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THE RELATIONSHIP BETWEEN CONSERVATION ACQUISITION AND FIRST GRADE READING ACHIEVEMENT

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Several reading specialists have suggested that there is a positive relationship between conservation acquisition and successful learning of reading (Winkeljohann, 1974; Schwebel and Raph, 1973; and Raven and Salzer, 1971). Although the intuitive appeal of these suggestions is great, there is little evidence to support them. The purpose of this study was to ascertain the relationship between these two important characteristics of children.

Conservation is "the realization that one aspect of something, e.g., quantity (length, area, volume, weight, etc.), remains the same while another aspect is changed (e.g., shape, position) (Gorman, 1972)." For example, water poured from a short, wide glass has the same quantity when poured into a tall, thin glass, or the number of checkers in a set remains the same independent of the set being stacked or placed in a row. The conserver employs a form of logic called reversibility—what has been changed can be put back in the original form, and/or another of the object's spatial characteristics has changed to compensate for the spatial characteristic intentionally altered, thus conserving the quantitative characteristic (compensation).

According to Piagetian followers, determining a student's level of conservation is significant during the period of the elementary grades because it best exemplifies intellectual behavior (Evans, 1971).

Schwebel and Raph (1973) state: "Piaget's system also provides us with clues to use in discovering a child's level of thinking and accordingly the adequacy of his preparation for reading."

According to Piaget's theory, the first conservation skills appear between the ages of six and eight (Piaget and Inhelder, 1969). This age span encompasses the mystical readiness age of six years-six months.

Raven and Salzer (1971) link Piaget's theory to the reading act in the following manner: "Non-conserving children lack reversibility—undoing some operation and coming back to the starting point. The inference might be drawn that he (the student) should not be expected to succeed in decoding-emphasis reading programs which require him to convert graphemes to phonemes and then validate his transformation." They further argue that the characteristic of "centration" (the inability to consider more than one aspect of a situation at a time) of non-conserving

students negates the ability to deal with words in two almost entirely unrelated but necessary ways: “as line puzzles to be deciphered (phonetically), and as messages to comprehend.”

John Merritt (Reid, 1972) points out the need not only for reversibility skills, but for the ability to discriminate between when to apply the rules of reversibility and when not to, e.g., the graphemes “b-d” and “p-q” lose their original identity when reversed.

Isolated research reports tend to support the above associations. Almy (1966) found a significant positive relationship between reading readiness and conservation acquisition. Lepper (1966) had similar findings, and Brekke (1973) found a significant positive relationship between first grade reading achievement and conservation acquisition. However, Dombrower and March (1971), supporting Goldschmid and Bentler’s 1968 study, reported no significant correlation between reading and conservation.

The hypothesized correlation warrants further investigation because a significant body of data has not yet been collected to either confirm or refute the claim.

Research Hypotheses:

1. There will be a significant, positive relationship between first grade students’ numerical degrees of conservation acquisition and “Total Reading” scores on the Primer Battery of the Metropolitan Achievement Test.
2. There will be a significant, positive relationship between first grade students’ numerical degrees of conservation acquisition and “Total Reading” scores on the Primary I Battery of the Metropolitan Achievement Test (MAT).
3. There will be a significant, positive relationship between first grade students’ numerical degrees of conservation acquisition and “Total Reading” achievements.

Definition of Variables:

1. “*Total Reading*” Achievement is measured by the MAT Primary I Battery “Total Reading” scores, after the variance in common with the MAT Primer “Total Reading” scores has been removed. “Total Reading” achievement (learning performance) is the degree of learning during a period of time between two achievement tests (one academic year).
2. *Conservation acquisition* was assessed by the use of classic Piagetian tasks; basically the same as those described by Bybee and McCormack (1970). Their format was modified to make the test more appropriate for the primary grade subjects: 1) a classic number conservation task was substituted for the displacement of volume task (Piaget and Inhelder, 1969); and 2) the continuous quantity task (water) included a second identical small jar for comparison purposes. In essence the seven tasks determined, through transformation tasks, reversibility tasks, one-

to-one correspondence tasks, and seration tasks, the numerical degrees of the subjects' conservation understanding.

Subjects:

All first grade students in one Kalamazoo, Michigan area school were tested for conservation acquisition. The progressive, early elementary school's student population is primarily Caucasian from middle class home environments. The school has four first grade classrooms. (N= 62). The school uses the Houghton Mifflin reading series.

Method

The subjects were administered the MAT Primer Battery during the month of September, 1974, by the school staff. During the next four months the subjects were assessed for their degree of conservation acquisition; scores ranged from 0 to 7.

The researcher administered seven tasks: 1) conservation of matter (clay); 2) conservation of continuous quantity (water); 3) conceptualization of water level; 4) ordering events; 5) conservation of number; 6) conservation of length; and 7) conservation of area. Each subject's responses were judged as conserving if the child logically justified the correct answer through reversibility. If the subject's responses were not correct or they could not be justified by reversibility, the responses were recorded as non-conserving. Responses (conserving marked as 1, and non-conserving marked as 0) were recorded on a worksheet. The total number of 1's for the seven tasks constituted the numerical degree of a subject's conservation acquisition. Conservation assessment tests were conducted informally, individually, and with as little pressure as possible. Using cardboard screens for privacy, the testing was conducted in student study areas located in the hallways adjacent to the subject's classroom. All responses, verbally treated as correct, were followed with a brief positive verbal response with no further elaboration of the correctness of the subject's answer. If the subject's justification was not clear, he was asked to explain and/or demonstrate. A subject's decision to participate or not to participate was respected and adhered to.

The subjects were administered the MAT Primary I Battery during the month of May, 1975, by the school staff.

Data was analyzed by correlation procedures to obtain: 1) Pearson product-moment correlation coefficients; and 2) part correlation coefficient.

Results

The mean and standard deviation of the Primer Battery "Total Reading" scores, the Primary I "Total Reading" scores, and the conservation assessment test scores are presented in Table I.

TABLE I
Descriptive Data Analysis

	x	S.D.	n
Conservation Assessment	4.597	2.138	62
Primer "Total Reading"	18.823	6.562	62
Primary I "Total Reading"	60.984	15.134	62

The correlation matrix is presented in Table II.

TABLE II
Correlation Matrix (N = 62)

	Conservation Assessment	Primer "Total Reading"	Primary I "Total Reading"
Conservation Assessment	1.0000		
Primer "Total Reading"	0.5696*	1.0000	
Primary I "Total Reading"	0.4010*	0.5955	1.0000
	= .05	c.v. = 0.211	

Positive, statistically significant from zero, correlation coefficients were obtained. The first and second research hypotheses were not rejected: 1) There is a significant positive relationship between first grade students' numerical degrees of conservation acquisition and "Total Reading" scores on the MAT Primer Battery; 2) There is a significant positive relationship between first grade students' numerical degrees of conservation acquisition and "Total Reading" scores on the MAT Primary I Battery. These findings may not be new or of great interest to the school practitioner. The value of conservation acquisition assessment as a predictor of reading achievement scores may be of greater interest to the classroom teacher.

Table III presents corresponding coefficients of determination.

TABLE III
Coefficients of Determination

	Conservation Assessment	Primer "Total Reading"	Primary I "Total Reading"
Conservation Assessment	1.000		
Primer "Total Reading"	0.324	1.000	
Primary I "Total Reading"	0.160	0.354	1.000

The coefficients in Table III are interpreted as follows: 1) the conservation assessment test accounts for 32.4% of a subject's MAT Primer Battery "Total Reading" score variance, and 16% of a subject's MAT Primary I Battery "Total Reading" score variance; and 2) variables not examined in this study account for 67.6% and 49% of the subject's score variances respectively.

Part correlation analysis was used to test the third (null) hypothesis. This statistical procedure was used to obtain a coefficient of the relationship between the numerical degree of conservation acquisition and "Total Reading" achievement. A part correlation analysis, eliminating variance shared by both sets of "Total Reading" scores, produced a coefficient of 0.095. This coefficient is not statistically significant and accounts for less than one percent of the variance in reading achievement. Therefore, the third research hypothesis is rejected. There is no significant relationship between first grade students' numerical degree of conservation acquisition and "Total Reading" achievement.

Through part correlation analysis it has been demonstrated that conservation acquisition is not significantly correlated with first grade students' "Total Reading" achievement, when "Total Reading" achievement is measured as the degree of learning during a period of time between two achievement tests (one academic year).

Summary

Researchers have proposed the use of conservation acquisition assessment as an aid for predicting primary grade reading success. Piagetian theory has been applied to justify the proposal, and research findings have added support to the hypothesis.

The results of this study do not support the use of conservation acquisition assessment as a predictor of primary grade reading achievement. Although significant correlations were observed between conservation acquisition and MAT Primer Battery "Total Reading" achievement scores, and between conservation acquisition and MAT Primary I Battery "Total Reading" achievement scores, corresponding

coefficients of determination only account for approximately one-third, or less, of the scores' variance. Furthermore, a part correlation analysis (eliminating variance in common between the MAT Primer Battery "Total Reading" achievement scores and the MAT Primary I Battery "Total Reading" achievement scores) to assess the relationship between conservation acquisition and reading achievement (learning) revealed no significant correlation.

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