Developmental level and concept learning: A possible artifact

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Forty each of 8- and 9-year-old children were given a paired associates learning problem. For half the Ss in each age group a mediated response was available; for the other half it was not. No significant effects were obtained directly for either condition or age. Strongly significant experimenter differences were found which contributed to other main effects and interactions. The results were discussed in terms of previous research findings and interactions. The results were discussed in terms of previous research findings and interpreted as a caveat against experimenter effects.

Recently there have appeared in this journal several papers wherein interactions between some measure of intellectual ability and age, puberty, or some other factor have been reported (e.g., Klugh et al, 1964, 1965; Friedman, 1965; Pishkin & Rosenbluh, 1966). The experiment reported here was originally undertaken to test certain hypotheses suggested in one of these earlier papers (Friedman, 1965), but the results obtained appear to have somewhat wider implications.

Friedman observed an apparent reversal in intellectual ability of school children as indicated by a performance decrement on a concept learning task. This reversal he attributed to changes with age, in that the child at a critical age (around 9 yr.) underwent a transition from a simpler S-R type learning to a more sophisticated mediated technique. This being the case, a younger child, using a cruder but more familiar technique, would be able to outperform the 9-year-old using his inherently better but as yet unfamiliar mediation technique.

Method

In this experiment 8- and 9-year-old children from the University School, Bloomington, Indiana, were tested on a simple paired-associates learning task. For half the Ss in each age group a mediated response was available. For the other half no such mediation was available.

The Ss were assigned randomly, four of each age group and condition, to each of five experimenters. Of the 80 Ss, 46 were girls and 24 were boys. Through fortuitous sampling, equal numbers of each sex appeared in each age group.

The stimuli were nine 3 x 5 in. white cards, each bearing a geometric figure in black. Three of the figures were triangles, three quadrilaterals, and three pentagons. One triangle, one quadrilateral, and one pentagon were equilateral; the others in each group were somewhat irregular. The responses assigned to the stimuli were the letters of the alphabet J, P, and S. In the mediation condition the same letter was assigned to all

three elements within a geometric class, but the specific class-letter pairing was determined randomly for each S. In the Nonmediated condition the letter names were assigned to the stimulus elements at random, with the constraint that none of the assignments duplicated the Mediated condition requirements.

After the instructions were read to the Ss the nine stimulus cards were shown one at a time. On the first trial the Ss were told to guess the response from among the three possible responses. If they were correct they were told so. If they were incorrect they were told the correct response. Then, after the completion of the trial the cards were shuffled and presented to the S again. Each S was presented 10 trials with the whole deck. For each item the experimenter recorded the order position of the item within the trial, the S's response, and whether the response was right or wrong.

Results

The score each S received was his total number of correct responses on the 10 trials. The analysis of the data was further simplified by summing the scores for the four Ss tested within each experimenter. The resulting 2 by 2 by 5 data matrix was examined by the application of an analysis of variance. The Conditions ($F = 12.50$, $df = 1/780$) and Experimenters ($F = 9.24$, $df = 4/780$) main effects, and the Experimenters by Conditions and Experimenters by Conditions by Age interactions ($F = 3.39$, $df = 4/780$ and $F = 3.75$, $df = 4/780$) respectively were all significant at the .01 level of confidence. The F-ratios for Age of Subject main effect and the Age by Conditions interaction were less than 1.

The data matrices from which the analysis of variance terms were derived were examined to see whether the sources of the interaction effects could be identified. The data entries in the triple-interaction table for each experimenter were rank-ordered within each condition and each age group. Thus each experimenter was assigned four ranks relative to the other four experimenters, one for each of the cells of the Age by Conditions matrix. It was noted that one experimenter held rank 1 (smallest total number of correct responses) in the 8-year Nonmediated condition, but rank order 5 (out of 5) in the 8-year Mediated group. No such inversion of ranks appeared in the 9-year-old group. Therefore, a post hoc reanalysis of the data was done with the elimination of the data from the deviant experimenter. The main effect due to Experimenters ($F = 12.5$, $df = 3/624$, $p < .01$) remains, but all other main effects and interactions fail the criterion of significance at the .05 level.

Discussion

For the initial purpose of this experiment, that of evaluating the Friedman hypothesis, the critical terms are the Conditions and Age main effects and their interactions. Since in the initial analysis only the Conditions effect of these three was significant the data do not support the Friedman hypothesis. However, of greater interest are some of the other terms. As the *post hoc* examination of the data matrices indicated, there was a three-way interaction with one experimenter and one age group under one condition of such magnitude as to cause other effects to be seen as significantly large. Of course, it is recognized that in the reanalysis *N* was reduced by 20%. However, it does not seem likely that such a change could produce such vast differences in the significance levels.

The sample included only two age groups and the critical age for the reversal might not have been tapped. However, it was the fourth grades (9-year olds) which were specifically designated by Friedman as the inverted group, and it is the comparison of fourth-grade children to third-graders which is crucial to the hypothesis.

In the earlier-reported research the reversal phenomenon was related to the age of the Ss. In fact, it could well have been an effect of some aspect of the particular school system or (since we have no information on how the Ss were selected) even an effect of a particular teacher within that school system. With respect to this question, it is obvious that exact replication is called for.

The most important criticism which can be leveled at this study is that insufficient control was exerted to reduce or eliminate differences due to experimenters. It is by no means intended to excuse poor experimental control in the present instance. Rather it is important to point out that such experimenter-subject interactions can exist and can produce quite large effects which may be overlooked and/or misinterpreted. It is clear, then, that certain experimental results previously reported

(e.g., Pishkin & Rosenbluh, 1966) might well be due to similar effects, rather than the more complex explanations offered.

In none of the previous studies mentioned above was the data broken down to allow an analysis of experimenter effects. In such cases no conclusions can be drawn. It would appear that future research with children should involve not only controls against experimenter differences, but analysis of the data to determine whether or not such differences did in fact occur, in spite of controls.

Conclusions

It may be concluded from this experiment that the Friedman hypothesis cannot account for an age-dependent reversal of intellectual ability, at least in a paired-associates learning situation. Alternatively, the critical age might not correctly have been identified.

On the other hand, it has been shown that significant effects of a type similar to but not identical with those reported by Klugh et al, Friedman, and by Pishkin and Rosenbluh can be produced merely by experimenter differences. It is suggested that intellectual reversal may not exist at all, but may merely be an artifact. Alternatively, it is possible that the effects reported may be functions of conditions other than the age of Ss. It is strongly recommended that the data from earlier studies be examined for experimenter differences and the possible intrusion of other artifacts.

References

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