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ABSTRACT

This study extends some recently acquired knowledge about the development of visual imagery as an associative-learning strategy. Incorporating the present findings into the data already gathered, it appears that as a facilitator, sentence production precedes imagery generation since preoperational children benefit from instructions to engage in the former though not in the latter. Moreover, the provision of relevant motor activity, which has been shown to induce imagery generation in 6-year-olds, has at best a variable effect on the performance of 3- and 4-year-olds. (Author/SET)

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THE UNIVERSITY OF WISCONSIN
Madison, Wisconsin

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Technical Report No. 282

IMAGERY INDUCTION IN THE PRE-IMAGERY CHILD

by
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Report from the Project on
Childrens Learning and Development

Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

July 1974

Statement of Focus

Individually Guided Education (IGE) is a new comprehensive system of elementary education. The following components of the IGE system are in varying stages of development and implementation: a new organization for instruction and related administrative arrangements: a model of instructional programing for the individual student; and curriculum components in prereading, reading, mathematics, motivation, and environmental education. The development of other curriculum components, of a system for managing instruction by computer, and of instructional strategies is needed to complete the system. Continuing programmatic research is required to provide a sound knowledge base for the components under development and for improved second generation components. Finally, systematic implementation is essential so that the products will function properly in the IGE schools.

The Center plans and carries out the research, development, and implementation components of its IGE program in this sequence: (1) identify the needs and delimit the component problem area; (2) assess the possible constraints—financial resources and availability of staff; (3) formulate general plans and specific procedures for solving the problems; (4) secure and allocate human and material resources to carry out the plans; (5) provide for effective communication among personnel and efficient management of activities and resources; and (6) evaluate the effectiveness of each activity and its contribution to the total program and correct any difficulties through feedback mechanisms and appropriate management techniques.

A self-renewing system of elementary education is projected in each participating elementary school, i.e., one which is less dependent on external sources for direction and is more responsive to the needs of the children attending each particular school. In the IGE schools, Center-developed and other curriculum products compatible with the Center's instructional programing model will lead to higher student achievement and self-direction in learning and in conduct and also to higher morale and job satisfaction among educational personnel. Each developmental product makes its unique contribution to IGE as it is implemented in the schools. The various research components add to the knowledge of Center practitioners, developers, and theorists.

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Abstract

This study extends some recently acquired knowledge about the development of visual imagery as an associative-learning strategy. Incorporating the present findings into the data already gathered it appears that as a facilitator, sentence production precedes imagery generation in that preoperational children benefit from instructions to engage in the former though not in the latter. Moreover, the provision of relevant motor activity, which has been shown to induce imagery generation in six-year-olds, has at best a variable effect on the performance of three- and four-year-olds.

I
Introduction

In the past few years we have been tracing the development of what Piaget and Inhelder (1971) have referred to as "anticipatory imagery." In so doing we have utilized a paired-associate learning task, performance on which is known to be extremely sensitive to manipulations of organizational strategies (cf. Levin, 1972). Specifically, children who can be induced through instructions to construct a mental interaction between the pair members outperform their noninstructed counterparts by so much that there is rarely any overlap between the two score distributions.

What we have learned to date may be summarized as follows: Although children already into the concrete-operational stage (which starts at about age 6 or 7) are easily able to generate interactive visual images to facilitate paired-associate learning (e.g., Levin, Davidson, Wolff, & Citron, 1973), children younger than this are not (Wolff & Levin, 1972). However, in accordance with the Piagetian belief that visual imagery emerges from the young child's play and imitation, we have found that preoperational children may be assisted in imagery generation by providing them with relevant concurrent motor activity (Wolff & Levin, 1972; Wolff, Levin, & Longobardi, 1972). The present study was conducted to determine whether there exists a stage of development at which such "imagery-inducing motor activity" ceases to be facilitative in comparison to the effectiveness of alternative kinds of associative-learning strategies.

II
Experiment I

Method

Subjects

Sixty children, 30 at each of two age levels, served as Ss. Children in the younger group (four-year-olds) were between 3 years, 8 months and 4 years, 9 months of age, with a mean age of 4 years, 2 months; those in the older group (seven-year-olds) were between 6 years, 9 months and 7 years, 6 months of age, with a mean age of 7 years, 1 month. Within each age group, Ss were assigned in equal numbers to the three treatments described below.

Design and Materials

The objects used for the paired-associate task were 24 common children's toys (e.g., a plastic telephone, a metal truck, a wooden rolling pin). The 12-item list was formed by pairing the toys such that an interaction between them was plausible but not obvious. A "stage" was used during the study trial to screen the toys from the S's view while he was conforming to one of three instructional conditions: Sentence, where S was asked to tell a story about the stimulus toy doing something to the response toy; Motor Imagery, where S was asked to make the stimulus toy do something to the response toy while thinking of the names of the two toys;[1] and Control, where S was asked to think of the names of the two toys. The naming instruction was included in the latter two groups in order to equalize to some extent the availability of the toys' names to Ss in all conditions, since a recall test followed the study trial.

Procedure

Subjects were seated at a low table opposite E. After initial familiarization with the experimental situation three practice pairs were presented to ensure that S understood the task and was able to produce interactions. (In cases where S failed, E provided an appropriate example.) The paired-associate task was begun immediately after the practice session. Each pair was presented for approximately 8 seconds and the instructions were reiterated for each pair (to ensure that inability to benefit from the instructions would not be confounded with inability to remember them or to continue to use them). In the Sentence and Control conditions, the toys were placed behind the stage curtain while S generated the sentences or names. In the Motor Imagery condition, the toys were placed in S's hands behind the curtain where the interactions were generated. Following the study trial Ss were presented each stimulus toy (in a random order different from that of the study trial) and asked to recall the corresponding response toy.

Results and Discussion

Within each age group, Dunnett one-tailed tests ($\alpha = .05$) were conducted to assess the effects of verbal and motor interactions on recall. Although the level of recall was very low in the four-year-old group (averages of 1.2, 1.6, and 2.9 out of 12 in the Control,

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[1] Although it is not possible to conclude with certainty that visual imagery is indeed induced through Ss' "blind" motor manipulations, this assumption appears warranted on the basis of our previous research (see Wolff, Levin, & Longobardi, 1972).

Motor Imagery, and Sentence conditions respectively), the performance of Sentence $\underline{S}$s was found to be significantly greater than that of Control $\underline{S}$s while the performance of Motor Imagery $\underline{S}$s was not. In relative terms the Sentence and Control means are about one within-group standard deviation apart, while the Motor Imagery and Control means are less that one-quarter of a standard deviation apart. In the seven-year-old group, compared to the Control condition both Motor Imagery and Sentence instructions facilitated performance (the means being 1.7, 6.7, and 6.5 respectively), with the latter two representing about a two standard deviation increase over the former.

On the basis of these data it appears that four-year-olds are able to utilize a sentence generation strategy (to some extent), but not an imagery-inducing motor strategy, to improve their paired-associate recall. On the other hand, seven-year-olds benefit from both types of strategy. Although such conclusions appear valid for the seven-year-olds (where recall in the two strategy conditions was respectable), they appear less so for the four-year-olds (where the overall level of recall was quite low). Thus, in order to assess the generality of these conclusions, a second experiment was conducted with young children, utilizing a shorter list and a recognition test procedure. In so doing it was hoped that: (1) the mean performance level of these children would increase, thereby revealing more clearly any differential effects of strategy; and (2) the data could then be directly related to the earlier Wolff-Levin research which was also based on a recognition method of testing.

III
Experiment II

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Method

Subjects

Two nursery schools furnished 44 Ss for the second experiment. These children ranged in age from 3 years to 4 years, 11 months, with a mean age of 4 years. Subjects were randomly assigned in equal numbers to the four conditions of the experiment.

Design and Materials

Eight pairs were formed from a pool of toys similar to that used in Experiment I. As in Experiment I, the conditions consisted of Control, Sentence, and Motor Imagery; the only difference was that Ss in the Motor Imagery condition were not requested to think of the names of the toys during their manipulations (thereby more closely approximating instructions we have used previously). In addition, a Visible Motor condition (where S's interactions were not screened from view) was included since it is known that visible motor manipulations comprise a powerful facilitator of associative learning among slightly older children (McCabe, Levin, & Wolff, 1974; Wolff & Levin, 1972; Wolff, Levin, & Longobardi, 1972, 1974). Elevated performance in this condition would provide evidence that three- and four-year-olds are not mediationally deficient.

Procedure

Essentially the same procedures were followed as in Experiment I. During testing, however, the eight response toys were placed in an array on the table in front of S. One stimulus toy at a time was presented and S was required to pick out the appropriate response toy. The selected toy was replaced in the array each time.

Results and Discussion

Consistent with the analysis of Experiment I, Dunnett comparisons revealed that the mean performance of Ss in the Motor Imagery condition (3.4 correct out of 8) was not statistically different from that of Control Ss (2.4), whereas the mean performance of Sentence Ss (4.2) was. And, as expected, performance was most efficient in the Visible Motor condition (5.4).

However, the most striking aspect of the results was the marked variability in the Motor Imagery condition ($S^2 = 6.9$) in comparison to that of the other conditions (average $S^2 = 3.0$) which, upon closer inspection, revealed distinct bimodality in performance. Thus, although the mean performance of Motor Imagery subjects suggests that the children did not profit from the instructions given, it is clear that we cannot conclude that this is true for all (or even most) subjects. We have, in the past, regarded such variability and bimodality as additional evidence for a transitional period in the development of a cognitive ability (e.g., Kerst & Levin, 1973); these motor imagery data mimic perfectly our data for children about two years older who are required to generate anticipatory imagery without the benefit of concurrent (invisible) motor activity (obtained, though not reported, by Wolff and Levin, 1972).

IV
General Discussion

How do these data fit into what we already know about the development of cognitive strategies in children? Our previous research with five- through seven-year-olds has indicated that imagery-inducing motor activity facilitates paired-associate learning when it is assessed by a recognition method of testing. The results of Experiment I support the claim for the upper end of this age range even when Ss are tested by a recall method. Four-year-olds, however, could not effectively utilize a motor-imagery strategy when asked to recall (Experiment I), and could do so only with variable success when asked to recognize (Experiment II), the previously paired response toys. That this was not simply attributable to possible mediational deficiencies in children of this age is supported by the comparable data of Ss permitted either visible motor manipulations or sentence generation (see also McCabe et al., 1974). Yet even this latter strategy was n · completely successful, in that the absolute paired-associate performance of four-year-olds generating sentences was still quite low.

A tentative conclusion might be that just as subject-generated anticipatory imagery, as a facilitator of paired-associate learning, seems to reach its lower limit at about seven or eight years of age, so too does imagery-inducing motor activity cease to be a facilitator at about three or four years of age. Determining the components of this process which distinguish it from sentence production, or those which are responsive to additional experimental inducements (including an exploitation of individual differences), would appear to be a reasonable next step.

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