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ABSTRACT

The purpose of this experiment was to provide further information on how an individual's strategy and his performance are affected by increasing the amount of relevant or irrelevant information he receives. The subjects were sixty volunteers from an undergraduate course in educational psychology who were randomly assigned to one of six treatment groups. Each subject was told that he would be asked to solve several concept identification problems and to learn the concept in as few card choices as possible. Each subject solved 16 problems appropriate to his particular treatment group. Scores were obtained for focusing strategy, number of card choices to solution, and time to solution. It was concluded that since a subject's focusing strategy score is lowered by increasing the amount of information in a concept learning task, the learning of concepts in the classroom would be enhanced by presenting students with concepts which involve small amounts of information, making it possible for students to develop strategies appropriate for coping with such information. Also, since strategies appear to develop over time, students should be given an opportunity to solve several problems in order to perfect their strategy and performance at solving such problems. (WR)

Strategy Development as a Function of the Amount of Relevant or Irrelevant Information

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Experiments in concept learning have typically varied stimulus complexity by increasing either the number of relevant dimensions or by increasing the number of irrelevant dimensions. In general, both types of experiments have yielded similar results with respect to general performance measures. Concept identification appears to become more difficult as the number of relevant dimensions increases (Walker and Bourne, 1961; Bulgarella and Archer, 1962) or as the number of irrelevant dimensions increases (Walker and Bourne, 1961; Bulgarella and Archer, 1962; Haygood and Bourne, 1964). In both cases it is fairly well established that general performance measures such as number of trials to solution, bear a linear relationship to concept complexity (Bourne, Ekstrand and Dominowski, 1971).

Little research, however, has dealt with the relationship between a S's strategy and concept complexity. Laughlin (1966) appears to be the only exception. Laughlin varied the number of relevant dimensions from 2 to 4 while holding total complexity constant. Laughlin found that Ss had a greater tendency to adopt a focusing strategy in more complex problems. No systematic study has been conducted, however, which examined the relationship between a S's strategy and the amount of irrelevant information.

The purpose of the present experiment was to provide further information concerning how an individual's strategy and his performance are effected by increasing the amount of relevant or irrelevant information.

Method

Stimulus Materials. Stimulus cards which were used in the experiment combined two levels of each of seven bi-valued dimensions on cards 7.62 cm. square. The dimensions and their corresponding values were: letter (A or E), number of letters (1 or 2), size of letters (large or small), color of letters (red or blue), orientation of letters (upright or tilted), horizontal position of letters (left or right), and vertical position of letters (top or bottom). The display of the stimulus cards for each level of amount of information (3, 5, or 7 dimensions) was composed of 8, 32, or 128 cards, respectively. The cards were mounted on large stimulus display board in an ordered array. In the four treatment groups which utilized less than 128 cards the cards not used were screened from the subject by means of a cardboard sheet which covered the cards. The dimensions of size, horizontal position, vertical position, letter orientation, and number were utilized in the 5-bit condition. All seven dimensions were utilized in the 7 bit condition.

Subjects and Procedure. Sixty volunteers from an under graduate course in educational psychology were utilized in the experiment. Upon entering the laboratory each S was randomly assigned to one of the six treatment groups. Ten Ss were utilized per treatment group for a total of 60. Each S was told that he would be asked to solve several concept identification problems. The S was then given a set of instructions concerning that task. Briefly, the experimenter described all the stimulus dimensions utilized in each subject's particular treatment condition. Each S was told that all problems were conjunctive in nature, and the number of dimensions which were relevant to his particular condition was given. Subjects were told to learn the concept in as few card choices as possible. Subjects were further told that although they would be timed, they should be more concerned with accuracy than speed.

Each S solved 16 problems appropriate to his particular treatment group. From the unique concepts available for each particular condition, 16 problems were drawn at random and administered to each subject. A three factor repeated measures design was employed in the experiment with the independent variables: a) amount of information (3, 5, or 7 bits), b) type of information (relevant or irrelevant), and c) blocks (4 blocks of 4 problems each).

Amount of information was varied by the addition of either relevant or irrelevant dimensions. Type of information was varied in one of two ways. In one half of the treatment groups (relevant), amount of information was varied by the addition of relevant dimensions while the number of irrelevant dimensions remained constant at two. In the other half of the treatment groups (irrelevant), the total complexity was varied by the addition of irrelevant dimensions while the number of relevant dimensions was held constant at two.

Scores were obtained for each of three dependent measures: a) focusing strategy, b) number of card choices to solution, and c) time to solution. Strategy scores were computed using Laughlin's (1966) rules of focusing which basically compare a subject's choices with the focusing card to determine the amount of information gained on each trial. A block was defined as a group of four problems. The mean score over a block of four problems, then, was the unit of analysis.

Results

A 3 x 2 x 4 repeated measures analysis of variance was carried out on each of the three dependent variables. Since intercorrelations computed between the three scores were relatively high, only the results of the analysis for focusing strategy will be reported. Any differences in the results between the three variables will be reported.

A significant main effect for type of information was found for focusing strategy ($p < .05$). Means for the relevant and irrelevant conditions were .77 and

.70 respectively, indicating Ss had higher focusing strategy scores where the addition of relevant information was the source of information. Type of information was not a significant factor, however, for the other two dependent variables--card choices and time to solution--suggesting that a S's strategy and his performance in a concept learning problem are effected by different variables.

A significant main effect was also found for amount of information ($p < .01$). Means focusing scores for the 3, 5, and 7 bit conditions were .89, .66, and .66, respectively. Thus, focusing socres were higher in the 3-bit condition than in the 5-bit condition or the 7-bit condition. Tests for trends by means of an orthogonal polynomial revealed both linear and quadratic components in the trend ($p < .01$). The test for trend between amount of information and the other two variables--card choices to solution and time to solution--however, revealed a linear trend in both cases ($p < .01$).

A third significant main effect of blocks of problems was also found using the conservative test ($p < .01$). Means for blocks I-IV were .67, .72, .80 and .77, respectively. Newman-Keuls post tests revealed that Ss had significantly higher focusing socres at blocks III and IV than at blocks I and II. Post tests also revealed that Ss made significantly more card choices and took significantly more time to solution at block I than at any of the subsequent blocks ($p < .05$). Additionally, significantly more card choices were made at blocks I, II, and IV than at block II ($p < .05$).

The interaction of amount of information by blocks of problems was also significant ($p < .01$). Subsequent tests by means of simple main effects revealed no significant differences between blocks for the 3-bit condition. There were significant differences, however, for both the 5-bit and 7-bit conditions ($p < .01$).

Subsequent tests by means of Newman-Keuls showed that in the 5-bit condition Ss had significantly higher focusing strategy scores at block III than at any of the other blocks. Subjects in the 5-bit condition also had significantly higher focusing strategy scores at block II and IV than at block I. In the 7-bit condition, Ss had significantly higher scores at block III than at blocks I or II. Subjects in the 7-bit condition also had significantly higher scores at block IV than at blocks I and II. Thus, it appears that with large amounts of information a change in focusing strategy occurs over problems. Specifically, a general improvement in performance occurs over the first three blocks followed by a slight deterioration, probably due to fatigue, at block IV. The nonsignificant results associated with the 3-bit condition, suggest, however, that performance is stable over problems for those problems involving low levels of complexity. This suggests that Ss may be learning or modifying a startegy within the learning situation.

Conclusions

The results of the present study suggest two things for educators. Since a S's focusing strategy score is lowered by increasing the amount of information in a concept learning task, the learning of concepts in the classroom would be enhanced by presenting students with concepts which involve small amounts of information, making it possible for students to develop strategies appropriate for coping with such information. Second, since strategies appear to develop over time, students should be given an opportunity to solve several problems, in order to perfect their strategy and performance at solving such problems.

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