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Conservation of Weight With the Learning Disabled

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Conservation of Weight with the Learning Disabled

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Conservation has been a central concept and prerequisite for the subsequent development of stages within Piaget's system of cognitive growth. As outlined by Piaget (1966), the attainment of conservation of weight was verified for 75 percent of the children tested at 9-10 years of age. Elkind (1961), in his replication of Piaget's study, reported that 73 percent of the children attained conservation of weight at nine years.

Comparative studies of normal and exceptional subjects have confirmed differences in the acquisition of conservation of weight. The performance of eight year old deaf children was shown to be similar to that of six and a half year old hearing children in an investigation conducted by Furth (1964). Miller (1969) assessed the effect of blindness on cognitive development and reported that ten year old blind children lacked conservation of weight. However, no differences in conservation of weight were substantiated for blind subjects (Ss) living at home and sighted Ss matched for age in results of Brekke, Williams, and Tait (1974). The place of residence was found to be of more importance than degree of blindness. Both blind Ss living at home and sighted Ss conserved more often than the institutionalized blind Ss. Brekke, Johnson, and Williams (1975) demonstrated that the motorically handicapped have a lower degree of conservation and attain conservation at a later chronological age than normal children.

The learning disabled (LD) child is also handicapped; though his deficits may not be as obvious as those previously mentioned, they are real and may have a serious effect upon the child's cognitive development.

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The present study was undertaken to investigate the relationship between the presence of a learning disability and the child's performance on three measures of conservation of weight.

Method

Subjects

The conservation tasks were individually administered to 98 children (79 males and 19 females) enrolled in the LD programs in three public school systems in North Dakota. These subjects ranged from 6 years 1 month to 13 years 2 months in chronological age, and from 4 years 10 months to 10 years 7 months in mental age as measured by the Slosson Intelligence Test.

A group of 98 normal children (58 males and 40 females) were also administered the conservation tasks. These subjects were selected from schools located in lower middle class neighborhoods in North Dakota and Minnesota. The normal subjects ranged in age from 6 years 4 months to 13 years 6 months in chronological age and from 6 years 9 months to 12 years 5 months in mental age. The mental age scores for the normal subjects were based upon the results of either the Lorge-Thorndike, Slosson, or Kuhlman-Anderson tests.

Procedure

The conservation of weight tasks presented to the subjects were modifications of the series of thirteen steps formulated by Furth (1964) in his study with deaf children. The sequence remained unchanged, but the nonverbal presentation was adapted to a verbal procedure in the same manner as was done in the study of conservation of weight with blind by Brekke, Williams, and Tait (1974).

Each subject was tested individually. During an initial practice period the child was given the opportunity to form a ball, a snake, a ring, and a pancake from a 1 1/2 ounce piece of clay. Then the child was asked to cut a ball in half with a knife. Next the child was presented with two clay balls (positioned

one in each hand) and asked, "Do the balls have the same weights or different weights?" The examiner repeated the question using two 1 1/2 ounce and one 3/4 ounce clay balls in a sequence of ten comparisons with two of the three balls. The concept of same and different weights had been determined when the child passed six consecutive trials. This concept must be established prior to the testing since it is crucial to the conservation of weight tasks.

The series for assessing conservation of weight (Furth, 1964) was as follows:

Step 1 Two similar balls
Step 2 One ball - one snake
Step 3 One snake - half a ball
Step 4 Two similar balls
Step 5 One whole ball - two halves of the other ball
Step 6 One whole ball - one half ball
Step 7 Two similar balls
Step 8 One ball - one ring
Step 9 One disc - one ring
Step 10 Half ring - half disc
Step 11 Half ring - half disc
Step 12 One ball - half ring
Step 13 Two similar balls

The crucial tests for attaining conservation were steps 2, 8, and 9 according to the criteria established by Furth. Each of these steps involved the transformation of one of two equal-sized balls into the shapes of a snake, a ring, and a pancake. Conservation of weight was tested by asking, "Do they have the same weight or different weights?" For the transformation steps 2, 8, and 9, all subjects were asked, "How do you know?" The justifications contributed to the classification of the response as conservers or nonconservers. Steps 4, 5, 7, 10, 11, and 13 utilized pairs of equal weight balls. Steps 3, 6, and 12 were used as control measures to check on consistent "same weight" response. Only subjects who succeeded on all three of the crucial items (2, 8, and 9) were defined as conservers.

Results

Presented in Table 1 are the proportion of conservers and non-conservers (Conservation) and the proportion of males and females (Sex) in the sample. The chi-square test was used to test for differences in the variables of conservation and sex between the LD and normal subjects. The age and intelligence means for the LD and control groups are also presented in Table 1. The t-test was used to test for differences in these two variables.

TABLE 1

PROPORTION OF CONSERVERS, MEANS FOR AGE AND INTELLIGENCE, PROPORTION OF MALES, t TESTS and χ^2 TESTS FOR LEARNING DISABLED AND CONTROL STUDENTS (N=196)

Variables	Learning Disabled	Control	Test for Significance
Conservation Conserver=1 Non-Conserver=0	.296	.469	χ^2=6.38*
Age (in months)	111.00	110.73	t = .09
Intelligence	95.84	112.45	t =7.76**
Sex Male=1 Female=0	.806	.592	χ^2=9.50**

*p <.05
**p <.01

A significant difference between the two groups was found in conservation (χ^2=6.38, p <.05). Of the normal subjects, 46.9% were classified as conservers while only 29.6% of the LD group were classified as

conservers. A difference in intelligence was found ($p < .01$) between the two groups. The LD group had a mean intelligence test score of 95.84, whereas the mean intelligence test score for the control group was 112.45. The difference in proportion of males and females in the two groups was significant at the .01 level. The learning disabled group was made up of 80.6% male subjects while the control group consisted of 59.2% male subjects. No differences were found in mean age, reflecting an attempt to partially match the two groups on the age variable.

The number of conservers and non-conservers at each of eight different age levels is presented in Table 2.

TABLE 2

NUMBER OF CONSERVERS AND NON-CONSERVERS IN EACH CHRONOLOGICAL AGE RANGE

Chronological Age Range in Months	Normals		Learning Disabled	
	Con-servers	Non-Conservers	Con-servers	Non-Conservers
72-83	4	8	2	10
84-95	5	12	2	13
96-107	7	13	4	14
108-119	9	7	7	10
120-131	7	4	6	17
132-143	9	3	5	1
144-155	3	4	2	2
156-167	2	1	1	2
Total	46	52	29	79

This data shows that the LD subjects conserved at a later chronological age than did the normal subjects with the greatest differences occurring at the lower age levels.

The relationship of conservation to age, intelligence, sex, and group (learning disabled or normal) is

shown in Table 3. While all the variables except sex show a significant zero-ordered correlation with conservation, the group variable (learning disabled vs normal) fails to make a significant, unique contribution to the prediction of conservation.

TABLE 3

MULTIPLE CORRELATIONS, ACCOUNTED VARIANCE, AND UNIQUE CONTRIBUTIONS OF ALL VARIABLES WITH CONSERVATION-NONCONSERVATION AS CRITERION

Variables	Accounted Variance R	R^2	Unique Contribution
All variables	.366**	.134	
All variables except age	.299	.052	.082**
All variables except intelligence	.335**	.112	.022*
All variables except sex	.352**	.124	.010
All variables except group	.353**	.124	.010
Age	.258**		
Intelligence	.153*		
Sex (Male = 1, Female = 0)	.082		
Group (Learning disabled = 1, Normal = 0)	-.178		

*p <.05
**p <.01

The fact that normal subjects were superior to the LD subjects in their ability to conserve was commensurate with the expected outcome; and it can be

concluded from this data that LD children will most probably be delayed in acquisition of conservation of weight.

This is consistent with research that has been done with other areas of exceptionality (Furth, 1964; Miller, 1969; Brekke and Williams, 1974; Brekke, Williams, and Tait, 1974).

The question to be examined, however, is what variable can be attributed to this delay? According to widely accepted definitions (Bateman, 1967), children who have learning disabilities show significant discrepancy between their estimated intellectual potential and actual level of performance which is related to basic disorders in the learning processes. Myers and Hammill (1969) describe basic learning processes as those necessary for perception, response formation, and the connecting associations. It is possible that a partial explanation for the difference in conservation found in this study is that the ability to conserve is in itself a learning process in which LD children are deficient. This idea, however, is not supported by the evidence in this study.

Of the variables considered in this study, only intelligence and sex discriminated between the LD and normal children. The fact that the LD children were less intelligent than the normal children is consistent with data gathered on a national level by Kirk and Elkins (1974). They found a median IQ score of LD children of 93. Thirty-five percent of the LD children had IQ scores below 90 as compared to 25% for an "average population" (p. 3). The sex variable in this study was also consistent with the national trend. Kirk and Elkins found that 75% of the LD children in the programs they surveyed were boys.

While the normal children in this study conserved more than the LD children the group variable (LD vs normal) failed to make a significant contribution to the prediction of conservation when age, intelligence, and sex are included in the predictive system. It would appear reasonable to conclude that one of the explaining factors in the difference between normal and LD children is the intelligence variable.

Suggested follow-up research should experimentally control for age, sex and intelligence in order to investigate the possibility that delay in conservation is related to learning disability through some construct other than intelligence.

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