DOCUMENT RESUME

ED 073 583 EC 051 235

AUTHOR Funk, Kerri L.; Tseng, M. S.
TITLE Effects of Classification Exposure upon Numerical Achievement of Educable Mentally Retarded Children.
PUB DATE 73
NOTE 12p.; Paper presented at 1973 Annual Meeting of American Educational Research Association (New Orleans, Louisiana, February 27, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Classification; *Educable Mentally Handicapped; *Exceptional Child Research; *Mathematics; Mentally Handicapped; *Number Concepts

ABSTRACT

Two groups of 32 educable mentally retarded children (ages 7 to 14 years) were compared as to their arithmetic and classification performances attributable to the presence or absence of a 4 1/2 week exposure to classification tasks. The randomized block pretest-posttest design was used. The experimental group and the control group were matched on their arithmetic skills prior to the experiment. It was found that arithmetic post-test scores covaried significantly with arithmetic pre-test scores and classification pre-test scores and that classification post-test scores covaried significantly with age and classification pre-test scores. The experimental group showed significantly higher post-test performances on arithmetic and classification over the control group, indicating that the classification exposure treatment facilitated the acquisition of arithmetic as well as classification skills. (Author)

EFFECTS OF CLASSIFICATION EXPOSURE UPON NUMERICAL ACHIEVEMENT OF EDUCABLE MENTALLY RETARDED CHILDREN*

Kerri L. Funk and M. S. Tseng
West Virginia University

Abstract

Two groups of educable mentally retarded children were compared as to their arithmetic and classification performances attributable to the presence or absence of four and a half week exposure to classification tasks (taken from Inhelder and Piaget). The randomized block pretest-posttest design was used. The experimental group (N=16) and the control group (N=16), constituting 16 pairs, were matched on their arithmetic skills prior to the experimentation. ANOVA revealed significantly greater mean gains for the experimental group on both arithmetic performance ($p<.05$) and classification performance ($p<.01$). It was found that arithmetic post-test covaried significantly with arithmetic pre-test ($p<.001$) and classification pre-test ($p<.05$) and that classification post-test covaried significantly with age ($p<.05$) and classification pre-test ($p<.001$). When the effects of these covariates were sorted out and the two groups were compared by ANCOVA, the experimental group showed significantly higher post-test performances on arithmetic ($p=.01$) and classification ($p<.001$) over the control group, indicating that the classification exposure treatment did indeed facilitate, greatly, the acquisition of arithmetic as well as classification skills.

* Paper presented to the 1973 Annual Meeting of American Educational Research Association, New Orleans, February 27, 1973.

Effects of Classification Exposure Upon Numerical Achievement of Educable Mentally Retarded Children

Piaget discussed four basic factors that contribute to intellectual development. They are physiological development, direct experience with the physical world, social transmission, and equilibration, the ability to assimilate new information and generalize correct answers for similar experiments (Ripple and Rockcastle, 1964). In order for equilibration to occur the child must operate on or act on objects; such a process is called an operation which is considered to be the basis of arithmetic.

One of the fundamental assumptions of Piaget's theory of cognitive growth is that there is a fixed order in which concepts are acquired. Especially with reference to the acquisition of number concepts, it is emphasized that the idea of classification must be investigated by children before numbers can be fully understood (Copeland, 1970). This strategy would appear to be even more important to the mentally retarded child who is severely handicapped by the lack of ability to concentrate, low transfer of learning, low abstract thinking ability, poor comprehension of details and situations, and the lack of initiative (Garton, 1964).

Classification is defined as the grouping of objects or instances on the basis of one or more observable characteristics. Inhelder and Piaget (1964) point out that the origin of classification has been traced to the maturation of the central nervous system and to the developmental period prior to language and symbolic representation (sensori-motor level, 0 to 2 years of age). As the child progresses through the other developmental stages (pre-operational, 2 to 7 years; concrete operational, 7 to 11 years; and formal operational 11+ years), the classification behavior, that is, the act of building classes becomes increasingly complex, building upon previous classification experiences.

The average child is ready for number concepts when he is six or seven years of age chronologically while the educable mentally retarded does not reach the readiness stage until the mental age of six or seven years - obviously much older chronologically (Garton, 1964). This creates the situation in which the retarded child is exposed to books and materials on his ability level, but not on his interest level. In relation to this issue, taking into consideration that in most cases the elementary special teacher must adapt materials designed for the average child to suit the retarded children in her class, Dunn (1969) comments:

> Do not use traditional textbooks and workbooks. These are generally unsuitable for the retarded child . . . the illustrations are often too childish. The interest levels are below these older boys and girls.

In view of the importance of classification skill, which constitutes one of the essential aspects in the process of cognitive development, and the nature of numerical instruction employed in classes for the educable mentally retarded, which seems to provide limited exposure to classification tasks, the present study was undertaken for the purpose of testing a hypothesis that additional exposure to the classification of objects in the school environment would significantly increase the educable mentally retarded's skill to work with numerical concepts.

Methods

Subjects

A sample of 42 mentally retarded children, with IQs ranging from 50 to 85, was drawn from the educable mentally retarded classes of 5 elementary schools in a northern West Virginia county. Due to absenteeism and transfer only 16 intact pairs or 32 of these subjects (17 males and 15 females) completed all the requirements of this study. Each of the subjects had been previously classified as E.M.R. from scores obtained on either the Wechsler Intelligence Scale for Children or the Stanford-Binet Intelligence Test.

The chronological ages of the subjects completing the experiment ranged from 7 years 2 months to 13 years 10 months, with the mean age being 10 years. The age range 9 to 10 years contained more individuals than any other single age group. IQ scores varied from 50 to 84, with a mean score of 69. The majority of subjects (23 of them) obtained scores between 65 and 79.

Design

The randomized block pretest-posttest design was used. Two identical pre-test and post-test, the California Arithmetic Achievement Test and a classification test, were administered to ensure accurate measures of each subject's arithmetic and classification skills. The subjects were exposed to training sessions in two groups, experimental and control, where specific treatments were administered. While the subjects in experimental group received lessons in classification, the subjects in control group were exposed to neutral stimuli, storytelling.

The investigation covered a period of 7 1/2 weeks. One and one-half weeks were used for pre-testing, 4 1/2 weeks for treatment (9 instructional sessions), and 1 1/2 weeks for post-testing.

Procedures

All individuals selected for the experiment were administered the first pre-test, the California Arithmetic Achievement Test, Level 1, Form A (1970 Edition). Groups of 3 to 4 subjects were administered the test in two 25-minute sessions to ascertain their current level of numerical understanding.

The resulting scores were ranked and subjects were matched with one of equal value or the next closest value. Each member of the matched pair was then randomly assigned to either the experimental or control group, with each group containing 16 subjects.

Upon completion of pre-test 1, California Arithmetic Achievement Test, all subjects were administered pre-test 2, classification test, to measure their ability and comprehension in classification tasks. Each subject was tested individually in a session lasting approximately 20 minutes. Four Piagetian classification tasks: changing criteria; classification of real objects; class inclusion; and multiple classification were employed in the evaluation (Wei, Lavatelli and Jones, 1971).

Following the completion of both pre-tests, the subjects were exposed to training sessions. The investigator met individually with each subject in a training session lasting 15 to 20 minutes. Two training sessions a week were conducted with each subject for a total of 9 meetings. With the exception of the treatment received, the sessions for the experimental and control subjects were conducted in the same manner.

The experimental subjects were individually exposed to a series of classification tasks develop by Inhelder and Piaget (1964). The classification sessions were presented in the following order of difficulty: introduction of shapes; resemblance sorting; consistent sorting; exhaustive sorting; multiple class membership; horizontal reclassification; "some" and "all"; whole is the sum of its parts; and "conservation of hierarchy".

The control subjects were exposed to a neutral stimulus - storytelling - which was felt to have little or no effect upon the post-test employed. Nine treatment sessions were conducted over the same time period that was utilized to expose the experimental group.

When the training sessions were completed, all subjects were given the post-tests. The same tests employed in pre-testing the subjects were readministered. The testing sessions were conducted in the same locations and using similar methods and procedures Only the order of test presentation was adjusted. The classification test was given first in order to determine what effect the treatments had upon classification skills. The California Arithmetic Achievement Test was then administered to determine the effects of treatments upon arithmetic achievement.

Results

Means and standard deviations of all the variables examined are summarized in Table 1.

INSERT TABLE 1 HERE

Results of the California Arithmetic Achievement showed that the experimental group's (N=16) pretest mean score was 58.3; posttest mean, 62.6; and the mean gain 4.3. The control group's (N=16) pretest and posttest means were 60.62 and 60.56, respectively, with the mean difference being -0.1.

A randomized block analysis of variance was carried out to compare the experimental and control groups on their gains in arithmetic achievement. Results (See Table 2) revealed that the experimental group's mean gain in arithmetic was significantly greater than the control group's mean gain ($p<.05$). The difference denotes that the experimental group's exposure to classification tasks did indeed have a significantly positive effect upon their arithmetic achievement.

INSERT TABLE 2 ABOUT HERE

The classification test results showed that the experimental group's pretest mean was 8.3, posttest mean was 10.5, and the mean gain was 2.3. The control group's pretest, posttest, and gain means were 9.6, 8.9, and -0.6, respectively.

The experimental group, as compared to the control group, also showed a significantly greater gain on classification performance. The difference was significantly beyond the .01 level (See Table 2 for results yielded by randomized block ANOVA), indicating a positive effect of the treatment upon the classification performance.

An attempt was made to determine the extent to which the subjects' posttest scores on arithmetic and classification might have covaried with their age, intelligence, arithmetic pretest scores, and classification pretest scores. Correlational analyses revealed that arithmetic posttest performance correlated significantly with arithmetic pretest performance ($r=.96$, $df=30$, $p<.001$) and classification pretest performance ($r=.39$, $df=30$, $p<.05$) and that classification posttest performance had significant correlates in age ($r=.34$, $df=30$, $p<.05$) and classification pretest performance ($r=.69$, $df=30$, $p<.001$).

Randomized block analyses of covariance were then conducted to adjust for (a) the effect of arithmetic pretest and classification pretest scores upon the arithmetic posttest scores and (b) the effect of age and classification pretest scores on classification posttest scores. Results of the adjustment on group means are summarized in Table 3.

INSERT TABLE 3 HERE

When the effects of covariates were sorted out much greater mean differences between the experimental and control groups on arithmetic posttest performance (mean difference changed from 62.6 - 60.6 = 2.0 to 63.9 - 59.3 = 4.6, with the adjusted mean difference significant at the .01 level) and classification posttest performance (mean difference changed from 10.5 - 8.9 = 1.6 to 11.0 - 8.4 = 2.6, with the adjusted mean difference significant beyond the .001 level) resulted, both in favor of the experimental group, indicating greater impact the classification exposure had upon the acquisition of arithmetic and classification skills.

Discussion

Exposure to classification tasks proved to facilitate numerical achievement as well as classification performance of educable mentally retarded children considerably. In order to capitalize on the effect of the classification treatment, it would appear logical to implement the following strategies: (a) establishing an extensive classification program at the primary level before numbers are introduced; (b) formulating a classification program, of varied interest and ability levels; (c) developing materials and methods that allow for the fullest development of the classification behavior; and (d) integrating the classification behavior in all subject areas and not just arithmetic to facilitate the development of logical thought.

Finally, the importance and complexity of the classification behavior demands additional research. Among the areas that seem to be in need of further investigation are the relationship between the classification ability and age as well as IQ, the relationship between the classification behavior and verbal communication, and the formation of a developmental sequence of the classification behavior for educable mentally retarded children.

References

Copeland, R. W. How children learn mathematics, teaching implications of Piaget's research. New York: MacMillan, 1970.

Dunn, L. M. Exceptional children in the schools. New York: Holt, Rinehart and Winston, 1967.

Garton, M. D. Teaching the educable mentally retarded. Springfield, Ill.: Charles C Thomas, Publisher, 1964.

Inhelder, B. and Piaget, J. The early growth of logic in the child. New York: Harpe and Row, 1964.

Ripple, R. E. and Rockcastle, V. (Eds.). Piaget rediscovered, a report of the conference on cognitive studies and curriculum development. Ithica, N.Y.: Cornell University, 1964.

Wei, T. T., Lavatelli, C. B., and Jones, R. S. Piaget's concept of classification: a comparative study of socially disadvantaged and middle-class young children. Child Development, 1971, 42, 919 - 927.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF VARIABLES FOR THE EXPERIMENTAL AND CONTROL GROUPS

Variable	Experimental (N=16) Mean	Experimental (N=16) SD	Control (N=16) Mean	Control (N=16) SD
Age (in months)	121.1	21.8	133.0	20.5
IQ	71.6	6.9	67.1	8.1
Cal. Arith. Achievement				
Pre	58.3	22.7	60.6	20.7
Post	62.6	19.9	60.6	19.9
Gain	4.3	5.9	-0.1	5.0
Classification Skill				
Pre	8.3	3.6	9.6	2.9
Post	10.5	2.7	8.9	2.9
Gain	2.3	1.7	-0.6	2.3

TABLE 2

RANDOMIZED BLOCK ANALYSES OF VARIANCE ON CALIFORNIA ARITHMETIC ACHIEVEMENT GAIN AND CLASSIFICATION SKILL GAIN

		Arithmetic Gain		Classification Gain	
Source	df	MS	F	MS	F
Groups	1	153.13	5.95*	66.13	15.06**
Blocks	15	34.43	1.34	3.79	0.86
Residual	15	25.73		4.39	
TOTAL	31	34.05		6.09	

*p< .05
**p< .01

TABLE 3

UNADJUSTED AND ADJUSTED MEANS (THROUGH ANCOVA) OF POST-TEST PERFORMANCE OF EXPERIMENTAL AND CONTROL GROUPS ON ARITHMETIC AND CLASSIFICATION

Group	Arithmetic Post-Test Mean		Classification Post-Test Mean	
	Unadjusted	Adjusted*	Unadjusted	Adjusted**
Experimental (N=16)	62.6	63.9	10.5	11.0
Control (N=16)	60.6	59.3	8.9	8.4

* California Arithmetic Achievement post-test means of the experimental and control groups were adjusted for the significant covariates ($p<.05$) arithmetic pre-test performance and classification pre-test performance.

** Classification post-test means of the experimental and control groups were adjusted for the significant covariates ($p<.05$) age and classification pre-test performance.