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AN EMPIRICAL ANALYSIS
OF THE COMPONENTS OF BEHAVIORAL OBJECTIVES

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Rule Learning and Systematic Instruction in
Undergraduate Pilot Training

Vernon S. Gerlach, Principal Investigator

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I. Problem

Behavioral objectives are used by instructional designers, researchers, and evaluators. However, virtually no empirical analysis of the structure and characteristics of such objectives has been reported. Many individuals have been content to generate statements of objectives with seeming confidence that almost any explicit statement of the goals of the learning process will serve as a behavioral objective. As a result, so called "behavioral" objectives display a wide range of characteristics.

Deno and Jenkins (1969) were among the first to note that behavioral objectives did not necessarily deal with highly observable behaviors. They asked 14 in-service educators to rate the observability of 99 verbs drawn from the objectives of a "widely-cited experimental curriculum." The results clearly showed that many commonly used verbs received intermediate ratings (around 3.0 on a 1 to 5 scale), and that almost half of the "action" verbs received ratings toward the "un"-observable end of the scale (3.0 to 4.9). Deno and Jenkins concluded that verbs used in behavioral objectives are selected for consistency of usage rather than for maximum observability per se, and that the terms "behavioral" and "observable" may not be synonymous.

This study by Deno and Jenkins dealt with only one component of an objective, the verb, rated without context. Most advocates of behavioral objectives agree that an objective should have three components: (a) the verb, which states what the learner is to be able to do (e.g., to draw), (b) the condition, which states the circumstances under which the action is to take place (e.g., given a straight edge, pencil, and paper), and the criterion, which states how well the action is to be performed (e.g., with an accuracy of 90% or greater).

Gerlach and Barron (1974) extended the work of Deno and Jenkins in a study designed to assess the role of the condition and criterion. Twenty-one students in an advanced education course rated verbs, conditions, and criteria, as well as statements containing these components. They obtained verb ratings quite similar to those reported in the Deno and Jenkins study. They also found that the choice of condition and criterion statements appeared to have some influence on the rating of an objective. This finding led to a reexamination of the assumption that the verb is the most important part of an objective.

The present study was designed to determine the ratings of typical verbs, conditions, and criteria used in behavioral objectives. Additionally, the role which each type of component plays in a complete objective was observed. Finally, the study was designed to explore the effects of four scales used to rate the various expressions.

II. Method

Materials

Twenty-five objectives were created by combining, on a quasi-random basis, the required number of verbs, conditions, and criteria. Some statements were rearranged to avoid combinations that seemed either meaningless or frivolous to the research team (e.g., "to like . . . given appropriate tools"). The components were selected to cover the entire range of ratings (1.0 to 5.0) obtained in previous work (Deno and Jenkins, 1969; Gerlach and Barron, 1974). The rating booklets were prepared by randomly listing the 25 items of each type (verbs, conditions, criteria, objectives) on a single page and counterbalancing the order of the pages to control for order effects. Each item appeared once in its component list and once in the list of objectives. The four pages of lists, containing the 100 items to be rated, plus a cover page giving instructions and five sample ratings constituted the experimental booklet. The four rating scales and four page orders generated sixteen difference booklets.

The four rating scales used in this study were most observable - least observable, precise - vague, clear - ambiguous, and concrete - abstract. Each subject rated items on only one of these scales. This scale was presented on each page of the booklet, along with a diagram on which the extremes were labeled A and E. Subjects recorded their ratings on an IBM scoring sheet.

Subjects and Procedures

Eighty students in an upper-division education class participated in this study as part of a regular class session. The booklets were interleaved in such a manner that every sixteenth subject received the same booklet. The subjects were given oral and written instructions explaining the method of rating and the use of the scoring sheet.

Data Analysis

This study was designed to ascertain the correlations between the three separate components of behavioral objectives and the complete objective in which they are embedded. The basic data consists of the means and variances of the subjects' ratings of each of the 100 items in the booklet. All bivariate coefficients reported in this paper are Pearson product-moment correlation coefficients.

Analysis was done by computer, using appropriate SPSS programs, after data were transferred from the IBM answer sheets to punched cards.

III. Results

When the mean ratings for the objectives are compared with those of the components, it becomes apparent that the verb's effect on the rating is not as significant as had been assumed. Table 1 gives the means and variances for four of the 25 objectives and components. These ratings are fairly consistent across the four rating scales. In the first two objectives, #11 and #18, little difference is found when the mean rating for the objective is compared with the verb rating. However, when similar comparisons are made for the last objectives, #15 and #2, distinct differences are observed. In these latter cases, the ratings for the conditions and criteria are different from those of the verbs and the ratings for the objectives tend to agree more with those obtained for the conditions and criteria.

The correlations between mean ratings of individual components and objectives are shown in Table 2. In each case, the correlation is based on 25 pairs of scores--25 component means and 25 objectives. The pattern of intercorrelations is generally the same for each rating scale, and the relative homogeneity of the coefficients suggests that each component makes nearly the same contribution to the rating of the objective.

Positive correlations were also found between the mean ratings of conditions and criteria. These correlations ranged from +.14 to +.36 and do not overlap with those reported in Table 2, indicating that we are dealing with very discrete and different phenomena.

	Observability	Precision	Clarity	Concreteness
	\bar{X} s^2	\bar{X} s^2	\bar{X} s^2	\bar{X} s^2
Objective #11	1.5 .7	1.8 1.4	1.4 .8	1.6 1.6
To measure	1.8 1.0	1.6 .8	1.6 1.0	1.3 .4
To the nearest quarter inch	2.0 1.4	1.8 1.5	1.4 .9	1.4 .6
Given a ruler	2.0 1.7	2.0 2.4	1.4 1.2	1.8 1.9
Objective #18	3.5 1.0	3.7 1.2	3.1 1.3	3.6 1.7
To infer	3.4 1.9	3.6 1.9	3.4 1.5	4.0 1.5
Knowingly	3.4 1.4	3.4 1.9	2.8 2.3	3.2 2.8
Given previous unencountered examples	3.0 1.3	3.3 2.2	3.0 1.5	2.7 2.2
Objective #15	2.3 2.0	2.0 1.8	2.2 2.4	2.2 .7
To know	3.0 2.0	3.7 2.3	3.6 1.4	3.3 3.4
In the same order as that given in the textbook	1.8 1.3	1.9 1.4	1.6 .8	1.9 1.5
Given an unordered list of items	2.6 2.3	2.8 2.9	2.2 1.6	2.0 1.2
Objective #2	3.2 1.5	3.8 1.2	2.8 1.9	3.1 1.0
To read	1.7 .7	1.8 1.4	1.9 1.4	1.8 .9
With feeling	2.7 1.9	4.2 1.6	2.2 .8	3.9 1.1
Given a passage not encountered in the previous week	3.1 2.0	3.6 2.2	2.2 1.8	2.6 1.4

Table 1. Means and Variances for Selected Objectives and Components by Characteristic

<u>Rating Scale</u>	<u>Verb</u>	<u>Condition</u>	<u>Criterion</u>
Observability	.43	.60	.58
Precision	.39	.59	.71
Clarity	.42	.62	.53
Concreteness	.56	.52	.53

Table 2. Correlations Between Components
and Objectives

IV. Discussion

The results of this study clearly indicate that conditions and criteria contribute to individuals' perceptions of objectives. This is in marked contrast to findings of earlier studies, where the emphasis was on the verb. The present study provides strong indication that variables other than the observability of the verb must be considered when objectives are constructed. Instructional designers, researchers, and evaluators must also be concerned with the choice of conditions and criteria.

Since it is often meaningless to consider the observability of conditions and criteria in isolation (e.g., "given the occasion," or "confidently"), the similarity of ratings for the four scales--observability, precision, clarity and concreteness--indicate that these characteristics could be used interchangeably. If an objective is to be used to guide a student's study, it may be more informative to talk about its precision or clarity than about its observability. In such cases, the instructional designer wants to be certain the student knows what is important in the material. This is in contrast to the teacher's desire to know how the student will respond when he has mastered the material. It is in this latter case that an observable behavior becomes important.

The quasi-random procedure used to assemble the objectives may have resulted in a "built-in" correlation between the conditions and criteria in some objectives. The investigators edited the list in an effort to make sensible objectives. Nonsensical combinations, such as "To construct x genuinely, given a passage not encountered during the past week" were either edited or replaced. This probably introduced a bias against objectives in which very vague criteria were coupled with very precise conditions or in which very precise criteria were coupled with very vague conditions. However, as far as method is concerned, this was probably the best way to proceed in order to avoid meaningless objectives.

One other factor may have influenced the ratings obtained in this study. In the list of objectives, "x" and "y" were inserted for the direct objects to avoid the use of specific subject matter in the study. The respondents' choice of a replacement for these variables may also have influenced their ratings. This is an area for future study.

Despite the limitations suggested above, the evidence of the importance of the condition and criterion is so strong that the authors are moving to the next level of research: the experimental manipulation of various levels of the variables "verb," "condition," and "criterion" in an effort to determine the effect on subjects' ability to (1) select appropriate objectives for given situations and (2) construct objectives of the highest possible quality. Furthermore, the research is being extended to a non-school area, namely, the U. S. Air Force undergraduate pilot training curriculum, in order to gather evidence regarding the generalizability of the findings reported.

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- Gerlach, V. S., and Barron, M. C. What makes a behavioral objective "behavioral"? (Technical Note No. 41231) Tempe, AZ: Arizona State University, 1974.

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contribute to individuals' perceptions of objectives. This is in marked contrast to findings of earlier studies, where the emphasis was on the verb. The present study provides strong indication that variables other than the observability of the verb must be considered when objectives are constructed. Instructional designers, researchers, and evaluators must also be concerned with the choice of conditions and criteria.