PREREQUISITE PRACTICE AND CRITERION FORM IN MATHEMATICS LEARNING

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IN A SERIES of studies (1, 2, 3, 4, 5) it has been found that unless S can operationally make use of terms or statements, a description of a superordinate topic, which involves these terms or statements, is essentially not understandable (i.e., can not be interpreted). Furthermore, providing S with definitions of the prerequisite verbalizations is not always sufficient. Practice in using the referents of these terms and statements (prerequisite practice) has been shown to improve superordinate criterion learning (4, 5). In all of these experiments, (1, 2, 3, 4, 5), use was made of some artificial abstract material (1) devised for use in problem solving research.

In this short article, a related pilot study, involving actual mathematical materials, is outlined. It was hypothesized that prerequisite practice would facilitate superordinate criterion learning only when the prerequisite terms and statements were used explicitly to describe the criterion material.

METHOD

Basically, a 2 x 2 factorial design with repeated measures, was used. The original design, in which each S was given each treatment, included four sets of mathematical material which were originally unfamiliar to the Ss (i.e., matrix multiplication, derivative of polynomials, divisibility rules, and the game, NIM). Both materials and order of presentation were counterbalanced over treatments.

One factor in the 2 x 2 design was prerequisite practice, given or not given. The second factor was criterion form. Two descriptions of how to solve the criterion tasks were prepared, one description utilizing prerequisite terminology and the other not. For example, matrix multiplication was described in terms of matrix symbolism (e.g., \[ a_{ij} \]) in two treatments and in more familiar language in the others. Irrespective of which criterion form was used, the prerequisite material dealt with matrix symbolism. Practice, when provided, consisted of answering questions involving this symbolism.

The Ss were 32 Florida State University juniors majoring in elementary education. They were tested during their regular class periods. One hour-period was allotted for each of the four treatments. Each treatment booklet consisted of prerequisite material with or without practice, one form of the criterion, and some test questions based solely on the criterion. They were told simply to study the material in preparation for a test. The experiment was self-paced.

Unfortunately, the basic design was contaminated when the regular instructor gave the Ss a homework assignment which was directly relevant to one set of materials (divisibility) and indirectly to another (NIM).

RESULTS AND DISCUSSION

General linear hypothesis methods were used to analyze the uncontaminated data. In spite of losing half of our data, the interaction between prerequisite practice and criterion form attained a suspect level (.05 < p < .10). The overall effect due to practice also attained the .10 level but, in view of the obtained interaction, this result is of secondary importance. Prerequisite practice improved test performance only when the criterion was described in terms of the prerequisite notions.

Mere exposure to new terminology may provide an insufficient base for describing higher order material. It may be necessary for S to be able to easily recall prerequisite notions in order for him to acquire superordinate knowledge.

Insufficient familiarity with prerequisite terminology is a real problem in many mathematics classrooms, particularly at the college level, where the material presented during single lessons is typically hierarchical in nature. Instructors should perhaps bear in mind that desired behavior may often be imparted by presenting the criterion material in a form which depends only on requisites already had by the Ss.
FOOTNOTE

1. The authors would like to thank Judith Anderson for her assistance with the data analysis.

REFERENCES


TABLE 1

SUMMARY OF MEANS AND VARIANCES*

<table>
<thead>
<tr>
<th></th>
<th>Criterion Using Prerequisite Terminology</th>
<th>Criterion Not Using Prerequisite Terminology</th>
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</thead>
<tbody>
<tr>
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<td>Practice</td>
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</tr>
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<tr>
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<tr>
<td>Total</td>
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* The matrix and derivative means are based on eight measures; the total means on 16. These measures are correlated to some extent so that general regression methods are required for appropriate statistical tests.