A Concept Analysis Program for Teaching Elementary Verbal Relationships

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A CONCEPT ANALYSIS
PROGRAM FOR TEACHING
ELEMENTARY VERBAL RELATIONSHIPS

by

Norman McLeod Peterson

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
April 1975
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Norman McLeod Peterson
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INTRODUCTION

"There are more people in the world than ever before, and a far greater part of them want an education. The demand cannot be met simply by building more schools and training more teachers. Education must become more efficient. To this end, curricula must be revised and simplified, and textbooks and classroom techniques improved." (Skinner, 1968, p. 28)

The task of developing improved and more efficient educational techniques is an awesome one indeed. It is, none-theless, not an impossible one. In recent years, psychology has made tremendous gains in understanding the principles of behavior and these principles are being increasingly applied to the field of education. Indeed, a "technology of teaching" is being systematically developed and applied to all aspects of the instructional process (Skinner, 1968; Semb, 1972).

The primary components of effective instruction have been delineated (Michael, 1973). Irrespective of the problems of specific curricula or of motivational procedures, three essential features underlie the educational task. The first is good source material. This material may be of virtually any form: lectures, textbooks, audiovideo materials, direct personal experience, etc., but regardless of the form it takes, to be good, it must be well sequenced, complete, and contain little or no irrelevant material.
Secondly, frequent sampling of the student's repertoire must be made to measure what learning has taken place. Such sampling serves a dual purpose. On the one hand, it provides a form of consequating the student's work; on the other hand, it provides both the student and the instructor with information about what progress has been made and about what misconceptions and deficiencies exist. Finally, some form of remediation must be made available to the student to correct these misconceptions and deficiencies. Ideally, the process of sampling and remediation should continue until the student has attained a level of performance that has previously been determined to be satisfactory.

With respect to the first component, adequate source materials, the major advance arising from the behavioral analysis of education is the concept of programmed instruction. Programmed instruction and in particular, the programmed textbook, grew out of the development of the teaching machine (Skinner, 1954). The notion of using a machine containing carefully programmed source material appeared as early as 1926 (Pressey, 1926). The great hopes of the "industrial revolution in education" (Pressey, 1932) and the initial fervor over programmed textbooks have diminished somewhat. Some of the problems with teaching machines have related to difficulties of a primarily mechanical nature (Pressey, 1960), but both the
machine and the programmed textbook have suffered from inadequate programming.

A good source of art is needed in composing a successful program, and as a result, many bad programs as well as good ones have been developed (Skinner, 1968). As programming becomes more of a science and less of an art, programs should become better and better. Another problem arises when the written program is seen as all the programming that is necessary. The programmed text is but one aspect of an effective instructional system. Motivational variables must also be programmed, as well as additional repertoire sampling and necessary remediation. Programmed textbooks are not yet perfect, but once their limitations are realized and contingencies are arranged to compensate for them, then perhaps the full benefit of the programmed textbook will become more apparent.

Elements of Programmed Instruction

Programmed instruction is not easily defined. Several methods or schools of thought exist within the field of programmed instruction. However, all programs seem to have certain features in common (Pipe, 1966).

1. The material is presented in small steps arranged in a logical sequence. These steps may range in length from one sentence in the typical "linear" program (Holland and Skinner, 1961), to a paragraph or two in the
"branching" program (Mager, 1962), to even longer units as advocated by the users of "mathetics." "Each mathetic exercise has the student respond to a whole task or to some meaningful portion of that task (Praxis Corporation, 1970)."

2. All programs require active participation by the learner. The nature of this participation varies from program to program. Skinner has argued strongly for the "composed" response (Skinner, 1968) while many designers of the branching type program advocate the use of multiple choice questions (Crowder, 1960). The mathetics program also requires a composed response.

The debate over which type of response the student should use to maximize his learning remains unresolved for the most part. Some research (Fry, 1960) lends support to the proponents of the composed response; however, the multiple choice format has been successfully used to increase conceptual learning (Reese, 1972). Furthermore, the composed response would be highly impractical, if not impossible, for most types of branching programs as will become evident in the next section.

3. All programs provide immediate feedback to the student. Most programs simply provide the correct answer, but in the case of the branching programs, an attempt is made to give the student feedback when he makes an incorrect response. If a student selects the
wrong multiple choice answer, he is directed to a par-
ticular page (Mager, 1962) which tries to present the
likely reason for the error and then tries to offer
supplementary material. It is this use of the error
response that virtually dictates the use of multiple
choice questions, since the author can, in a sense,
restrict the range of possible answers.

4. Finally, all programs allow the student to
proceed at his own rate. There is little distinction be-
tween the methods of programming in this regard. The use
of the branching format may result in more variation in
the rate since some students, as a result of their
errors, are being directed to additional material. It
is not clear that this function is not accomplished in
the other types of programs when the student simply
reviews the last unit presented prior to an error response.

Although the above suggests that clear cut distinc-
tions can be made among the various types of programs,
this is becoming less and less the case in application.
Many programs contain or combine elements from each of
the different schools of programming. In addition,
further variations of programming techniques are con-
stantly being developed. An excellent treatment of
different techniques can be found in Lysaught and
Williams (1962).
Levels of Learning

The basic rationale for programmed instruction is to improve the efficiency with which students learn. Learning is a complex phenomenon and can occur at many different levels (Espich and Williams, 1967).

The first level is the exposure level. This is essentially material that the student should merely make contact with and be aware that it exists. This may be referred to as "enrichment" material. It is never seen as essential to the student's further learning and is typically not tested. Such material has little place in a programmed textbook since one of the main emphases is on presenting little or no irrelevant material.

The second level is recognition. This type of learning requires the student to acquire broad discriminations, such as identifying correct versus incorrect statements. This type of learning may set a foundation for more complex learning and has a definite place in programmed materials.

The third level is recall. At this level the student is expected to be able to define terms in his own words. This is the terminal level of learning in many programs.

The fourth level is similar to the third and is the memory level. At this point the student is expected to recite verbatim the definitions of the terms being taught. This degree of memorization is rarely required in any type of program.
The final level of learning is conceptual learning. This level requires fine discriminations and generalizations, including the application of the concept to novel situations.

Teaching Concepts

The subject matter of the program developed by this author requires the student to be able to make certain discriminations based upon an understanding of seven basic elementary verbal relationships and the concept of stimulus generalization. These relationships represent basic concepts that the student must learn. Englemann (Becker, Englemann, and Thomas, 1971) has devoted a great deal of research to the task of teaching concepts and this program relies heavily upon his efforts.

A concept may be defined as a set of characteristics (stimulus features) shared by a set of instances in a given universe and not shared by other instances in that universe (Becker, et al., 1971, p. 241). A concept may be said to have been taught when any or all the members of the concept set are correctly identified, even though some are not in the teaching set (Becker, et al., 1971, p. 238). Essentially, concept learning is the acquisition of a certain response evoked by characteristic discriminative stimulus features.
The basic process of concept learning is as follows: in the presence of a concept instance or set of discriminative stimulus features, reinforce one response consistently; in the presence of a non-instance, reinforce some other response. The process of teaching concepts requires the instructor to identify three different types of stimulus features: those that are relevant to instances of the concept, those that are relevant to non-instances, and those that are irrelevant to both instances and non-instances. An example will serve to demonstrate this breakdown.

A table has certain relevant stimulus features. It is difficult to precisely delineate these features since they are not based upon any absolute definition, but rather on the verbal communities reinforcing practices (Skinner, 1957.) Nonetheless, a table might be defined as a flat surface, supported by some kind of leg(s), used to set things on. An instance of the concept "table" should have these as relevant stimulus features. Relevant features of non-instances might include some kind of back (a chair) or a number of drawers (a desk). Irrelevant features of both instances and non-instances might include such things as shape (tables can be round or square), type of material (wood, metal, etc.), or size (coffee tables and dining room tables, for example).
Concept learning involves a double discrimination as shown above. First a discrimination must be made on the basis of relevant features of both instances and non-instances of the concept. Secondly, a discrimination must be made between relevant and irrelevant features for either instances or non-instances.

Stimulus generalization plays a major role in concept learning. This process allows us to identify novel instances of a concept, but also leads to errors in identifying concepts. There are three critical factors which control the likelihood of stimulus generalization (Becker, et al., 1971, p. 263).

The first is the number of identical stimulus features shared by instances of two different concepts. Calling a wolf a dog occurs frequently because almost all of the relevant stimulus features of both dogs and wolves are identical. Secondly, the number of and the magnitude of the differences in irrelevant features between two concepts affects the degree to which generalization occurs. If we have learned the concept "dog" only in the presence of small dogs, our tendency to erroneously identify a wolf as a dog would be very slight because of the large difference in size. In this situation, the tendency to call a St. Bernard a dog might also be very slight. Finally, the degree of prior discrimination training alters the probability of erroneous generalization occurring. The zoologist,
who has received extensive training, is not at all likely to identify a wolf as being a dog. All of these factors must be taken into account when attempting to teach any concept or set of concepts.
DEVELOPMENT OF THE PROGRAM

Skinner's classification of verbal behavior first appeared in 1957 (Skinner, 1957). To this day, it remains the only major work in this area from the point of view of behavioral analysis. Some behaviorally oriented psychology curricula include a course on Skinner's treatment of this topic. Others would perhaps like to include such a course. This presents a problem because Skinner's book was not written as a textbook, but rather as a scholarly analysis of the topic, not easily understood by the layman or the student with little background in classical grammar. Indeed, it has proven to be difficult to understand even among many professionals in the field of behavioral psychology.

Nonetheless, courses are taught using Verbal Behavior as the primary text. As the course is taught at Western Michigan University, it involves not only reading the text, but also requires the use of carefully developed study objectives to guide the student through the book. Many sections are skipped and the order is often reversed. The instructor has written some supplementary material and spends four hours per week lecturing.

Study questionnaires indicate that most students say they spend as much or more time studying for this course than all their other courses combined. Generally, a
student at Western Michigan University enrolls in five courses per semester. Students report that they spend between six and ten hours per week studying for this course. This particular course fulfills the second and third components of effective instruction, and with the aid of considerable lecturing, supplementary written materials and extensive study objectives, has relatively adequate source materials.

This author decided that the major improvement that could be made for a class of this nature would be improved source materials. This does not imply that Skinner's analysis is necessarily being improved, although some minor changes have been made. The present task is to organize the content in a manner consistent with teaching it to large numbers of students with a minimum of time and effort on their part and a maximum of learning.

A suitable task size was necessary, at least for these initial efforts, and this author chose to begin by attempting to write a concept analysis program which would teach the basic elementary verbal relationships upon which much of the further analysis of verbal behavior is based.

Program Development

The task of choosing a suitable format for a program is not an easy one. As was indicated before, several
different methods of programming exist, as well as numerous variations and combinations of these methods. "How to write" manuals exist for virtually all the types of programs that have been written. These include a straight linear program (Pipe, 1966), intrinsic or branching programs (Walther, 1968), the "ruleg" system (Homme and Glaser, 1960), mathetics (Praxis Corporation, 1970), and concept analysis programs (Becker, et al., 1971). Some success has already been reported in writing concept analysis programs to teach behavioral principles, although these were intended to be "adjuncts" to the primary text (Wolfenden, 1972; Reese, 1972). The present program is primarily based upon the concept analysis model, but certain aspects of other techniques are present and considerable inspiration is derived from mathetics.

Analysis and Definition of Objectives

Objectives for a program should be specifiable as a set of tasks, any number of which the student can perform upon completion of the program (Mager, 1962). The objectives for this program are best described in three stages. The preliminary objectives are that the student be able to define the terms "verbal behavior," "point-to-point correspondence," "formal similarity," and "establishing operation" (Michael, 1973). This is essentially the memory or recall level of learning. Secondly, the student should
be able to list the essential features of each concept or at least identify the features that relate to a specific concept when given the set of possible relevant features. The terminal objective of the program is that given an instance of a verbal relationship, the student should be able to identify or state the category under which Skinner would classify it.

Once the objectives have been determined, it is necessary to identify the essential concepts in terms of relevant and irrelevant stimulus features that are the basis for the discriminations that must be taught. The most satisfactory manner of dealing with this problem is to develop a concept hierarchy (Becker, et al., 1971). The concept hierarchy developed for this program appears in figures 1 and 2, pages 15 and 16. These are the preparatory stages and they represent a great deal of the work necessary to write a successful program.

The Program

The basic format of the present program is the presentation of a concept, including its essential features and some examples, followed by a series of instances and non-instances of the concept the student must attempt to identify. The examples of instances and non-instances may be considered discrimination frames (Reese, 1972). These discrimination frames occur as two separate sections.
Figure 1
Concept Hierarchy of Verbal Relationships
Session I

Behavior

Verbal Non-Verbal

$S^+ \rightarrow S^R$ mediated through another person
$S^-$ Direct Reinforcement
$S_i$ Response Topography
Stimulus Conditions

Prior $S^D$?
Yes $\rightarrow$ Verbal $S^D$?
No $\rightarrow 1$

No
Mand

Yes

$S^+$ Characteristic reinforcer
Establishing operation
$S^-$ Prior $S^D$
Generalized conditioned reinforcer
$S_i$ Response Topography

Yes
Formal Similarity?
No

Echoic
Copying a Text
Taking Dictation
Textual

$S^+$ Vocal $S^D$
Vocal R
$S^-$ Non-vocal $S^D$
Non-vocal R
$S_i$ Response form Same
Type of reinforcement

Same

Legend: $S^+ = \text{Relevant features of instances}$
$S^- = \text{Relevant features of non-instances}$
$S_i = \text{Irrelevant features}$
Figure 2
Concept Hierarchy of Verbal Relationships
Session II

1. Intraverbal
   S+ Verbal R
       Verbal S
   S- Pt-to-pt
       Formal Similarity
   S_i Type of reinforcement

2. Tact
   S+ Non-verbal S
       Verbal R
   S- Verbal S
       Non-verbal R
   S_i S Mode
       Type of reinforcement

Tact Extension
Generic Metaphorical Metonymical

S+ All essential stimulus features
   S+ Some S+ S+ No S+
S- Not all S+
   S- All or none S+ S- Some or all S+
S_i Accompanying S_i
   S_i Same as generic S_i Same as generic

Legend:  S+ = Relevant features of instances
         S- = Relevant features of non-instances
         S_i = Irrelevant features

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The first set of frames following the presentation of a concept primarily serves the function of testing the student's understanding of the material he has just read. If he has difficulty answering some of these frames he goes on to a longer series of frames intended to serve both a teaching function and an additional testing function. The answer provided for each frame indicates why the answer given is correct by listing the essential features present in the example. The segment of the program over the concepts "Echoic Behavior" and "Copying a Text" is presented in Appendix I.

Once the text and the discrimination frames were written, it was necessary to test for clarity and completeness. This was accomplished by presenting the program to one student at a time and making necessary revisions based on the feedback received before passing it to another subject. This was done until all obvious problems were corrected and it was felt that the program was ready to be presented to a large group of students. This aspect of program development is emphasized in virtually all descriptions of how to write a program.

In summary, this study attempted to develop a concept analysis program to teach elementary verbal relationships from a behavioral perspective. The basic format was the presentation of a concept followed by a series of discrimination frames containing instances and non-instances
of the concept to be identified. A test performance of 90% was set as an appropriate criterion of success.
GROUP VALIDATION

Subjects: The primary subjects were 16 male and female college freshmen who were enrolled in an experimental program at Western Michigan University, the Student Centered Education Project (SCEP). The SCEP program is generally a student's entire class load for a semester and allows a student to complete most of the requirements for a psychology major in fewer semesters. All SCEP students must have already completed the introductory psychology course and received a letter grade of "A". All of these students reported that they had no previous exposure to Skinner's analysis of verbal behavior. One hundred fifty-two male and female undergraduates enrolled in a course on verbal behavior in the standard curriculum at Western Michigan University served as an additional control group. The majority of these students were at the junior or senior classification. Therefore, one experimental and two control groups were employed in this study.

Procedure: During weeks two through four of the winter semester 1974, scores on selected test items were collected from the 152 students in the course on verbal behavior. These test items corresponded to the material presented in the program written by this author. Several of these
test items were then included in the tests given to the remaining two groups.

The 16 SCEP students were paired on the basis of previous cumulative test scores obtained prior to the time of this study. The SCEP students met daily in a four hour time block and each day had two reading assignments and two 20 point quizzes over those readings. At the time of the pairing, the students had just completed a segment of study equivalent to the course in behavior analysis, Psychology 350, taught at Western Michigan University. At the end of that sequence, each student took a final exam worth 50 points. The quiz scores were added to the final exam scores to provide the basis for the pairing.

Each member within a pair was then randomly assigned to either the control group or the experimental group. The students in the control group read the sections of Verbal Behavior which dealt with the basic elementary verbal relationships. The students in the experimental group read this author's programmed material covering the same concepts. Since the material would normally take more than four hours to thoroughly study, it was broken into two sections. A pre-test was administered to all the SCEP students to further insure that no one had any prior knowledge of Skinner's classification. This was given at the beginning of the first session. The second session occurred one week later.
During each of the two sessions, the subjects read their respective material, with the aid of study objectives, for a period of three hours. The study objectives appear in Appendix III. The study objectives for the group reading Verbal Behavior also contained supplementary material the experimenter thought necessary to fully equate the material, in terms of content, presented to each group. At the end of each reading period, an hour-long exam was given to the subjects. The two exams appear in Appendix II. (The items marked with an asterisk were taken from the exams given earlier to the students in the Verbal Behavior course.)

Before the beginning of the second session, one-half of the pairs of SCEP students were reversed. In other words, half of the students who read the program the first time read from Verbal Behavior during the second session and half of those who read the book during the first session read the program during the second. This was done to prevent cumulative failure from biasing the results of the second session. A complete reversal was not used because this might obscure the possible effects of the second half of the material being more difficult and would also possibly bias the results of the second test in the opposite direction of no reversal.

The tests were graded by teaching apprentices who normally grade exams for the Verbal Behavior class. They
were not told to which group the test they were grading belonged. All the papers were then graded by the experimenter. Reliability was calculated (agreements/agreements + disagreements x 100%) and was found to be 97.5%.

An error analysis was performed to determine the performance on each concept presented at three different levels of learning: recognition, recall, and conceptual.

Finally, the performance of both SCEP groups was compared to that of the students in the Verbal Behavior class. No formal analysis was made of this comparison. This was done only to determine whether the performance of the SCEP experimental group, if superior to the control group, was approximately equal to the performance of the students in the traditional class. About two-thirds of the students in the Verbal Behavior class received a letter grade of "A".
RESULTS

The pre-test administered to the 16 SCEP students indicated that no individual had any significant knowledge of the subject matter, and that a significant difference did not exist between the control group's mean per cent correct and the mean per cent correct for the experimental group. These scores are presented in Table 1, page 25.

The test scores obtained from exam I indicate a better mastery of the subject matter by the group that read the concept analysis program. The results are presented in Table 2, page 26. A correlated pairs "t" test failed to result in statistical significance (p<.05); however, in only one case did the control member of a pair score higher than his experimental partner.

The results from exam II yielded a greater difference in the scores between the two groups and are presented in Table 3, page 27. On this exam, each member of the experimental group scored higher than his partner in the control group, and the difference between the means of the two groups was found to be statistically significant (p<.01).

Because some of the test items on exam II were over material presented in session I, the degree of prior learning may have influenced these later results. Consequently, the session II exams were rescored and results were obtained only for those questions covering session II
material. These scores are presented in Table 4, page 28. These results yielded an even greater difference between the means for the two groups.

A comparison between the test scores on items given to the Verbal Behavior class and the two SCEP groups indicates that although the scores for the SCEP control group were generally well below the mean scores of the students in the Verbal Behavior class, the scores of the SCEP experimental group were only slightly lower, and in one case, the mean score was higher. These data are presented in Table 5, page 29.

The results of the analysis of the performance on each separate concept appear in Table 6, page 30. Performance on five of the nine concepts was above 90% on concept discrimination questions answered by the experimental SCEP group. Recognition level questions were asked over seven of the nine concepts and the scores on five of these were above 90%. Recall level questions were asked over three of the concepts and one concept yielded a score above 90%. In all but one case, recall level learning of the "mand," the scores for all concepts across all levels of learning tested were higher for the experimental group.
Table 1

Pre-Test Scores in Per Cent Correct

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$\bar{x} = 20.8 \quad \bar{X} = 10.4$
Table 2

Exam I Scores in Per Cent Correct

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\[ \bar{X} = 70.7 \quad \bar{X} = 80.3 \quad D = 76.0 \quad D^2 = 2637.50 \]

"t" = 1.65
Table 3

Exam II Scores in Per Cent Correct

<table>
<thead>
<tr>
<th>Pair #</th>
<th>Control Group</th>
<th>Experimental Group</th>
<th>D</th>
<th>$D^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80.1</td>
<td>100.0</td>
<td>19.9</td>
<td>396.01</td>
</tr>
<tr>
<td>2</td>
<td>77.7</td>
<td>95.4</td>
<td>17.7</td>
<td>313.29</td>
</tr>
<tr>
<td>3</td>
<td>75.4</td>
<td>86.3</td>
<td>10.9</td>
<td>118.81</td>
</tr>
<tr>
<td>4</td>
<td>70.3</td>
<td>93.1</td>
<td>22.8</td>
<td>519.84</td>
</tr>
<tr>
<td>5</td>
<td>65.7</td>
<td>80.0</td>
<td>14.3</td>
<td>204.49</td>
</tr>
<tr>
<td>6</td>
<td>72.6</td>
<td>80.1</td>
<td>7.5</td>
<td>56.25</td>
</tr>
<tr>
<td>7</td>
<td>71.4</td>
<td>80.1</td>
<td>8.7</td>
<td>75.69</td>
</tr>
<tr>
<td>8</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>------</td>
</tr>
</tbody>
</table>

$\bar{X} = 73.3 \quad \bar{X} = 87.9 \quad D = 101.8 \quad D^2 = 1684.38$

"t" = 6.14
Table 4

Exam II Scores in Per Cent Correct
Excluding Questions Over Session I Material

<table>
<thead>
<tr>
<th>Pair #</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75.8</td>
<td>100.0</td>
</tr>
<tr>
<td>2</td>
<td>92.3</td>
<td>91.2</td>
</tr>
<tr>
<td>3</td>
<td>69.2</td>
<td>75.8</td>
</tr>
<tr>
<td>4</td>
<td>63.7</td>
<td>85.7</td>
</tr>
<tr>
<td>5</td>
<td>49.5</td>
<td>80.2</td>
</tr>
<tr>
<td>6</td>
<td>71.4</td>
<td>76.9</td>
</tr>
<tr>
<td>7</td>
<td>55.0</td>
<td>89.0</td>
</tr>
</tbody>
</table>

\[ \bar{X} = 68.1 \quad \bar{X} = 85.5 \]
Table 5

Comparison Between Scores Obtained by Verbal Behavior Class and two SCEP Groups in Per Cent Correct

<table>
<thead>
<tr>
<th>Exam Question</th>
<th>Verbal Behavior Class</th>
<th>SCEP Experimental</th>
<th>SCEP Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-3</td>
<td>94.4</td>
<td>91.7</td>
<td>83.1</td>
</tr>
<tr>
<td>I-4</td>
<td>90.5</td>
<td>88.7</td>
<td>83.7</td>
</tr>
<tr>
<td>I-5</td>
<td>86.5</td>
<td>90.0</td>
<td>77.5</td>
</tr>
<tr>
<td>II-2</td>
<td>95.3</td>
<td>91.7</td>
<td>77.4</td>
</tr>
<tr>
<td>II-3</td>
<td>96.7</td>
<td>90.8</td>
<td>82.6</td>
</tr>
<tr>
<td>II-4</td>
<td>91.0</td>
<td>80.9</td>
<td>57.1</td>
</tr>
<tr>
<td>II-5</td>
<td>92.1</td>
<td>73.6</td>
<td>65.3</td>
</tr>
</tbody>
</table>

Legend: Roman numeral indicates either exam I or exam II (See Appendix II)
Arabic numerals indicate question number
Table 6

Mean Scores for Each Concept in Per Cent Correct

<table>
<thead>
<tr>
<th>Concept</th>
<th>Levels of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recognition</td>
</tr>
<tr>
<td>&quot;Verbal Behavior&quot;</td>
<td>--</td>
</tr>
<tr>
<td>&quot;Mand&quot;</td>
<td>78.6 (50.0)</td>
</tr>
<tr>
<td>&quot;Echoic&quot;</td>
<td>98.2 (95.3)</td>
</tr>
<tr>
<td>&quot;Copying a Text&quot;</td>
<td>100.0 (97.3)</td>
</tr>
<tr>
<td>&quot;Taking Dictation&quot;</td>
<td>88.6 (80.5)</td>
</tr>
<tr>
<td>&quot;Textual&quot;</td>
<td>90.6 (78.1)</td>
</tr>
<tr>
<td>&quot;Intraverbal&quot;</td>
<td>96.4 (78.6)</td>
</tr>
<tr>
<td>&quot;Tact&quot;</td>
<td>90.5 (52.4)</td>
</tr>
<tr>
<td>&quot;Tact Extension&quot;</td>
<td>--</td>
</tr>
</tbody>
</table>

Legend: ( ) indicates control group scores
This study suggests that the programmed instructional materials written by the author represent a significant improvement in source materials required to effectively teach Skinner's classification of elementary verbal relationships. The results indicate that not only did the experimental group obtain significantly higher test scores than the control group reading only *Verbal Behavior*, but that their test scores were very close to the 90% criterion decided upon prior to the testing of the program.

When compared to the performance of the students in the traditional course at WMU on *Verbal Behavior*, the performance of the students in the experimental group indicates that they understood the subject matter almost as well as the students in the *Verbal Behavior* class. This would seem to indicate that a considerable savings of time and effort would be possible both in terms of the time students spend in contact with the course materials and the time and effort required of the staff of the *Verbal Behavior* course to insure adequate performance by the students. Further research would be necessary to quantify this savings, but a rough comparison can be made at this time.

In addition to reading the text, *Verbal Behavior*, the students in the *Verbal Behavior* course are provided with detailed study objectives, often containing instructional
material, supplementary handouts, copies of old exam questions and answers (upon which new exams are frequently based) and typically spend three to four hours per week in lectures over the reading assignments. This is in addition to the six to ten hours per week the students report that they spend studying reading assignments and their lecture notes. The material presented in the program is roughly equivalent to two weeks content in the Verbal Behavior class. The experimental group spent approximately six hours studying this material, compared to the approximately 18 to 28 hours spent by the students in the traditional course.

The results of exam I probably do not reveal the actual magnitude of the difference between the two groups of SCEP students. Although all students were told that their grade would not suffer as a result of having "worse" study materials because remediation would be available, it was later reported that while the experimenter was temporarily out of the room, several students in the experimental group took it upon themselves to act as tutors to some students in the control group because they thought they were getting "the short end of the deal." In addition, no study objectives were provided to the experimental group during the first session. This perhaps explains the poor performance of the experimental group on the recall and recognition level questions over the "mand" concept.
Study objectives indicating that the student should be able to define certain terms were given to both groups during session II (see Appendix III). The experimental group scored 98.6% on the recall item over "tact extension" on the second exam, compared to 40% on the "mand" and 87% on "verbal behavior" on the first exam.

The analysis of the performance of the experimental group on the test items at the conceptual discrimination level (see Table 6, page 30) indicates that the students mastered six of the nine concepts presented. The remaining three appear to represent the most difficult concepts (cf. scores of the control group on these concepts, Table 6). These results indicate that further revisions and testing of the sections on the "mand" and the "tact" would be necessary to bring the level of learning up to the 90% criterion. The third concept, "tact extension," presents a somewhat different problem.

Tact extension requires a double discrimination. First the student must decide whether the example presented is a tact relationship; only after this has been done can the student then identify the type of extension involved. The test items on exam II, question 5 (see Appendix II) magnify this problem by requiring the student to identify four of seven examples as "none." These four items are examples of other verbal relationships. Before any revision is done on this section, it would seem that further testing is necessary.
Since there was some difficulty with the "tact" concept, some of the errors on "tact extension" could be the result of identifying a non-instance of the "tact" concept as a "tact." Once the "tact" concept is mastered, then "tact extension" can be more accurately tested.

Nonetheless, although all concepts were not mastered, the performance of students reading the program was superior to that of the students reading Verbal Behavior.
REFERENCES


Michael, J., "The Essential Components of Effective Instruction and Why Most College Teaching is Not," Western Michigan University, 1973. (Mimeographed)


APPENDIX I

Verbal Behavior Under the Control of Verbal Stimuli

When considering verbal behavior controlled by prior discriminative stimulus conditions, it is necessary to make a distinction between two major subdivisions of such stimuli. These are VERBAL and NON-VERBAL stimuli. In this section we will be primarily concerned with verbal stimuli. A verbal stimulus may be defined as a stimulus resulting from the response-product of someone else's verbal behavior. A response-product is the result of verbal response. When we talk, we produce an auditory stimulus which other people (and ourselves) can hear and react to as listeners. When we write something, we produce as a response-product, a set of verbal stimuli which other people (and ourselves) can read.

When our verbal response produces an auditory response-product which sounds like the stimulus that controlled the response, we call the response ECHOIC. An echoic response has four essential defining features. First, the stimulus must be an auditory verbal stimulus; that is, it must be the response-product of someone's speech. Secondly, the response must be vocal, not written. Third, there must be point-to-point correspondence between the stimulus and the response. By point-to-point correspondence, we mean that

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the first part of the stimulus must control the first part of the response, the middle of the stimulus must control the middle of the response, etc. For example, the auditory "tip" controls the response "tip" rather than "pit." The "t" controls the "t" and indicates that it is the first part of the response rather than the last part as in the response "pit." The "i" and the "p" in the stimulus control the "i" and the "p" in our response, respectively. Finally, there must be formal similarity between the stimulus and the response-product. In other words, the response-product of saying "tip" produces an auditory stimulus which is similar in sound to the original stimulus "tip" which controlled our response.

Another type of verbal behavior which also has point-to-point correspondence and formal similarity is COPYING A TEXT. A good example of this type of verbal behavior occurs when you take notes from a textbook and copy the exact wording. Another example would be copying a phone number from a phonebook. The only difference between this type of behavior and echoic behavior is in the stimulus and response mode. From the examples given, it should be clear that the stimulus for copying a text is visual and the response involves writing. Note that the response-product of writing is a visual stimulus.

Both echoic responses and copying a text are typically reinforced by some form of generalized conditioned
reinforcement. Some degree of reinforcement may be the result of our being able to hear and see our own responses and because of the formal similarity, our efforts may be reinforced by the closeness of the respective approximations.
Questions over Echoic Responses and Copying a Text

1. The four essential features of an echoic response are
   a) The stimulus is ___________________.
   b) The response is _____________________.
   c) There (is/is not) ____________point-to-point correspondence.
   d) There (is/is not) ____________formal similarity.

2. The four essential features of copying a text are
   a) The stimulus is _____________________.
   b) The response is _____________________.
   c) There (is/is not) ____________point-to-point correspondence.
   d) There (is/is not) ____________formal similarity.

The following questions can be answered by writing either ECHOIC BEHAVIOR, COPYING A TEXT or NEITHER in the blanks.

3. A tendency to say "ice cream" as the result of hearing someone else say "ice cream" is an example of ________.

4. A tendency to say "dog" as the result of seeing a dog is an example of _____________________.

5. When someone tells us their name and we repeat it to remember it, we are engaging in _____________________.

6. Your instructor writes the next assignment on the blackboard and you write it in your notebook. Your behavior is ________________________.
ANSWERS

1. a) AUDITORY
   b) VOCAL
   c) IS
   d) IS

2. a) VISUAL (Note that it also must be a verbal stimulus)
   b) WRITTEN
   c) IS
   d) IS (Note that the response-product becomes a visual S)

3. ECHOIC BEHAVIOR The stimulus is auditory, the response is vocal and there is both point-to-point correspondence and formal similarity.

4. NEITHER The stimulus isn't a verbal stimulus. This type of relationship will be discussed in a later section.

5. ECHOIC BEHAVIOR Check to see if all four conditions are met.

6. COPYING A TEXT The stimulus is visual, the response is written. If you write it down correctly, there is point-to-point correspondence and formal similarity. Remember, if there is formal similarity, the stimulus and the response-product must both be in the same stimulus mode—either both auditory or both visual.

If you answered all of these questions correctly, go on to page 21. If you missed any or are still not sure, you can readily identify examples of echoic responses or copying a text, work through the practice problems on page 19.
Echoic and Copying a Text: Review

Answer the following questions by writing ECHOIC BEHAVIOR, COPYING A TEXT, or NEITHER.

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Response</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The written word &quot;dog&quot;</td>
<td>Saying &quot;dog&quot;</td>
<td></td>
</tr>
<tr>
<td>2. The written word &quot;dog&quot;</td>
<td>Writing &quot;dog&quot;</td>
<td></td>
</tr>
<tr>
<td>3. Hearing the word &quot;dog&quot;</td>
<td>Saying &quot;dog&quot;</td>
<td></td>
</tr>
<tr>
<td>4. Hearing the word &quot;dog&quot;</td>
<td>Writing &quot;dog&quot;</td>
<td></td>
</tr>
</tbody>
</table>

5. A mother is trying to teach her child the response "cat." She points at a cat and says "cat." The child then says "cat." The child's response is  

6. A tendency to say "stop" as the result of seeing a stop sign is an example of  

7. Someone asks you to write the first word that comes to mind. They say "verbal" and you write "behavior." Your response is an example of  

Check your answers on the next page. You have formulated your answers first, haven't you?
1. NEITHER Because the stimulus is visual and the response-product is auditory, there can be no formal similarity. There is, however, point-to-point correspondence.

2. COPYING A TEXT The stimulus is visual, the response is written and there is both formal similarity and point-to-point correspondence.

3. ECHOIC BEHAVIOR The stimulus is auditory, the response is vocal and there is both formal similarity and point-to-point correspondence.

4. NEITHER The stimulus is auditory and the response-product is visual. This means there can be no formal similarity. Note that there is point-to-point correspondence.

5. ECHOIC BEHAVIOR All four features are present.

6. NEITHER This is like number one.

7. NEITHER There is no point-to-point correspondence between the stimulus "verbal" and the response "behavior."
APPENDIX II

Exam I

1. a) Define "Verbal Behavior." (2)
   b) According to Skinner's definition, indicate which of the following examples of behavior are to be considered "verbal" and which "non-verbal." The behavior to be classified is underlined.
   i) A physician squirts a little bit of lemon juice into a child's mouth and this causes the child to salivate. (1)
   ii) A person goes to the refrigerator and gets a glass of orange juice to drink. (1)
   iii) A person asks a friend to bring him a glass of orange juice, but the friend refuses. (1)
   iv) The telephone rings and a person picks up the receiver and says "Hello," but by the time he answers, the caller has hung up. (1)

2. There are two different ways of identifying the mand relationship.
   a) One is in terms of the unique relationship between what and what? (1,1)
   b) The other is in terms of the independent variable occurring immediately prior to and which is causally responsible for the form of the mand. Name and describe this variable. (1,1)
   c) Define "generalized conditioned reinforcer." (2)

*3. a) Define "point-to-point correspondence." (2)
   b) "formal similarity." (2)
   c) Fill in the cells of the table shown below. (2)

<table>
<thead>
<tr>
<th>S^D Mode</th>
<th>R Mode</th>
<th>pt-to-pt?</th>
<th>formal sim?</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echoic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
*4. Classify the following behaviors as either Mand, Echoic, Textual, Copying a Text, or Taking Dictation. Also fill in the rest of the cells. (1)

a) writing "cup" as the result of seeing a cup.
b) saying "water" because of thirst.
c) saying "cat" as the result of seeing "cat" written on a blackboard.
d) saying "cat" as the result of hearing someone else say "cat."
e) writing "Give me food" as a result of hearing someone say "Give me food."

<table>
<thead>
<tr>
<th>Type of</th>
<th>Pt-to-pt R</th>
<th>Corresp? of R-Product</th>
<th>Sense Mode</th>
<th>Form Sim (Aud or Vis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*5. Same instructions as #4. (1 each)

a) saying "airplane" as a result of hearing an airplane.
b) writing "locomotive" as a result of hearing the Morse code signal (dot and dashes) spelling out "locomotive."
c) saying "happy" as a result of hearing someone say "joyful."
d) holding up your hand as a result of hearing someone say "hand."
e) saying "ten" as a result of seeing the number "10" on a chalkboard.
Exam II

1. Name and describe each of the 3 major types of Tact Extension. (1 for each name; 2 for each description)

2. Fill in the cells of the table below by answering each of the questions below. (3)

   a) Is the form of the response determined by an establishing operation, Verbal $S^D$, or non-verbal $S^D$?
   b) Does the definition restrict the response to being Vocal, Writing, or can it be Either?
   c) In those cases where you wrote "verbal $S^D$" in a), does the definition specify that there must be point-to-point correspondence between $S$ and $R$? (yes or no)
   d) In those cases where you answered either "verbal $S^D$" or "non-verbal $S^D$", does the definition restrict the sense mode of the $S$? (Write no or yes: if yes, also write whether it must be visual or if it must be auditory.)
   e) In those cases where you wrote "yes" to c), does the definition specify that there must be formal similarity between the $S$ and $R$-product? (write "yes" or "no")

<table>
<thead>
<tr>
<th>TD</th>
<th>Echoic</th>
<th>IV</th>
<th>Tact</th>
<th>Mand</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Someone provides information about a behavioral relationship and you have to indicate which of the 7 elementary verbal relationships it might be. If the information excludes all 7, then write "none." (2 for each error) (note that there may be more than one answer)

   a) $R$ is controlled by a verbal $S^D$.
   b) $R$ controlled by $S^D$ which is NOT visual.
   c) The behavioral relationship is non-verbal.
   d) $R$ is NOT vocal and there is point-to-point correspondence between $S$ and $R$.
   e) $R$ controlled by a tactile $S$.
   f) Prior $S^D$ is non-verbal, but does show point-to-point correspondence between $S$ and $R$.
*4. Classify each of the following examples as one of the 7 elementary verbal relationships (mand, tact, etc.) or write "none."

Response . . . as a result of . . .

a) saying "table" seeing a table
b) writing "chair" seeing a table
c) saying "house" seeing the written word "house"
d) writing "house" hearing someone say "bread"
e) saying "butter" bread being an effective reinforcer
f) writing "butter" hearing someone say "bread"
g) saying "bread" hearing an airplane go overhead
h) writing "bread" hearing someone say "water"
i) saying "fast" hearing someone say "water"
j) writing "airplane" hearing someone say "water"
k) saying "water" hearing someone say "water"
l) writing "faucet" hearing someone say "water"

*5. Identify each of the following types of tact extension, or say "none" if the example doesn't exemplify any of the three types. (2 for each)

a) a tendency to say "carpet" as a result of seeing a towel spread on the floor.
b) same tendency as a result of seeing the word "rug" on the chalkboard.
c) same tendency as a result of seeing a bare hardwood floor.
d) same tendency as a result of hearing someone describe a hardwood floor.
e) same tendency as a result of seeing an unusual looking carpet.
f) same tendency as a result of the fact that you would like to have your floor carpeted.
g) a tendency to place a carpet on a floor.
APPENDIX III

SCEP Control Group Objectives

Section I Objectives

1. Be able to define "verbal behavior." (pages 1-2)

2. Be able to define the essential features of the mand. (35-36) There are two ways of identifying the mand relationship. One is in terms of a unique relationship between the form of the response and the reinforcement that has characteristically been received for that response.

   Another way of defining the mand relationship is in terms of the independent variable occurring immediately prior to and which is causally responsible for the form of the mand response. In the case of the mand this variable is an ESTABLISHING OPERATION for a reinforcer. An establishing operation is whatever it was that was responsible for the thing being manded becoming an effective reinforcer. Skinner relies heavily upon deprivation and aversive stimulation as his establishing operations, but many reinforcers seem only remotely related to such establishing operations, and for this reason I prefer the more general term "establishing operation."

3. What is a generalized conditioned reinforcer; that is, distinguish it from an ordinary conditioned reinforcer. Do this in terms of the way it acquires its unique characteristic, and also in terms of the characteristic itself (namely, its lack of dependence upon any specific establishing operation). (52-55)

4. Be able to give the essential features of Echoic behavior. (55-56)

5. — — of Textual behavior. (65-66)

6. — — of the two types of transcriptive behavior, copying a text and taking dictation. (69-70)
7. Be able to explain what is meant by "point-to-point correspondence" and "formal similarity." (55, 59, 61, 68) Skinner sometimes uses the term formal correspondence to refer to formal similarity. Note that Echoic behavior and copying a text have both formal similarity and point-to-point correspondence. Textual behavior and taking dictation have point-to-point correspondence but NO formal similarity.

"Point-to-point correspondence" means that the first part of a stimulus controls the first part of a response, the middle part of the stimulus controls the middle of the response, etc. (i.e., the first syllable in the word "alligator," as a verbal S, controls the first part of the echoic response "alligator."

For two events to have formal similarity they must be measurable in the same dimensional system and when so measured must resemble one another. Thus, stimuli and responses can never have formal similarity, since they are never measured in the same dimensional system. Stimuli and response-products, however, may have formal similarity.
Section II Objectives

For SCEP Experimental Group

1. Know the essential features of intraverbal behavior. (30-31)

2. - - - of the tact. (35-36)

3. Note carefully the table showing the 7 elementary relationships on page 36.

4. You have now learned something about all 7 of the elementary forms of verbal behavior. For each of the relationships you should be able to answer the following questions:
   a. What controls the form of the response?
   b. Does the definition specify whether the response must be vocal, written, or can it be either?
   c. Does the definition specify the existence of a typical prior controlling stimulus for the response?
   d. If the answer to "c" is yes, does the definition specify that this immediately prior S must be a verbal stimulus?
   e. If the answer to "d" is yes, does the definition specify that there must be point-to-point correspondence between the S and the response? (review page 15)
   f. If the answer to "e" is yes, does the definition specify that there must be formal similarity between the S and the response-product? (review pages 15 and 16)
   g. Does the definition specify whether the sense mode of the S is visual or whether it is auditory? (or both . . . or not specified)

5. Be able to describe the essential features of the three major types of tact extension. (41-44) Note especially questions 1, 2, and 3 on page 45. Also, remember that for a response to be tact extension, it must first be a tact and not one of the other 6 elementary relationships.
Section II Objectives

For SCEP Control Group

1. Be able to give the essential features of intraverbal behavior. (71-74)

2. -- of the tact. (81-86)

3. You have now learned something about all 7 of the elementary forms of verbal relationships. For each elementary relationship you should be able to answer the following questions:
   a. What controls the form of the response?
   b. Does the definition specify which musculature the response must be executed with, and if so, which? (vocal, writing, etc.)
   c. Does the definition specify the existence of a typical prior controlling stimulus for the response?
   d. If the answer to "c" is yes, does the definition specify that this immediately prior S* must be a verbal stimulus?
   e. If the answer to "d" is yes, does the definition specify that there must be point-to-point correspondence between the S* and the R?
   f. If the answer to "e" is yes, does the definition specify that there must be formal similarity between the S* and the R-product?
   g. Does the definition specify whether the sense mode is visual or auditory? (or both . . . or not specified)

4. Be able to describe the essential features of the three major types of tact extension: GENERIC, METAPHORICAL, and METONYMICAL. (91-101)

Skinner's analysis of metaphorical extension draws heavily upon metaphor as it is used in literature; furthermore, the analysis is not well stated. Metaphorical extension is quite common in day-to-day verbal behavior. When we see a zebra and say it is
like a horse, our response "horse" is controlled by stimulus properties which are common to both horses and zebras. These properties do enter into the contingency respected by the verbal community. The crucial difference between generic and metaphorical extension is the number of properties present in a novel stimulus situation. If all the properties upon which reinforcement is contingent are present, the response is generic extension; i.e., seeing a smaller or unusual type of horse . . . we still say "horse" because all the defining stimulus properties of horses are present. To say "horse" in the presence of a zebra is metaphorical because only some of the defining properties of a horse are present . . . not all of them.

Note that in the case of metonymical extension none of the defining stimulus properties are present, only those which accompany the defining properties. Ignore all examples of metonymy that Skinner uses from literature (they are not quite what he has defined anyway) and pay very close attention to the example of the response "orange" on page 101. The process involved in this example best typifies metonymical extension.