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ABSTRACT

The effectiveness of acceleration training with children who were in a transition period was examined. Forty-eight kindergarten children were separated into four groups on the basis of their status (Preoperational vs. Transitional) and whether or not they received three sessions of inversion-negation training. The results of the immediate and delayed posttests indicated no difference due to the status dimension. However, differences as a function of training were manifest. The results of the investigation do not support Inhelder's contention that acceleration can only occur during transition periods between stages. (Author/CS)

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Current evidence (Brainard and Allen, 1971; Richardson and Biskin, 1974) supports the position that certain cognitive operations characteristic of concrete operational thought can be acquired by preoperational children who have been exposed to a systematically presented training program. However, in the rush to challenge Piaget's contention that children cannot be accelerated from preoperations to concrete operations researchers have neglected to formally introduce Piaget's concept of transition period as an independent variable. It was the purpose of this study to explore the effects of being in the transition period on the successfulness of acceleration training.

Flavell (1963) observed that there is a period of preparation and shifting before stability and final achievement of a given stage is reached. It is during this period of transition from one stage to another that Inhelder (1969) speculates that acceleration might be possible. When discussing the possibility of experimentally inducing conservation in nonconservers Inhelder states "It is clear that the possession of an elementary invariant (i.e., conservation of number) is a prerequisite of success even partial success" (19). Thus, in order to accelerate conservation the child must possess some characteristic of the next stage. The initial appearance of these characteristics might indicate that the child is in a transition period. Inhelder's (1969) hypothesis is supported by Beilin's (1971) extensive review of different types of techniques used to train children for operativity. He concludes that the facilitation of true

operativity seems to occur only in cases where subjects had previously displayed some vestige of operativity.

The present study employed the transition period between preoperational and concrete operational thought as the optimum starting point for acceleration. Responding to Inhelder (1969) children were considered to be in the transition period if their performance revealed a grasp of conservation of number but none of the other tested first order conservations.

Method

Subjects

Subject selection was carried out in a two step procedure. First 64 subjects were randomly selected from 196 children enrolled in a public kindergarten in a semi-rural area of southwest Virginia. Second, all Ss were screened and forty-eight of the original 64 children were selected as subjects based on their performance on the conservation of number, substance and continuous quantity items of the Conservation Assessment Kit (Goldschmidt and Bentler, 1968). The twenty four subjects who could conserve number but not continuous quantity or substance were assigned to the Transition Group while the remaining 24 subjects who could not conserve number, continuous quantity or substance were assigned to the totally Preoperational Group. Half of the subjects within each group were then randomly assigned to either the treatment or control group.

The chronological ages of the subjects at the time of the study ranged from 64 to 77 months for the Preoperational Group and 64 to 81 months for the Transition Group.

A. Experimental

After subjects were pretested and assigned to their respective groups the training procedure was begun. Each subject in the experimental group was given

three individual training sessions over a period of two weeks. The interim period between each training session was three days.

The experimenter employed conservation of substance using clay balls as the medium for teaching reversibility. Subjects were presented with two clay balls and were allowed to decide the balls were the same size. The experimenter then altered the shape of the balls by rolling the clay balls into a sausage while the subject watched. The subject was then asked, "Now does this ball have more clay (unaltered) or does this ball (altered) have more clay or does one have just as much clay as the other?" If the subject responded correctly the experimenter would ask him to explain his answer. If the subject responded incorrectly or said he didn't know then the experimenter would say "But watch I can make this right back into a ball and then its just the same as when we started. So they must have been the same all the time, right." After his reshaping and confirmation by the subject that the two quantities were identical, successive alterations were performed. The alterations used in the treatment were 1) a sausage, 2) a pancake, 3) a ring, and 4) a tower. The training procedure was terminated when the subjects responded correctly to three out of the four alterations. All subjects reached criteria during each training session.

The day following the third training session each subject was administered the posttest (immediate) on conservation of substance and continuous quantity. Three weeks later the same posttest (delayed) was readministered. For both the immediate and delayed posttests a subject was assigned one point if he gave the correct answer and an additional point if he was able to justify his response.

b. Control

Control subjects were given no training but were immediate and delayed posttested at the same time as the experimental subjects. The same scoring

criteria were used with the Control subjects as were employed with the Experimental subjects. Order of posttesting was randomized at both testing periods.

Results

The subject's posttest scores were analyzed using a Status (Transitional vs. Preoperational) x Treatment analysis of variance with repeated measures. The results of the analysis are presented in Table 1.

Insert Table 1 Here

The main effect of the status condition was not significant ($F = 3.0$, $df = 1, 44$). However the Transition Group ($\bar{x} = 1.21$) did manifest a higher mean score than the Preoperational Group ($\bar{x} = .67$).

As can be seen in Table 1 the Experimental Group ($\bar{x} = 1.71$) achieved significantly higher scores ($F = 23.4$, $df = 1, 44$) than the Control Group ($\bar{x} = .19$), while the difference between the immediate and delayed posttests failed to reach statistical significance ($F = 1.9$, $df = 1, 34$). In addition, none of the interaction affects approached statistical significance.

Insert Table 2 Here

A more descriptive presentation of the results is included in Table 2. As can be observed the Experimental-Transition Group contained the most subjects who were successful on either one or both of the posttest items. This superiority was maintained for both posttests. However, in general the data presented in Table 2 correspond directly to the results of the analysis of variance. The differences in the number of subjects who successfully completed one or both of the posttest items was substantially greater between the Experimental and Control Groups than between the Preoperational and Transitional Groups.

Regardless of treatment condition there were 7 and 5 Preoperational subjects who completed at least one item on the immediate and delayed posttests respectively as compared to 11 and 9 in the Transition Group. When eliminating the differences in status condition there were 17 and 14 Experimental subjects who completed at least one item in the immediate and delayed posttests respectively. While there was only one Control subject who completed any of the items.

Discussion

The results stand in contradiction to Inhelder's (1969) recommendation that the transition period is the optimal time for acceleration training. The difference between the Preoperational and Transition Groups was not statistically significant. On the contrary, the statistically significant difference between the Experimental and Control Groups provide further evidence that certain conservations can be acquired by children who prior to some training did not possess the ability. These results in conjunction with the results reported in the Brainard and Allen (1971) and Richardson and Biskin (1974) reviews strongly support the hypothesis that the transition period is relatively unimportant when considering the probability of success of acceleration training.

It is highly likely that our results are a function of the operational definition of transition period used in this investigation. Our definition lacked strong empirical support and was based primarily on the authors' interpretation of a number of theoretical statements. The introduction of alternate conceptualizations of the transition period concept into future investigations might produce results which are consistent with Inhelder's (1969) contention that this epoch is the optimum time for acceleration.

Elkind (1967) provides an alternative which could be supported by the results of previously successful acceleration studies. Taking into consideration that (1) preoperational children have the ability to make identity judgments,

which Elkind (1967) feels are necessary for understanding conservation and (2) that preoperational children lack the ability to make the equivalence judgments which are necessary for success on Piagetian conservation tasks; it is reasonable to hypothesize that the experimental procedures employed in successful acceleration studies may be providing the critical amount of experience which is necessary for nonconserving subjects to test out their hypotheses about the equivalence of the altered stimulus and unaltered standard. In this case the transition period would be defined as that time when the subject can make identity judgments between a no longer existing stimuli and the transformed stimuli but not make equivalence judgments between the altered stimuli and a still existing standard.

A large number of both Experimental-Preoperational and Experimental-Transition subjects attained conservation. The absence of a statistically significant difference between the Preoperational and Transition Groups on the posttests could have been the result of a treatment that provided both groups with all the experiences each needed to acquire conservation. Ideally, the treatment should have consisted of experiences that would have facilitated the acquisition of operations that were preventing the Transition Group from conserving, but not include all the experiences that were necessary for the attainment of conservation by the Preoperational Group. In essence a stronger match between the status of the Transition subject and the treatment is required.

Even though there are serious alternative explanations for the results of this investigation, there is still the possibility that the concept of a transition period is unnecessary. The authors' orientation in defining the transition period was influenced by two theoretical assumptions. One that the ability to conserve appears as an integrated whole. And two that there is a higher

probability for successful accaleration training when the subject possesses at least a vestige of an elementary invariant. The authors did not consider the possibility that the acquisition of conservation could be subdivided into a sequential series of sub-skills and that the success of acceleration training might be contingent on the subjects previous acquisition of these skills. This approach is directly analogous to the concept of subject matter readiness popularly used by curriculum development specialists. A child is considered ready for instruction directed at the achievement of a particular objective only after he has acquired the necessary prerequisite skills and information.

The viability of applying the subject matter readiness concept to developmental readiness is supported by Schwartz and Scholnick's (1970) task analysis of discontinuous quantity. Using a scalogram analysis they were able to define a sequential pattern of comparison, identity and equivelance judgments that were all prerequisite to conservation. These data imply that there may not be a transition period as conceptualized by the authors. But that the ability to conserve is predicated on the acquisition of a series of potentially trainable subskills. To foster acceleration an experimenter would assess what specific skills a subject lacked and then provide training directed at the acquisition of these skills.

TABLE 1

Analysis of Variance with Repeated Measures on Two Posttest Scores Summary Table for the Variables of Status Group, Treatment and Trials

SOURCE	df	MS	F
Status Group	1	54	23.5
Treatment	1	7	3.0
Status Group & Treatment	1	1	<1
Error Between	44	2.3	
Trials	1	1	1.9
Trials x Treatment	1	0	<1
Trials x Status Condition	1	0	<1
Trials x Status Condition x Treatment	1	0	<1
Error Within	34	.53	

*p < .01

TABLE 2

Frequency of Subjects Who Completed None or At Least One Posttest Item

		EXPERIMENT		CONTROL		TOTAL	
		IMMEDIATE	DELAYED	IMMEDIATE	DELAYED	IMMEIDATE	DELAYED
Precperational	Number of Subjects Nct Successful on Any Posttest Item	5	7	12	12	17	19
	Number of Subjects Successful on at Least One Posttest Item	7	5	0	0	7	5
Transitional	Number of Subjects Not Successful on Any Posttest Item	2	3	11	12	13	15
	Number of Subjects Successful on at Least One Posttest Item	10	9	1	0	11	9
Total	Number of Subjects Not Successful on Any Posttest Item	7	10	23	24		
	Number of Subjects Successful on at Least One Posttest Item	17	14	1	0		

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