         b. drill—emphasized rote rules
         c. generalization—emphasized meaningful perception of relationships and derivations of generalizations
         d. generalization method—found superior
            1) except in situations calling for immediate, automatic recall of knowledge in same form as presented to the learner
         e. finding due to rote—meaningful distinction—not to discovery-reception distinction
         f. however, it is in this stage of entrance into concrete operations that children benefit most from the discovery method, when they are unsophisticated in a new, abstract subject-matter
      2. various curriculum reform movements—failed to yield research evidence in favor of the discovery method
         a. not that the evidence is negative
         b. there simply isn't any evidence
      3. sponsors of some of these projects—not concerned with proving the superiority of their programs—they were convinced from the beginning
         a. often no attempts to obtain comparable achievement test data from matched control groups
         b. rare effort to prevent operation of the "Hawthorne effect"
   B. Short-term studies
      1. a series of studies with varying amounts of guidance furnished to different groups of subjects in problem-solving situations
2. Stacy (1949)
   a. effects of directed vs. independent discovery on solving a group of simple meaningful problems, each of which required the subject to identify one item in a set of five that did not belong
   b. active participation and self-discovery—more beneficial for learning than passive participation involving only recognition of information
   c. no transfer differences seen between groups

3. Craig (1956)
   a. college students
   b. directed group—received brief explanation of principles
      1) learned and retained more principles than the independent group
   c. independent group—no help whatsoever in training situation
   d. no difference between groups on transfer test
   e. results—even less favorable for discovery methods

4. Kittell (1957)
   a. "intermediate group"—received explanation of principles plus organization of materials—superior in learning, retention, transfer to groups receiving more or less direction
   b. results—still more damaging to discovery methods

5. therefore, evidence supports the conclusion that in this type problem solving, guidance (i.e., providing information about underlying principles) facilitates learning, retention, and sometimes transfer more than provision of less guidance or furnishing specific rules for each problem

C. Summary of research evidence
   1. generally, providing guidance to the learner in the form of explanation of underlying principles—facilitates learning and retention and sometimes transfer
   2. most beneficial type of guidance (guided discovery)
      a. variant of receptive teaching similar to Socratic
questioning
b. demands learner's active participation
c. requires learner to formulate his own generalizations and to integrate his knowledge in response to carefully programmed, leading questions

3. examination of research literature allegedly supporting learning by discovery reveals
a. valid evidence—virtually nonexistent
b. enthusiasts of discovery learning—support each other by citing one another's opinions as evidence and by generalizing extravagantly from questionable findings

4. professional literature on learning by discovery regrettably exemplifies the often hollowness of the phrase, "research shows..."

5. in this instance, examination of what research shows leads to three conclusions
a. most articles cited in the literature as supporting discovery techniques actually report no findings, but consist of theoretical discussions of the superiority of discovery learning
b. most well designed, well controlled studies report neutral or negative findings
c. most studies reporting positive results (i.e., that discovery methods are superior)—poorly designed, poorly controlled, poor use of statistical analysis

6. issue of reception learning vs. independent discovery in learning, retention, and transfer—still very much in doubt
a. non-comparability of various studies
b. serious deficiencies in research design
c. failure to take into account other variables
   1) rote-meaningful distinction
   2) inductive-deductive sequencing
   3) verbalization
   4) ability level
   5) cognitive maturity and subject-matter sophistication
II. Psychological and Educational Rationale of the Discovery Method

A. In the early, unsophisticated stages of learning any abstract subject-matter—especially prior to adolescence—discovery method is extremely helpful

1. occasionally useful when the child is functioning in concrete operational stage of development
   a. simple verbal exposition with concrete, empirical props or a semi-autonomous type of discovery accelerated by the use of prompts, hints—adequate for teaching simple and relatively familiar ideas
   b. when learning task is more difficult, autonomous discovery probably enhances intuitive meaningfulness
      1) intensifies, personalizes concreteness of experience and operations of abstracting, generalizing from empirical data
      2) time-cost disadvantage of discovery learning—less serious because use of concrete, empirical prop takes time anyway

2. same rationale applies to adolescents and adults who are relatively unsophisticated in the basic concepts, terminology of a given discipline
   a. however, older individual will benefit from greater cognitive sophistication and experience relating abstractions to each other without concrete, empirical props
   b. he will move through the intuitive, subverbal stage of understanding faster than the child

B. For teaching scientific method, effective problem solving skills

1. no better way to develop effective skills in hypothesis making and testing
2. to develop desirable attitudes toward learning and independent problem solving
C. For testing meaningfulness of knowledge
   1. independent problem solving—feasible way to test whether student understands ideas he can verbalize

D. For increasing meaningfulness of material presented primarily by expository methods
   1. major rationale for laboratory work

E. Various cognitive and motivational factors enhance learning, retention, transferability of potentially meaningful ideas learned by discovery
   1. greater effort, motivation, excitement, vividness associated with independent discovery lead to greater learning, retention, transferability

F. Crucial issue
   1. discovery method is far more costly in both time and money than the receptive method
   2. are discovery methods worth the extra cost with students who are capable of learning concepts and principles meaningfully without them?

III. Use of Discovery Methods

A. Historical antecedents of discovery learning
   1. "Partly as a result of the superstitious faith of educators in the magical efficacy of problem solving and laboratory methods, we have produced in the past four decades millions of high school and college graduates who never had the foggiest notion of the meaning of a variable, a function, calculus, an exponent, molecular structure, electricity, but who have done all of the required laboratory work and have successfully solved an acceptable percentage of the required problems in differential and integral calculus, in logarithms, in molar and normal solutions, and in Ohm's law."
   2. problem solving in and of itself does not guarantee meaningful discovery learning
      a. problem solving may also be rote
      b. even the best program of problem solving is no substi-
tute for a minimally necessary amount of appropriate instruction.

C. Learning by discovery has been extrapolated from its legitimate uses to areas where it is ill-suited because of:
   1. misconceptions about intellectual development
   2. outmoded ideas about the relationship between thought and language
   3. sentimental fantasies about education and children
   4. uncritical acceptance of research evidence

D. Meaningful discovery learning vs. meaningful reception learning:
   1. large bodies of subject-matter—acquired through reception learning
   2. everyday problems of living—solved by discovery
   3. discovery learning—hardly an efficient means of transmitting the content of academic discipline
   4. meaningful discovery learning—more complex than meaningful reception learning
      a. involves antecedent problem solving stage
      b. before meaning can emerge and be internalized

E. Learning by discovery, then, has its proper place in the repertoire of accepted pedagogic techniques.
DEFINITIONS: Discovery Learning

Sequence A: Present as each word is discussed in lecture
Sequence B: Present at beginning of class, before lecture

rote-meaningful distinction—refers to the dimension from learning by
rote memorization to learning by attaching new information to
existing knowledge in the cognitive structures

discovery-reception distinction—a dimension of directedness in learning
from independent discovery of material before it is incorporated into
the cognitive structure to taking in material presented in final form
and internalizing it as it is

congrete operations—that period of cognitive development encompassing
the elementary school years in which the child learns and thinks with
congrete, empirical props

Hawthorne effect—evidence of superior achievement attributed to the
fact that the experimental group received some special, conspicuous
attention rather than to the technique itself

transfer—the ability to use knowledge gained in one situation in
another situation

pedagogic—pertaining to the art, practice, or profession of teaching
SELF-STUDY MATERIALS: Discovery Learning

Sequence A

Sequence B
1. Friedlander article
2. Bruner article
QUESTIONS TO ACCOMPANY BRUNER ARTICLE: Sequence A

1. What can the teacher infer from Bruner's hypotheses that will implement the goal of making each student as autonomous (i.e., independent) and self-propelled a thinker as possible?

2. How does Bruner hypothesise the benefit of discovery learning for the organization of information?

3. How does Bruner view discovery learning as an aid to motivation?

4. How does discovery learning fit into Bruner's view of human memory?

5. Discuss two ways in which one learns to inquire and to discover.

6. What does the act of discovery entail?

7. How does Bruner define discovery learning?

8. What kinds of learning capacities are developed by early over-achievers in school?

9. Contrast students who use generic, thematic, and whole-part mediation. Which type mediation results in greater retention of the learning task?
QUESTIONS TO ACCOMPANY BRUNER ARTICLE: Sequence B

1. How does Bruner define discovery learning?

2. What does the act of discovery entail?

3. What kinds of learning capacities are developed by early over-achievers in school?

4. Contrast students who use generic, thematic, and whole-part mediation. Which type of mediation results in greater retention of the learning task?

5. Discuss two ways in which one learns to inquire and to discover.

6. How does Bruner hypothesize the benefit of discovery learning for the organization of information?

7. How does Bruner view discovery learning as an aid to motivation?

8. How does discovery learning fit into Bruner's view of human memory?

9. What can the teacher infer from Bruner's hypotheses that will implement the goal of making each student as autonomous (i.e., independent) and self-propelled a thinker as possible?
QUESTIONS TO ACCOMPANY FRIEDLANDER ARTICLE: Sequence A

1. Compare and contrast Bruner and Friedlander's positions on discovery learning.

2. How would Friedlander suggest that a teacher enhance his students' appreciation of the ambiguities of everyday life and of formal learning?

3. In discussing the problem of evaluation in discovery methods, Friedlander suggests that "practical measures to cope with the problem may be relatively simple to devise." What measures would you suggest?

4. Why do the proponents of the discovery method consider it beneficial for student learning and thinking?

5. Do discoveries necessarily lead to productive findings and resolutions? Why?

6. Discuss failure and discovery.

7. Discuss retention and discovery.

8. Discuss discovery and synthesis of learning material.

9. What is the interaction between the "correctness" of thoughts and their retention in memory?

10. What is the interaction between discovery methods and errors in reasoning?

11. Discuss discovery and individual differences.

12. What is the relationship between reflection and evaluation and discovery methods?
13. Define ambiguity. How does ambiguity fit in with discovery learning?
QUESTIONS TO ACCOMPANY FRIEDLANDER ARTICLE: Sequence B

1. Why do the proponents of the discovery method consider it beneficial for student learning and retention and thinking?

2. Do discoveries necessarily lead to productive findings and resolutions? Shy?

3. Discuss failure and discovery.

4. Discuss retention and discovery.

5. Discuss discovery and the synthesis of learning material.

6. What is the interaction between the "correctness" of thoughts and their retention in memory?

7. What is the interaction between discovery and errors in reasoning?

8. Discuss discovery and individual differences.

9. What is the relationship between reflection and evaluation and discovery?

10. Define ambiguity. How does ambiguity fit in with discovery learning?

11. In discussing the problem of evaluation in discovery methods, Friedlander suggests that practical measures to cope with the problem may be relatively simple to devise. What measures would you suggest?

12. How would Friedlander suggest that a teacher enhance his students' appreciation of the ambiguities of everyday life and of formal learning?
13. Compare and contrast Bruner and Friedlander's positions on discovery learning.
SENNON 4 EXAMINATION: Learning by Discovery

1. Bruner sees discovery learning as an aid to motivation in the classroom because it
   a) becomes rewarding in itself.
   b) encourages rote learning.
   c) shows the learner where he can use his new and existing knowledge.
   d) usually results in greater teacher approval.

2. Bruner suggests that new information is rarely discovered as Newton thought in the form of islands of truth in an unchartered sea of ignorance because
   a) science is full of men who did not understand their own discoveries.
   b) few teachers have time to navigate their students through such a sea.
   c) some prerequisite knowledge is usually necessary before the individual grasps discovered content.
   d) discovery is like surprise, favoring the unprepared.

3. To increase his retention of the word pair "sidewalk—square" the child might use any of the following mediators except
   a) "Both sidewalk and square are made for walking."
   b) "Both the whole sidewalk and each square are made of concrete."
   c) "The child walked along the sidewalk, skipping over the lines between each square."
   d) "Sidewalks are made from squares of concrete."

4. A teacher who hopes to use discovery methods to increase independent thinking in his students might use Bruner's advice and
   a) present his students with expository mediators.
   b) stress avoidance of failure as a motivator for learning.
   c) encourage study of formal logic.
   d) attempt to develop appropriate attitudes toward research in his students.
5. Bruner asked, "how do we teach a child to risk forming an early hunch without formulating one so early with so little evidence that he is stuck with it" in a problem solving situation? The teacher might
   a) encourage the child to work with his peers to solve the problem,
   b) require the student to state his hypothesis for evaluation as soon as he thinks of it,
   c) try to discourage impulsive thinking and to encourage reflection upon the situation,
   d) eliminate discovery methods from his bag of teaching tricks.

6. Proponents of the discovery method claim that discovery encourages the child to
   a) deal effectively with failure,
   b) remain a passive observer,
   c) challenge himself to think,
   d) seek aid in evaluating his learning.

7. What is the relationship between a child's cognitive development and the teacher's use of discovery methods?
   a) The teacher can increase the child's rate of development by use of discovery.
   b) Familiarity with a child's thinking will allow the teacher to guide him in his discovery.
   c) Discovery by formal operational children leads to more errors in logic and reasoning.
   d) Only very young children should be taught by discovery.
8. One major problem Friedlander sees in the use of discovery learning is
   a) less likelihood that insights from discovery will be remembered over insights from reception.
   b) poorer synthesis of the learning material associated with discovery methods.
   c) lack of recognition of individual differences in styles of learning.
   d) high frequency of failure and its resulting confusion.

9. Friedlander states that a discovered piece of information will be forgotten unless it is incorporated into a systematic context. A similar statement might have been made by
   a) Gagne.
   b) Allport.
   c) Piaget.
   d) Ausubel.

10. Friedlander would predict that which of the following is least easily forgotten
    a) an incorrect generalization learned by discovery
    b) a correct fact learned by reception
    c) an incorrect answer rote memorized
    d) a correct hypothesis suggested by a friend.

11. In teaching an appreciation of ambiguity, Friedlander might suggest that the instructor
    a) place the statement in several ambiguous situations until he generalizes from them.
    b) recognizes the human tendency to think in "black" and "white" rather than in "gray"
    c) rely on group discussion to find alternative routes to the same solution.
    d) favor learning sequences which lead to open-ended uncertainty rather than demonstrable goals.
12. The major difference between discovery methods and reception methods of teaching is
   a) potential meaningfulness of the material.
   b) the amount of direction offered by the teacher.
   c) the student's ability to transfer what he has learned.
   d) motivation in the form of student ego-enhancement.

13. Meaningful discovery learning is more complex than meaningful reception learning because
   a) everyday problems are solved through reception learning.
   b) it involves an antecedent problem solving stage.
   c) young children can learn more through discovery than other children.
   d) rote discovery learning is more complex than rote reception learning.

14. Discovery learning is hardly an efficient means of transmitting the content of an academic discipline because
   a) discovering information before learning it takes a great deal of time.
   b) it is a simpler form of learning than reception learning.
   c) only very bright students can benefit from discovery.
   d) the vast amount of "discovery" in the classroom is rote—not meaningful.

15. Research on the question of discovery vs. reception reveals that
   a) discovery is clearly superior in lower elementary school.
   b) valid evidence supporting one method over the other does not exist.
   c) most well designed studies report superior performance from discovery.
   d) most studies supporting reception are poorly designed statistically.
16. Providing guidance to the learner in explaining principles underlying a problem situation facilitates the learner's
a) forgetting and transfer.
b) motivation.
c) learning and retention.
d) cognitive drive.

17. The most beneficial type of guided discovery appears to be
a) free, autonomous, unrestricted, unstructured discovery.
b) a variant of Socratic questioning carefully programmed by the teacher.
c) the Montessori method of free inquiry and internally motivated discovery.
d) a rather loose use of reception followed by independent reading.

18. You wish to teach the proposition that the sum of the angles of a triangle equal 180 degrees. Using a discovery method with a high probability that most students will discover this generalization you would
a) present the generalization verbally to the class without offering evidence, but utilizing it to teach that the sum of the angles of a rectangle equal 360 degrees.
b) allow your students to play with several cardboard triangles, rulers, protractors, compasses with the instruction to find any interesting facts about triangles.
c) present the generalization to the class, asking each student to verify it by working a set of problems in his workbook.
d) instruct the students to measure the angles of a triangle and add the results together, repeating this procedure until some conclusion could be formed.
19. How could a chemistry student solve difficult problems in normal and molar solutions without a coherent understanding of molecular structure?
   a) He couldn't.
   b) He could memorize the formulas involved.
   c) He could generalize from problems solved by the teacher.
   d) He could rely on his prior knowledge of physics.

20. The most plausible conclusion from your study of discovery learning is that
   a) school systems should de-emphasize discovery techniques.
   b) discovery will prove a superior method when long-term curricu­ lum projects are adequately studied.
   c) the discovery--reception dimension is more important to student retention than the meaningful--rote factor.
   d) although discovery has been used unwisely in the schools, it does have a place as one of several possible teaching methods.
VITA

Claudia Elisabeth McDade was born in Baton Rouge, Louisiana on July 31, 1948. After graduating from Baton Rouge Senior High School, she attended Newcomb College of Tulane University and Louisiana State University, Baton Rouge, where she received a B.A. degree in psychology in 1970. Later that year, she began graduate work in the department of psychology at Louisiana State University which resulted in an M.A. in 1972. Ms. McDade is a candidate for the Doctor of Philosophy degree in developmental-educational psychology.
EXAMINATION AND THESIS REPORT

Candidate: Claudia McDade

Major Field: Psychology

Title of Thesis: A Comparison of the Implications of Educational Set and Subsumption for Sequencing of Receptive Instructional Materials

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

July 12, 1974
McDANIEL, Marvin Albert, 1937-
A COMPARISON OF MUSIC ACHIEVEMENT TEST
SCORES OF FOURTH-GRADE STUDENTS TAUGHT
BY TWO DIFFERENT METHODS--KODÁLY
(THRESHOLD TO MUSIC) AND TRADITIONAL
(MAKING MUSIC YOUR OWN).

The Louisiana State University and Agricultural
and Mechanical College, Ph.D., 1974
Music

Xerox University Microfilms, Ann Arbor, Michigan 48106

© 1974

MARVIN ALBERT McDANIEL

ALL RIGHTS RESERVED

THIS DISSERTATION HAS BEEN MICROFILMED EXACTLY AS RECEIVED.