1978

A Comparison of Stages of Cognitive Development in Normal and Language Impaired First Grade Age Children

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A COMPARISON OF STAGES OF COGNITIVE DEVELOPMENT IN NORMAL AND LANGUAGE IMPAIRED FIRST GRADE AGE CHILDREN

by

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A Dissertation Submitted to the Faculty of the School of Education of Loyola University of Chicago in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

December

1977

ACKNOWLEDGEMENTS

This writer wishes to express gratitude to the many people who assisted throughout this project. Deep appreciation is expressed to Dr. Mary Jane Gray for her direction and encouragement. Special gratitude is extended to Dr. Barney Berlin, Dr. Joy Rogers and Dr. Jack Kavanagh for their interest and constructive criticism in helping to develop this study.

Ms. Judy Edison and Ms. Susan Deiser must be acknowledged for their help in collecting the data. Mr. Edward Brooks deserves thanks for his assistance in the computer analysis of the data.

A special thank you is extended to Dr. Standley Bristol and Dr. Jackie Wolfe for permitting data collection within their districts in Highland Park and Shiller Park respectively. This writer also wishes to thank the many children who participated in this study for their patience and cooperation while taking the tests.

Finally, the warmest gratitude goes to Margaret Atchison who continually provided the necessary support needed to complete this project.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF ILLUSTRATIONS

CONTENTS OF APPENDICES

CHAPTER I

INTRODUCTION

The Statement of the Problem

Specialists in the fields of curriculum and instruction are concerned not only with the education of the normal child but also with the unique needs of the child with special handicaps to learning. Educators have been teaching children with sensory, physical or mental handicaps for a long time. Of more recent interest to the field of education are children with language related impairments. These children traditionally receive speech and language services as an integral part of their educational program. Such services are often effective in remediating the learning disorder if language is, in fact, the central inhibitor to learning. Certain theoretical positions, however, suggest that language, or linguistic competence, may not be the central problem. Jean Piaget theorizes "... that the level of 'concrete opertations' operational structure precedes linguistic structure, the latter somehow growing out of the former to rely on it subsequently."[1] This suggests the possibility that at

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[1] Jean Piaget, Structuralism, trans. Chaninah Mashler (New York: Harper & Row, 1971), p. 96.

least some of the linguistic problems observed in children may be related to an underlying difference in the way cognition develops for this population. Then, if so, the design of specialized educational curricula needs to include systems which take advantage of the cognitive/linguistic interdependence.

It was the purpose of this study to investigate whether the conservation skills exhibited by language impaired children differ significantly from the conservation skills of first-grade age children with normal language development. One subproblem studied was whether age correlates with the emergence of conservation skills to the same degree in both groups. A second subproblem was to determine the relationship between measured intelligence and the emergence of conservation, and whether language performance and intelligence affect conservation skills. A third subproblem was to identify the specific conservation tasks which significantly related to language normal and language impaired first-grade age children.

Hypotheses

1. The relationship between measures of conservation and measures of language ability will not differ significantly between language normal and language impaired first-grade age children.

2. Measures of intelligence will not correlate significantly with the emergence of conservation in either language normal or

language impaired first-grade age children.

3. Chronological age will not relate significantly with the emergence of conservation abilities in either language normal or language impaired first-grade age children.

Definition of Terms

Cognitive development: The logical adaption of the environment as described by Jean Piaget.[1] It includes processes of assimilation and accommodation which serve to organize external stimuli into schemata or knowing.

Conservation: The maintenance of a structure as invariant during physical changes of some aspects. The stability of an objective attribute is never simply given but rather is constructed by organism. Conservation is the internal system of regulations that compensate internally for external changes.[2]

Expressive language: The ability to use speech for communication with others.[3]

Invariance: The state of things in the objective world. Also refers to a characteristic of the mental structure which functions

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[1] Jean Piaget and Barbel Inhelder, The Psychology of the Child, trans. Helen Weaver (New York: Basic Books, 1969), p. 6.

[2] Hans Furth, Piaget for Teachers, (New York: Prentice-Hall, Inc., 1970), p. 158.

[3] Doris Johnson and Helmer Myklebust, Learning Disabilities, (New York: Grune and Stratton, 1967), p. 40.

to maintain a belief in constancy.[1]

Language impaired children: Children between the ages of five years, six months and seven years, who are enrolled in a special education class with the label of learning disabled, behavior disordered, mentally retarded or any combination of the above and who test in the lower 10 per cent of the norms in either expressive or receptive language impaired children with severe motor dysfunctions, severe mental retardation, (i.e., IQ < 40) giftedness or severe emotional disturbance.

Language normal children: Children between the ages of five years, six months and seven years, who are enrolled in a public school. These children have never been in a special education program for language impairment. The study does not include any children of normal language if they are suspected of being language impaired or if English is not the first language spoken in the home.

Quantitive invariants: The processes composed of the differences that exactly compensate one another and vary in inverse directions at the same time.

Receptive language: The ability to comprehend the spoken or written word. Comprehension assumes the ability to discriminate and group words.

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[1]Rheta DeVries, "Constance of Generic Identity in the Years Three to Six," Monographs of the Society of Research in Child Development 34 (1969): 56-60.

Limitations

The cognitive developmental theory described by Jean Piaget evolved from the methode clinique. That is, Piaget's principal method of investigation resulted from systematic observation, description and analysis of the behavior of children. This approach, as Wadsworth states, is to discover the nature and level of development of the concepts used by children and not to produce developmental scales.[1] The "non-experimental" approach was not used in this investigation. Rather, behaviors which are characteristic of the language and conservation processes were coded for purposes of statistical analyses. The difference between the Piagetian approach and the one designed for this study may limit the usefulness of the results of this study if compared with the totality of the theoretical implications of development of logic in children.

The cross-sectional design of this study permitted the data to be compared by correlation procedures. The intent was to discover relationships and not to demonstrate specific changes which curriculum specialists might make to assist language impaired first-grade age children. Because the design of this project did not permit answering application questions, the author feels that such questions were beyond the scope of this study and should be considered by later investigations.

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[1]Barry Wadsworth, Piaget's Theory of Cognitive Development, (New York: David McKay Company, Inc., 1975), pp. 5-8.

The populations on which the data were collected were homogeneous on the criteria or race (all Caucasian) and geographic region (all from suburbs of Chicago). While these criteria served to control extraneous variables, they necessarily limited the generalizability of the findings. Also, the requirements of age, intelligence and language performance which were met before data collection limited the size of the groups to be studied.

The Significance of the Study

Language impaired children enrolled in special education classes in public schools are those students for whom standard curricula may be inappropriate. Major efforts have been made in education to develop compensatory programs for young children. These attempts have had an impact, but were limited to the theoretical models used in their design. The intervention schemes used with language impaired children have ignored the possible interdependency of language with the cognitive ability to conserve. This study will attempt to show a degree of interdependency.

The timeliness of this study relates to the present level of interest in the application potential of the language and cognitive models. The efforts of Chomsky, McNeill and Slobin[1] are being organized into assessment devices and used in the clinical evaluation of children's language.[2] Simultaneously, the "American School" of Piagetian researchers is designing assessment procedures based on the Geneva experiments. Specific attempts are being made to place cognitive developmental behavior into an ordinal scale.[3] While these attempts move with vigor, as yet no one in the curriculm field has attempted to apply the present body of knowledge to an investigation of the difference between conservation abilities in language impaired first-grade age children and a sample of normal language first-grade age children.

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[1]See Noam Chomsky, The Acquistion of Syntax in Children from 5 to 10 (Cambridge, Mass.: The MIT Press, 1969); David McNeill, The Acquisition of Language (New York: Harper & Row, 1970); and Dan Slobin, Psycholinguistics (Glenview: Scott Foresman and Company, 1971).

[2]Laura Lee, Developmental Sentence Analysis (Evanston: Northwestern University Press, 1974).

[3]See Owen Cahoon, A Teachers Guide to Cognitive Tasks for Preschool (Salt Lake City: Brigham Young University Press, 1974); Marcel Goldschmid and Peter Bentler, Concept Assessment Kit--Conservation (San Diego: Educational and Industrial Testing Service, 1968); Hans Furth, Piaget for Teachers (New Jersey: Prentice-Hall, 1970); and Donald Green, Marquerite Ford, George Flamer, Measurement and Piaget (New York: McGraw-Hill, Inc., 1971).

CHAPTER II

REVIEW OF RELATED RESEARCH AND LITERATURE

Introduction

The basic assumption of this study is that conservation interrelates with expressive and receptive language along developmental stages. The emergence of these stages implies normalcy.[1] Research which preceded this study includes the work of Forish's[2] developmental study on mental imagery and the verbal process, the study by Hughes and Walsh[3] on syntactic mediation effects on paired associate learning and the major effort by Edwards[4] yielding data on the interaction of child grammar on sensory-motor intelligence. Throughout these studies,

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[1] See Jean Piaget and Barbel Inhelder, The Psychology of the Child trans. Helen Weaver (New York: Basic Books, 1969), Dan Slobin, Psycholinguistics (Glenview: Scott Foresman and Company, 1971).

[2] Barbara D. Forisha, "Mental Imagery Verbal Process: A Development Study," Developmental Psychology 11 (1975): 259-267.

[3] S. Elieen Dolers Hughes and John F. Walsh, "Effects of Syntactical Mediation, Age, and Mode of Representation on Paired Associate Learning," Child Development 42 (1971): 1827-1836.

[4] Derek Edwards, "Sensory-Motor Intelligence and Semantic Relations in Early Child Grammer," Cognition 2 (1973):395-434.

the data reinforce the basic Piagetian notion as studied by Sinclair[1] that linguistic skill is dependent on the child's operational level and therefore operational performance cannot be improved by training more sophisticated linguistic structures. Following Sinclair's effort, Moerk[2] used Piaget's theory to explain the causal-genetic basis of language. His data also concur with the fundamental notion of Piaget that the cognitive universals are the main elements of verbal communication.

Language and Cognition in Normal Children

A number of studies have been completed on the relationship of cognition and language. Flavell[3] believes that a major component in assessing a child's cognitive status is interpreting the linguistic skills of comprehension and production. Conceding that the study of native languages falls under the auspices of transformational grammarians, he suggests using their tenets to obtain data on the child's knowledge of the nonspeech world.

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[1] Hermina Sinclair, "Sensory-Motor Action Patterns as a Condition for the Acquisition of Syntax," in Language Acquisition: Models and Methods, edited by R. Huslex and E. Ingram (New York: Academic Press, 1975).

[2] Ernst L. Moerk, "Piaget's Research as Applied to the Explanation of Language Development," Merrill-Palmer Quarterly 21 (1975): 151-170.

[3] John H. Flavell, "The Use of Verbal Behavior in Assessing Children's Cognitive Abilities," in Measurement and Piaget, edited by Donald Gree, Marquerite Ford, George Flamer, Measurement and Piaget (New York: McGraw-Hill, Inc., 1971).

Such a study, he believes, is the ultimate diagnostic area for cognitive studies. Just as the conservation tasks are use to determine the level of operations, the child's linguistic behavior can be used as a basis for inferences about cognitive abilities.

Brekke and Clark's[1] study support Flavell's notion of the diagnostic potential in the areas of language and cognition. They designed a clinical interview format to determine the use of relative clauses. Their assumption was that syntax develops at the time the child begins to decenter at the end of the sensori-motor stage, and that syntax becomes more complex with the emergence of operational thought. Their data on a twelve year old male with a verbal I.Q. of 88 were similar to a child in transition into operational thought. Brekke and Clark conclude from their findings that the grammar of the preoperational period mustbe restructured before the period of concrete operations can emerge.

Dimitrovsky and Almy[2] studied the effect of verbal I.Q. in the frequency of correct responses on conservation tasks in kindergarten. After completing a four year longitudinal study of 697 children's logical thinking ability, the analysis indicates

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[1]Beverly Brekke and Alice Clark, "Observations of a Piagetian Clinical Interview on Language Acquisition," Elementary English 51 (1974): 291-294.

[2]Lilly Dimitrovsky and Millie, "Language and Thought: The Relationship Between Knowing a Correct Answer and the Ability To Verbalize the Reasoning on Which It is Based," Journal of Psychology 80 (1972): 15-28.

that the ability to conserve and to explain the conservation task develop at different times. The children conservating early were less likely to be able to explain the process as well as the children who conserved at a later age.

Language and Cognition in Atypical Children

The studies cited thus far used populations assumed to be normal in developmental potential. The evidence on these populations weighs heavily towards demonstrating the isomorphic relationship between the development of language and the attainment of particular Piagetian defined stages. A few studies have tried to confirm this isomorphism with atypical populations.

Moorehead and Ingram[1] compared language samples of 15 normal young children with 15 linguistically deviant children who were matched according to base syntactic systems. The normal group ranged in age from one year seven months to three years, one month; the linguistically deviant group from three years, six months to nine years, six months. The two sets of data were analyzed in terms of the means of the number of morphemes per utterance, the number of relational utterances, and the ages of the children. Five levels of linguistic competence were used to scale the data. After scaling, the non-parametric tests of Mann-

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[1] Donald M. Moorehead and David Ingram, "The Development of Base Syntax in Normal and Linguistically Deviant Children," Journal of Speech and Hearing Research 16 (1973): 330-352.

Whitney U and Spearman Rank Correlation were used to show significance. From these analyses, the authors concluded that:

> ...the major differences between normal and linguistically deviant children of comparable linguistic level were not in the organization or occurrence of specific subcomponents of their base syntactic systems. Rather, the significant differences were found in the onset and acquisition time necessary for learning base syntax and the use of aspects of that system, once acquired, for producing major lexical items in a variety of utterances. (p. 340).

The research data on deaf subjects, provided by Furth,[1] add greatly to the understanding of the separate but interdependent nature of cognition and language. He studied the question of why deaf children and adults possess developmentally appropriate cognitive skills in the absence of a verbal system. The conclusion of his work is that the nature of the similarity between normal and deaf subjects indicates an underlying cognitive structure which is enhanced by, but not dependent on language.

Stephens and McLaughlin[2] analyzed the performance of normals and retardates assumed to be in the concrete operational period. With 75 subjects in each group, they attempted to determine, through an analysis of covariance, the accuracy of

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[1]Hans G. Furth, "Linguistic Deficiency and Thinking: Research with Deaf Subjects 1964-1969," Psychological Bulletin 76 (1971): 58-72.

[2]Beth Stephens and John A. McLaughlin, "Analysis of Performance by Normal and Retardates on Piagetian Reasoning Assessment as a Function of Verbal Ability," Perceptual and Motor Skills 32 (1971): 868-870.

the Piagetian notion that cognitive development is not entirely dependent on concurrent linguistic skills. Their results modify the Piagetian notion to the extent that:

> Although cognitive development is not dependent on language development, language is the major vehicle through which the individual demonstrates the level of cognitive development attained by him. (p. 870)

Two studies which led to this investigation were completed by Vogel[1] and Klees and Leboun.[2] The study by Vogel used the current knowledge of the role of syntax to demonstrate a major deficiency which is significantly related to the diagnostic category of dyslexia, as well as designing more sensitive measures for the assessment of syntactic abilities. The multivariate analysis of the data from 20 normals and 20 dyslexics show significant differences in syntax between the two groups. Her implications for further study stimulated the study herein being proposed. Vogel states that the findings

> ...suggest that it may be possible to identify high risk children prior to entering school. (and) if syntactic measures were incorporated into a screening process, potentially dyslexic children could be identified and appropriate intervention planned. (p. 108)

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[1]Susan Vogel, "Syntatic Abilities in Normal and Dyslexi Children," Journal of Learning Disabilities 7 (1974): 47-53.

[2]Marianne Klees and Ariane Leboun, "Analysis of the Figurative and Operative Processes of Thought of 40 Dyslexic Children," Journal of Learning Disabilities 5 (1972): 389-396.

Klees and Leboun[1] studied 40 dyslexic children, aged seven to eleven years, using the Piagetian notions of quantitative and qualitative processes. They used percentages to describe response patterns without further testing on levels of significance. Statistical significance notwithstanding, they maintain their hypothesis that the dyslexic child uses inferior qualitative processes compared to normal, age-matched children. That is, dyslexia seems to be related to an inability on the part of the child to elaborate a system of reference exterior to the object. Such children seem to be dependent on the concrete and figurative aspects of cognitive tasks.

Role of Conservation in Development

Many investigations have dealt with the question of the importance of conservation and cognitive development.

Russell[2] designed a study to determine whether conservation was related to decentering or was simply a function of a child's semantic development. In order to determine the answer, he tried to control verbal competence by regulating the level of ability used. Russell designed a perceptual conservation task based on variations in height and shape. After statistical analysis of the

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[1] *Ibid*.

[2] James Russell, "The Interpretation of Conservation Instruction by Five-Year Old Children," *Journal of Child Psychology* 16 (1975): 233-244.

responses from 80 five-year old children, he concluded that failure to conserve is more than semantic failure.

One aspect of a child's logical process which relates to language development was studied by Brook.[1] Her design yielded information on Piaget's notion of nominal realism, i.e., the child's belief that the name of an object or word is equivalent to the object itself. This phenomenon is related to the child's preoperational ability to decenter and consequently the inability to distinguish between internal and external realities. Brook interviewed 150 children, subdivided by age, i.e., three sets of 50 six, eight, and ten-year-old children. During the interview, she asked seven questions on the origin of names. After a chi-square analysis of the results she found that, as chronological age increases, the ability to separate the word from the object increases.

Logical thought, which is assessed by the ability or inability to conserve, is believed to be regulated by the process of decentering. Cromer[2] studied the importance of decentering in time in order to generate evidence of the age relatedness on linguistic references. He studied 70 children ranging in age

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[1] Judith S. Brook, "A Test of Piaget's Theory on Nominal Realism," The Journal of Genetic Psychology 116 (1970): 165-175.

[2] Richard F. Cromer, "The Development of the Ability to Decenter in Time," British Journal of Psychology 62 (1971): 353-365.

from 3 years, 11 months to 7 years, 4 months. Data were obtained by using a story telling procedure which revolved around temporal events affecting the main characters. His results showed that decentering is associated with verbal mental age. This outcome exists regardless of the specific linguistic forms of the verbal directions, except where the most complicated linguistic forms were used, e.g., the perfect tense. Therefore, Cromer concluded that "...the cognitive ability to decenter (therefore the ability to conserve) develops independently of specific linguistic ability to imitate particular forms." (p. 363).

Very young children's grammar was investigated by Greenfield, Nelson, and Saltzman.[1] They tested 64 children between the ages of 11 months and 36 months. Their goal was to support the theory that there is, in fact, an isomorphic relationship between language and cognition. The main effects which theoretically demonstrated this relationship were action and grammar. Serial tasks were presented such that solutions to the task demanded the child develop cognitive strategies. Chi-square analysis yielded significant results for group by age performance. The authors suggested that the difference among age groups might be a manifestation of some underlying cognitive skills which are critical for language acquisition.

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[1]Patricia Greenfield, Karen Nelson and Elliot Saltzman, "The Development of Rulebound Strategies for Manipulating Seriated Cups: A Parallel between Action and Grammer," Cognitive Psychology 3 (1972): 291-310.

Edwards[1] believes that sensory motor intelligence and the semantics used by young children interact to limit the child's ability to develop concepts. He attempted to integrate relational meanings into a general linguistic structure as well as the cognitive level of the sensory-motor stage. By analyzing two-word speech productions he concludes a system of semantic roles and relations. He suggests that actual words are not constrained cognitively but rather the constraint is in the semantic-syntactic usage of those words.

DeVries'[2] research is important to a complete understanding of the preoperational stage and the role of conservation. Her differentiation of quantitative and qualitative constancies of invariances strengthens the means through which logical thought may be investigated. She states that:

> Although conservation of concrete attributes does not occur until about seven or eight years of age, the development of constancy of qualitative attributes, or identity, occurs before this time. According to Piaget, the preoperational identity structures themselves undergo an evolution such that they become integrated into operation structures which make possible quantification and conservation. (p. 3).

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[1]Derek Edwards, "Sensory-Motor Intelligence and Semantic Relations in Early Child Grammer," Cognition 2 (1973): 395-434.

[2]Rheta DeVries, "Constancy of Generic Identity in the Years Three to Six," Monograph of the Society for Research on Child Development 34 (1969): 56-60.

This qualitative difference between child and adult is reflected in the emotional and behavioral areas as well as in the verbal responses.

DeVries studied the qualitative constancy notion by observing the responses of four sets of children (N=16 per set) ages three, four, five, and six years. Her study consisted of placing masks on a cat to give it the appearance of being a dog or a rabbit. The children were then asked to identify the animal. A scattergram analysis showed that generic identity occurs at an earlier age than conservation. That is, qualitative invariance emerges properly in the preoperational stage.

The concluding remarks of DeVries' work suggest "....a need for further research to clarify the developmental cognitive processes which occur several years before the concrete operational stage." (p. 59) She also recommends research into "The many ways in which egocentric views begin to give way to nonegocentric view this period ..." (p. 59).[1]

J. Roland Fleck[2] investigated conservation in 88 kindergarten, first, and second grade boys. His goal was to determine

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[1]Ibid.

[2]J. Roland Fleck, "Cognitive Styles in Children and Performance on Piagetian Conservation Tasks," Perceptual and Motor Skills 35 (1972): 747-756.

the preferred cognitive styles between field independence and verbal mediation-nonmediation. The hypothesis was that a verbally mediating, field independent child would display conservation ability before any other combination of the parameters. The notion is that verbal mediation would counteract the inability of the preoperational child to decenter the perception which keeps him from conserving. Fleck's results show that the age of the child was a significant main effect ($p=.01$) and the main effect of field independence was also significant ($p=.05$), but the main effect of verbal mediation did not influence the subject's ability to conserve.

Summary

The data contained in studies on conservation and language support Piaget's notion that language is used symbolically and chiefly influences intelligence through the social, educative aspects of development. The interdependent relationship between the emergence of conservation and language development seems clear when discussing the child with normal language functions. The absence of research on the relationship between the emergence of conservation in the child with impaired language functions has led to this proposal.

CHAPTER III

RESEARCH DESIGN

Introduction

The dearth of studies on how language developmental patterns relate to the emergence of conservation in language impaired first grade age children clearly supports the need for empirical research on the relationships between logical thought and language performance. This study defined, measured and analyzed conservation variables from a sample of 25 language impaired first-grade age children in relation to identical measures from 33 language normal first-grade-age children.

Data from both groups were collected via a cross-sectional measurement of the independent variables of language performance, mental age and chronological age and designated dependent variables of conservation ability.

Subjects

The language impaired group included 25 children between 5 years 6 months and 7 years of age in special education classes who showed impaired expressive or receptive language skills. The process for placement of the students was uniform in all cases.

These children were referred for evaluation by pediatricians, nursery school teachers and parents. The basic evaluation battery, performed by a registered school psychologist, included the Stanford-Binet intelligence test, the Peabody Picture Vocabulary Tests, the Beery Buktenica Test of Visual-Motor Integration and the Caldwell Cooperative Preschool Inventory. In addition to this basic test series, the psychologist may have used other standardized instruments along with clinical observations. The school psychologist's data were used to define a profile of the child's learning characteristics and social-emotional development.

Supplementing the information from the formal tests were medical reports, speech and language evaluations, anecdotal records from referral sources and interview data resulting from school social worker conferences with the parents. Prior to the final determination of categorical disability and admission to a first grade special class, a multidisciplinary conference was held. The purposes of the staffing for each child were:

(1) To review the case study by the psychologist and social worker.

(2) To determine eligibility for special education services.

(3) To determine the specific educational needs of the child and nature and degree of intervention required.

(4) To develop an individual educational plan.

The participants at this meeting including the program consultant, two psychologists, a social worker, a speech therapist, a special educator and parents. The control group was chosen to match the experimental group on age, geographic location, intelligence, race and amount of time in preschool setting. Any intervention program previous to the fourth birthday was assumed to be random across both groups.

Description of Variables

This study was concerned with the theoretical position of Jean Piaget which states that language is dependent on the development of logical thought. Since the presence of conservation demonstrates logical development, this study generated data on whether this Piagetian notion of the role of conservation is as valid with language impaired first grade age as it is with language normal first-grade-age children. The independent variables selected to indicate this validity were age, intelligence, and/or receptive language skills of first-grade-age children at the time when conservation emerges. The dependent variables were measures of conservation.

Materials

Measures of expressive language were obtained from Lee's[1] "Developmental Sentence Scoring (DSS)". This instrument is designed to provide profiles of the normal child between the age of 2 to 7.5 years. The DSS shows an overall reliability for this age range of 0.71 when measured by Cronbach's Coefficient Alpha. Lee states that the "...validity of the DSS scorings must in large part be indicated by significant differences produced among successive age groups of normally developing children."[2] This, she believes, is necessary because, "The validity of a test of language behavior cannot be proven directly."[3]

Receptive language abilities were obtained by scores on the Peabody Picture Vocabulary Test (PPVT). The PPVT is a standardized instrument with a minimum of eleven studies reported in the manual attesting to its reliability. The PPVT correlates with the Stanford-Binet and Weschler Intelligence Scales at 0.71 and 0.61 respectively. For this study, the results of the PPVT were analyzed as a measure of a child's one-word receptive vocabulary.

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[1]Laura L. Lee, Developmental Sentence Analysis (Evanston: Northwestern Press, 1974), p. 223.

[2]Ibid.

[3]Ibid.

Intelligence was measured with the Coloured Progressive Matrices (Revised, 1956) in both the language-normal and language-impaired groups. This test has been standardized on children five and one-half to eleven years of age with test-retest reliability at six and one-half of 0.6 ± 0.06. The author, J. C. Raven, explains this rather low reliability by stating that, "...the scale was sensitive to fluctuations in the output of intellectual activity in early childhood, rather than to any defect in the scale itself."[1] The results of the test are presented in percentile form for comparison and analysis of the child's present level intellectual development.

Measures of conservation development were generated from the Concept Assessment Kit-- Conservation (CAK--C).[2] Eight areas which measure the level of emergence of conservation are included:

(1) two-dimensional space
(2) number
(3) substance
(4) continuous quantity
(5) weight
(6) discontinuous quantity
(7) area
(8) length

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[1] J. C. Raven, Guide to Using the Coloured Progressive Matrices (London: H. K. Lewis & Company Ltd., 1968), p. 18.

[2] Marcel Goldschmid and Peter M. Bentler, Manual, Conservation Assessment Kit--Conservation (San Diego: Educational and Industrial Testing Service, 1968).

The CAK--C has forms A, B, and C. Forms A and B represent parallel forms, while Form C assesses area and length. The results of all forms are presented in percentiles. The reliability between Forms A and B is .94 and Form C is .91 on a test-retest measure.

The published age-range for this test is four years to seven years. Critical analysis of the CAK--C age norms was made by J. Douglas Ayers. He states, "The normative data, as well as general experience indicate that the age range should be 5-1/2 to 7-1/2, rather than the recommended 4 to 7".[1]

Summary of Measures

Language

Test	Data for Analysis
Peabody Picture Vocabulary Test (Receptive Vocabulary)	Percentile Raw Score
Developmental Sentence Scoring (Expressive Language)	Mean Score Raw Score

Cognition

Test	Data for Analysis
The Coloured Progressive Matrices (Intellectual Level)	Percentile Raw Score
Concept Assessment Kit - Conservation (Conservation) Forms A & C	Percentile Raw Score

[1] J. Douglas Ayers, "Concept Assessment Kit--Conservation," in The Seventh Mental Measurements Yearbook, editied by O. K. Buros (Highland Park, N.J.: Gryphon Press, 1972), p. 810.

Procedures

Thirty-three language-normal and 25 language impaired children received the same battery of tests. The data were collected by teachers and speech therapists who were familiar with the children and the instruments, thereby eliminating potential difficulties in either establishing rapport with the children or manipulating the test materials.

Statistical Procedures

Prior to statistical treatment of the hypotheses, t-tests of significance for independent group differences were run on the independent variable of chronological age, intelligence, receptive and expressive language. As a test of the major hypothesis, i.e., conservation ability in language impaired children is not different from conservation ability in language normal children, a Pearson product-moment correlation was run with the language measures and the conservation measures for each group. The resulting correlation coefficients were tested for equality using Fisher's Z transformation. Canonical correlation was run on the language and conservation measures to further test the major hypothesis.

Two of the assumed inherent characteristics which influence both language performance and conservation ability are chronological age and intelligence. Determining the relationship these independent variables had on the conservation measures was found using by Pearson product-moment correlations on age and intelligence by group.

The solution to the subproblem--which specific conservation tasks significantly relate to normal and impaired language performance -- was sought through a series of point biserial correlations with the individual conservation tasks.

An alpha level of .05 was used for all tests of significance.

CHAPTER IV

RESULTS

Conservation Abilities of Normal and Language Impaired Children

Group placement was determined on the basis of language ability with the variables of age and intelligence being similar across both groups. A t-test to determine significant differences was run to verify that these conditions were met. Raw scores were used in the analysis because the standardized scores included age. The results showed a significant difference between groups at $p=0.000$ for both receptive and expressive language measures. The variable of age was not significantly different across groups at the level $p=0.360$. The intelligence measures did not differ significantly across groups with the two-tailed probability equal $p=0.295$.

Twelve scoreable tasks on the Conservation Assessment Kit -- Conservation (CAK-C), forms A and C, measuring eight separate conservation abilities, were administered to both groups of children. The major hypothesis, the significance of the difference between the measured ability to conserve by group, was tested first by using a Pearson product-moment correlation on the number of conservation tasks which were mastered by the children in each group. The raw data were used because the standardized scores included age. These correlations were then tested for significant differences between the correlation of conservation for the normal language group (r_1=.5731) and the correlation of conservation measures for the language impaired group (r_2=.8649) using Fisher's Z transformation. This test transforms the correlations to Z_r values to test whether the two samples were obtained from two different populations, or whether the correlations are equal. The resulting score of $-2.344 \geq 2.344$ showed p=.0192.

The major hypothesis also included the question of the relationship between receptive and expressive language ability and the significant group difference in the ability to perform the tasks on CAK--C, forms A and C. A canonical correlation was run to answer this question. The scores from the two tests of conservation were correlated as dependent variables with the independent variables of receptive and expressive language. Raw scores were used in this statistical procedure because of the possible contaminating influence age might have if the standardized scores were used. Tables 1 and 2 display the results.

TABLE 1

CANONICAL CORRELATION FOR RECEPTIVE AND EXPRESSIVE LANGUAGE WITH SCORES ON CAK--C, FORMS A AND C, OBTAINED BY LANGUAGE IMPAIRED GROUP

Number	Eigen-value	Canonical Correla-tion	Wilk S Lambda	Chi-Square	D.F.	Signif-cance
1	0.41775	0.64634	0.53445	13.47029	4	0.009
2	0.08210	0.28652	0.91790	1.84175	1	0.175

Coefficients for Canonical Variables of the First Set

	Canvar 1
Receptive Raw Scores	0.84957
Expressive Raw Scores	0.30864

Coefficients for Canonical Variables of the Second Set

	Canvar 1
CAK--A Raw Scores	1.11823
CAK--C Raw Scores	-0.13954

TABLE 2

CANONICAL CORRELATION FOR RECEPTIVE AND EXPRESSIVE LANGUAGE WITH SCORES ON CAK--C, FORMS A AND C, OBTAINED BY LANGUAGE NORMAL GROUP

Number	Eigen-value	Canonical Correla-tion	Wilk S Lambda	Chi-Square	D.F.	Signifi-cance
1	0.18877	0.43448	0.79910	0.61609	4	0.158
2	0.01495	0.12228	0.98505	0.44443	1	0.505

Coefficients for Canonical Variables of the First Set

	Canvar 1
Receptive Raw Scores	0.36284
Expressive Raw Scores	0.90009

Coefficients for Canonical Variables of the Second Test

	Canvar 1
CAK--A Raw Scores	-0.04323
CAK--C Raw Scores	1.02415

The results from Tables 1 and 2 show the canonical correlation between receptive and expressive language with scores on CAK-C, forms A and C, for the language normal groups respectively. The contents of these tables reaffirm the rejection of the null hypothesis which states that measures of conservation and measures of language ability will not differ significantly from the language normal to the language impaired group.

The first eigenvalue in Table 1 is significant with p=.009. The first eigenvalue is Table 2 is non-significant with p=.158. The pattern of significance for these eigenvalues is examined by looking at the canonical variates for the first and second set of the two variables. Canonical variate 1 for the first set in Table 1 has loadings of .84957 for receptive raw scores and .30864 for expressive raw scores. For the language normal group (Table 2), the loadings on the canonical variates for the first set are .36284 for receptive raw scores. The magnitude of these loadings are in opposite directions for the language normal and the language impaired groups. The same circumstances are observed in the canonical variates of the second set. The canonical variates in Table 1 for CAK--A raw scores have a loading of 1.11823 and for CAK--C raw scores of -.13954. Whereas, the canonical variates in Table 2 for CAK--A raw scores have a loading of -.04323 and for CAK--C raw scores has a loading of 1.02415.

The pattern of the loadings between the canonical variate in Table 1 and Table 2 is opposite for each group. The different order of these loadings support the rejection of the hypothesis that the raw scores between the language normal and the language impaired would not differ.

Functions Related to Intelligence

The second hypothesis concerns the relationship of intelligence to conservation ability in children with impaired language and whether this relationship is different from children with normal language. This study's design eliminated the high and low extremes of intelligence scores. Subjects were selected from the middle range of intellectual ability for comparison. A Pearson product-moment correlation was run on the raw scores obtained by children from both groups on the intelligence test. Table 3 presents the results for the language normal group and the language impaired group.

TABLE 3

PEARSON r FOR INTELLIGENCE AND CONSERVATION

Group	Measure	r	Significance of r
Normal	CAK--A	0.1517	0.200
	CAK--C	0.0098	0.478
Impaired	CAK--A	0.5456	0.002
	CAK--C	0.3640	0.037

These correlations show that intelligence is not significantly related to the conservation scores achieved by the 33 language normal children. On the CAK--A the correlation with intelligence is .1517 which is significant at p=200. The language normal group intelligence score correlates with CAK--C at .0098. The score is significant at p=.478. Both p levels are not significant as defined by the alpha level of $\leq .05$.

The correlations between intelligence scores and conservation scores for the 25 language impaired children are within the alpha level of $p \leq .05$. On the CAK--A measures, intelligence correlated $r = .5456$. This correlation is significant at $p = .002$. The CAK--C measures show $r = .3640$ with intelligence. This correlation is significant at $p = .037$. These data suggest that intelligence is more related to success on conservation tasks for the language impaired population than the language normal group.

Functions Related to Age

The third hypothesis states that chronological age will not relate significantly to the ability to conserve regardless of language ability. The critical age range for the emergence of conservation is between four years and eight years of age. The children selected for this study were between five years, six mohths and seven years of age. The Pearson product-moment correlation results are summarized in Table 4.

TABLE 4

PEARSON r FOR CHRONOLOGICAL AGE AND CONSERVATION

Group	Measure	r	Significance of r
Normal	CAK--A	0.4572	0.001
	CAK--A	0.2289	0.042
Impaired	CAK--A	0.4498	0.012
	CAK--C	0.3390	0.49

The age of the children in the language normal group correlated with their scores on the conservation measures accordingly: CAK--A, r=.4572 and CAK--C, r=.2289. These correlations are significant at p=.001 and p=.042 respectively.

The correlation between age and measures of conservation for the language impaired group is also significant. On the CAK--A, r=.4498 with p=.012 and on the CAK--C, r=.3390 with p=.049.

Therefore, for both groups, increasing age seems to enhance improved scores on conservation tasks.

Conservation Tasks Related to Language Performance

The three hypotheses for this study all concern the correlation between the language variables and the conservation variables. In order to discover which of the 12 conservation tasks correlated significantly with the receptive and expressive language measures, point biserial correlations were obtained between the language scores and the 12 conservation tasks. The raw conservation scores were used to show how each group performed on the dichotomous variable of ability to or inability to conserve on a specific task. The percentile scores from the CAK--C, forms A and C, were used as the continuous variables. The significant correlations (i.e., r>0.300) shown in Table 5 indicate the relative predictive potential of each conservation skill when measured as a dependent variable.

TABLE 5

SIGNIFICANT POINT BISERIAL CORRELATIONS

Conservation Skill	Group	Language Ability	Correlation
Continuous Quantity	Normal	Expressive	0.37028
		Receptive	-0.40784
Weight	Normal	Expressive	-0.36091
Discontinuous Quantity	Normal	Expressive	-0.30520
Area Subtest #1	Normal	Receptive	-0.30190
	Impaired	Expressive	-0.87429
		Receptive	1.20207
Area Subtest #2	Normal	Receptive	-0.61936
Length Subtest #1	Normal	Expressive	1.07228
Length Subtest #2	Normal	Expressive	0.86653
Length Subtest #3	Normal	Expressive	0.54909

Table 5 lists the conservation measures which correlate at r=.3000 with the language skill by group. For the normal population, the conservation measures of continuous quantity, weight, discontinuous quantity, area (subtest #1 and 2), and length (subtests #1, 2 and 3) closely relate to each other. Whereas, the language impaired group has only one meaningful point biserial correlation i.e., area (subtest #1).

The specific language ability, either expressive or receptive, is noted as one of the correlates along with the conservation tasks. For continuous quantity, both expressive and receptive abilities relate for the language normal group. However, while expressive language skill positively correlates, receptive skill is negatively related.

The conservation tasks of weight and discontinuous quantity are associated inversely to the expressive language performance of the language normal population.

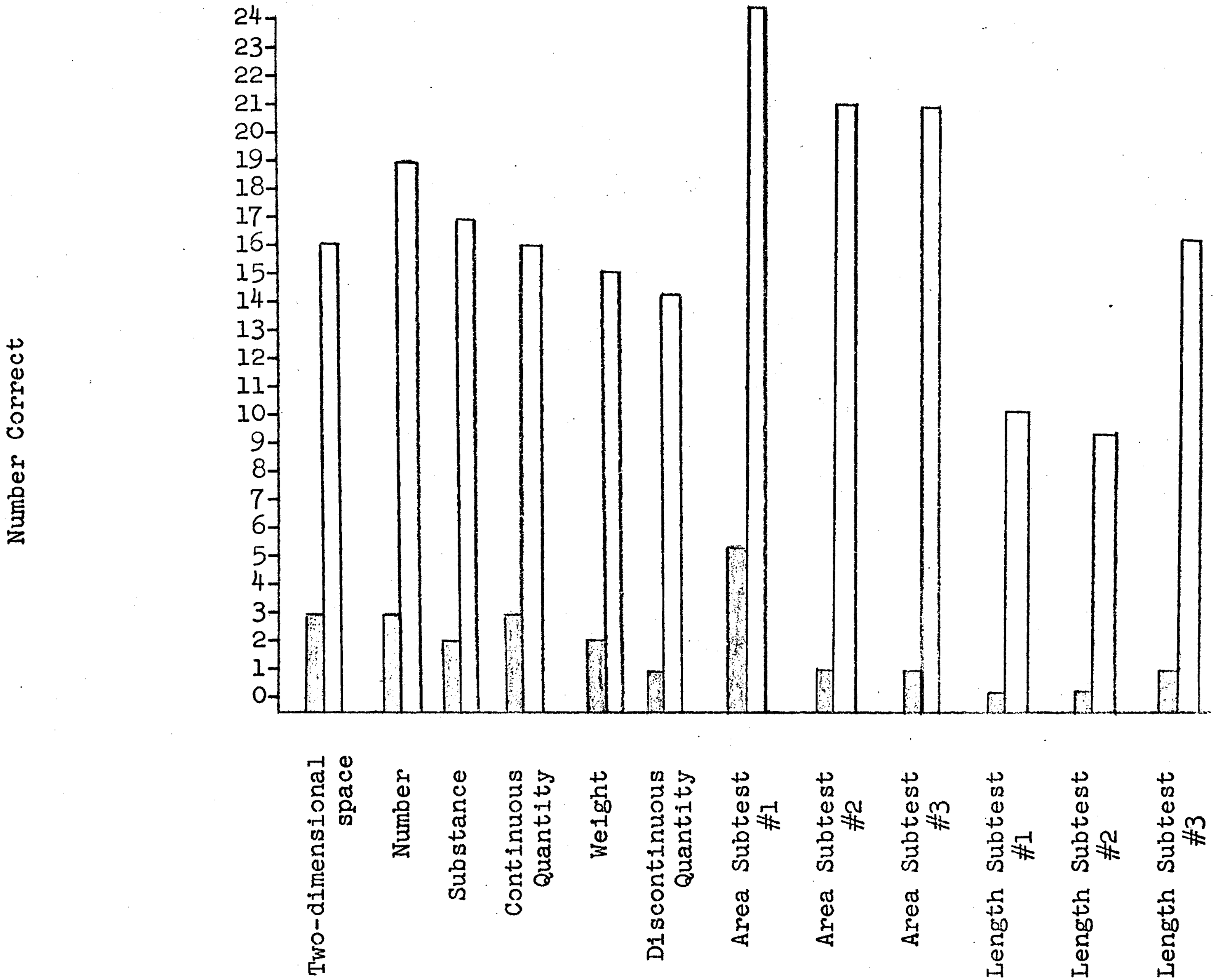
Area (subtest #1) correlates highly with both the language normal and language impaired groups. For the normal population, receptive language negatively correlates with performance on this conservation task. But for the impaired group, expressive language ability negatively correlates with the conservation measure and receptive language ability positively correlates to success on this task.

The Area (subtest #2) scores achieved by the language normal group inversely relate to that population's receptive language ability.

The three subtests for the conservation task of length all positively correlate with the expressive language skill of the normal language population.

No point biserial correlations were significant for the following conservation tasks: two-dimensional space, number, substance and area (subtest #3). Many of the possible correlations for the language impaired were not computed because of the low frequency of correct responses recorded by this group. Figure 1 graphically displays the difference between the frequency of correct responses by group.

Figure 1. Histogram of the number of language normal and language impaired correctly responding to conservation tasks. The shaded areas are the language impaired.



The results of the 12 measures of correlation which each group achieved are compared in Figure 1. The chart shows that for the two dimensional space task 16 language normal children were able to conserve, while only three of the language impaired children conserved. On the number task, 19 language normal children and three language impaired conserved. Eighteen language normal and two language impaired children successfully conserved substance. The continuous quantity task was correctly performed by 16 language normal children and three language impaired children. The conservation task of weight was achieved by 15 language normal children and two language impaired children. Fourteen language normal children and one language impaired child conserved discontinuous quantity. The task in area subtest one was achieved by 24 language normal children and the tasks in subtests two and three were achieved by 20 language normal children. In comparison, area subtest one was conserved by five language impaired children and subtest two and three by one language impaired child. For the three subtests on conservation of length, ten language normal and no language impaired correctly responded to subtest #1; nine language normal and no language impaired correctly responded to subtest #2; and 15 language normal and one language impaired correctly responded to subtest #3.

Summary

It was hypothesized that first-grade-age children with normal language skills would not differ significantly from similarly aged children with impaired language skills on their ability to conserve and that neither age nor intelligence would affect their ability to conserve.

The criterion used to discriminate between the groups was the child's score on tests of receptive or expressive language ability. Piagetian theory suggests that the increments in a child's language sophistication are dependent on gains in cognitive ability. The correlation procedures used in this study contra indicate the generality of Piaget's observations for language impaired children.

CHAPTER V

DISCUSSION

Characteristics of the Groups

The two groups, when statistically compared, showed significant difference on the independent variables of receptive language and expressive language. The 25 language impaired children were selected on the basis of this difference. The tests used to measure language ability in the two groups assessed separate performance aspects of language. The Peabody Picture Vocabulary Test (PPVT) evaluated the children's receptive semantic ability. The Developmental Sentence Scoring (DSS) evaluated the children's expressive syntactic ability. One result from using the two language measures was that, for the population of language impaired children used in this study, the receptive measures appeared to be redundant. All the children chosen because their receptive language measures placed them in the language impaired group were impaired also according to the expressive language measure. An explanation for this relationship may be based in the developmental function of language which requires that a child possess the semantic elements before being able to use syntax. This condition was ignored in the design of this study in order to collect data on the importance of the role of both semantic and syntactic development on the ability of children to conserve.

In order to isolate the conservation abilities of the two groups, it was necessary to control for variables which are known to be interconnected with the ability to conserve. One of these variables was age. Age was controlled experimentally for two reasons. First, the emergence of conservation spans a four year period with the majority of children making the transition at approximately six years of age. The subjects studied encompassed this critical age range. Second, the selection criteria limited the total possible number of children to a number too low for statistical analysis if the language impaired group were all of the same age.

Intelligence was also controlled experimentally to insure that any differences between the two groups on the conservation tasks were not related to differences in intelligence. The Raven Coloured Progressive Matrices was selected to measure intellectual ability as it does not require the child to verbalize responses.

The statistical treatment used to demonstrate that the groups difference on the language variable, but not on the variables of age or intelligence, was a t-test for independent groups.

The Major Hypothesis

The evidence affirms the answer to the primary research question: Are first-grade-age children with language impairment different in conservation abilities from first-grade-age children with normal language? The first null hypothesis can be rejected. Language impaired children's performance is significantly different from language normal children on conservation tasks when age and intelligence are similar across groups.

The following is a discussion of several aspects which resulted from the design and statistical analyses of the major hypothesis.

Cross-sectional measures of the two groups provided correlational data on the hypothesized relationship but no information on the causal nature of the isomorphism of language and conservation. Analysis with multivariate regression analysis techniques would be one way to arrive at the degree of variance explained by the independent variables of language on the emergence of conservation ability. Multivariate multiple regression analysis was considered for use with the data generated from the CAK--C, forms A and C, and the independent variables of age, intelligence, and receptive and expressive language. The requirements for this test could not be met as the statistic must use continuous variables as the dependent measure. In order to make the conservation scores continuous, the child's age needed to be used in the calculation. This fact contaminated the possibility of using the computed, continuous conservation scores as the dependent variables in a regression equation where one of the independent variables was age. Until more sensitive conservation measures are developed which provide continuous scores uncontaminated by age, it appears that researchers are limited to correlational procedures. One alternative to the use of more sensitive measures would be altering the data collection procedure from a cross-sectional measurement design to a longitudinal design which would more nearly replicate the initial experiments employed by Piaget.

The canonical correlation was used to identify the maximum degree of relationship between the independent and dependent variables for each group. This statistic was used in addition to the Pearson product-moment correlation to reflect the importance of the language variables in producing the raw scores on the conservation tasks. The results indicate that language is far more important in producing correct responses on conservation tasks for the language impaired group than is is for the language normal group. For the language impaired group the first canonical correlation was significant at the 0.009 level. The significant correlation in the language impaired group was between expressive language and the tasks on CAK--C, form A (i.e., two-dimensional space, number, substance, continuous quantity, weight, and discontinuous quantity). However, neither canonical correlation was significant for the normal group. There are two possible explanations for these findings. This may be explained, first, by the fact that the impaired expressive function interferes with the development of conservation ability or that the inability to conserve inhibits the development of normal exprssive language. The second possible explanation of the significant relationship between expressive language and the specific tasks on CAK--C, form A, might be that the level of success on form A is dependent on possessing normal expressive language. The correct explanation could be discovered in an assessment of the conservation tasks through non-verbal procedures, procedures which have yet to be developed.

The major hypothesis is rejected with the caution that the role of expressive language may need to be studied in a manner where the specific conservation ability is separated from a child's syntactic ability. Until the function of syntax has been isolated from the measurement of conservation, the nature of isomorphism between these two variables cannot be clearly understood. This fact, however, does not preclude curriculum and instructional specialists from recognizing that children who display expressive language impairment are at risk of delayed conservation ability.

The Relationship of Intelligence to the Emergence of Conservation Between the Language Impaired and the Language Normal Groups

The relationship between intelligence, as measured by standardized I.Q. tests, and the ability to conserve has been investigated by many researchers, including Flavell, Feigenbum, and Goldschmid.[1] The results of this study are consistent with the research which precedes it when the groups under study are combined. That is, the correlation between intelligence and conservation measures on CAK--C, form A, for the total population is p=0.009. The influence of intelligence was not as important in producing the conservation scores on CAK--C, form C, (i.e., area and length). The correlation between these two variables was not significant with p=0.138.

The relationship between intelligence and conservation was greatest when measured on the language impaired group. For this group, the correlation between intelligence and CAK--C, form A, was significant with p=0.002. The significance of the correlation between these variables, when CAK--C, for C, was used for the conservation measure, was 0.037. These scores differ greatly from the same tests run on the language normal groups, where the

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[1]See John H. Flavell, The DevelopmentalPsychology of Jean Piaget. (Princeton, N.J.: Vanostrand, 1963); K.D. Feigenbaum, "Task Complexity and IQ as Variables in Piaget's Problem of Conservation" Child Development 34 (1963): 423-432; and Marcel Goldschmid, "Different Types of Conservation and Nonconservation and Their Relation to Age, Sex, IQ, MA, and Vocabulary" Child Development 38 (1967): 1229-1247.

significance of the correlations was p=0.200 and p=0.478 for intelligence with CAK--C, forms A and C respectively. The size of this difference suggests that intelligence may be a more critical variable than the level of language development in the ability to conserve.

One explanation for the difference between groups on the variable of intelligence lies in the type of measure used to assess intellectual ability. The Raven Coloured Progressive Matrices which was used to derive intelligence levels is a non-verbal test which depends on perceptual logic for correct responses. It follows that children who display immature logical development, as indicated by performance on the Piagetian tasks, are at high risk of performing poorly on the Progressive Coloured Matrices.

Previous research which correlated the relationship between intelligence and conservation[1] used measures designed to emphasize the verbal (or syntactic) skill of the child. Goldschmid[2] studied the relation between intelligence and conservation in normal and emotionally disturbed children. He used conservation measures

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[1] Ibid.

[2] Marcel Goldschmid, "Different Types of Conservation and Nonconservation and Their Relation to Age, Sex, IQ, MA, and Vocabulary," Child Development 38 (1967): 1229-1247.

similar to those used in this study but his measure of intelligence was derived from the WISC vocabulary scale. The correlations for both groups were significant with $p<0.001$ level. By using a language based intelligence measure Goldschmid was unable to differentiate the groups on this variable even though the data slightly favored the normal children. He believed that:

> This conclusion is tentative, for IQ and verbal facility favored the normal children in this study. Other studies holding these variables constant are needed to confirm this finding.[1]

The evidence from this investigation on language normal and language impaired children adds support to the notion that the higher the intelligence, and the better the expressive language skill of a child, the more likely he will perform successfully on conservation tasks.

The implication is that Piaget's notion of conservation is not independent of language development or of verbal intelligence. The importance of this finding lies in the development of educational programs for language impaired and emotionally disturbed children. It is in these two areas of handicapping conditions that the research shows that a significant delay in the ability to conserve exists. It would appear that curriculum development and instruction for these two populations should recognize that any learning tasks which require reversibility,

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[1] Ibid., p. 1244.

compensations, and/or an understanding of invariant quantity will be exceptionally difficult. One alternative for curriculum specialists would be to design curricula for the facilitation of syntactic development.

The Relationship of Age to the Emergence of Conservation Between the Language Impaired and the Language Normal Groups

Age was the only variable significantly correlated with both forms of the CAK--C. This finding is consistent with the developmental theory of Piaget. Regardless of disabling conditions, children should master more conservation tasks as they grow older. The results of this study involving language impaired children are consistent with results obtained from studies of the deaf,[1] the gifted, the mentally retarded,[2] and the emotionally disturbed.[3]

The one additional interpretation that can be made from these correlations concerns the differential effect age had on the children's performance on the tasks from A as opposed to form C. The correlations between age and conservation are highly

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[1]Hans G. Furth, "Research with the Deaf: Implications for Language and Cognition," Psychological Bulletin 62 (3) 1964: 145-164.

[2]Ann L. Brown, "Conservation of Number and Continuous Quantity in Normal, Bright, and Retarded Children," Child Development 44 (1973): 376-379.

[3]Marcel Goldschmid, "Different Types of Conservation and Nonconservation and Their Relation to Age, Sex, IQ, MA, and Vocabulary," Child Development 38 (1967): 1229-1247.

significant for the normal group on form A, p=.001 and significant for the impaired group with p=.012. However, the correlations between the same variables for the conservation tasks on form C were significant with p=0.042 for the language normal group and p=0.049 for the language impaired group. These data suggest that age may not be as important to the emergence of the ability to conserve area and length as it is to the ability to conserve two-dimensional space, number, substance, continuous quantity, weight, and discontinuous quantity.

The implication for curriculum specialists involves the proper sequencing of tasks which require conservation abilities that are less dependent on age presented first within the sequence of learning activities. The possibility exists that area and length are related more to perceptual development which theoretically occurs in the later stages of the sensory-motor period of development. If this is true then the population for this study would have passed the age of transition for conservation of area and length. Therefore, the correlations used would not have been sensitive enough measures to define the impact of age on these two conservation tasks. Further studies using a younger population would be needed to investigate the relationship between perceptual development and the ability to conserve area and length.

<u>Relative Difficulty of Conservation Measures</u>

Curriculum and instructional specialists should be cognizant of the age-related ability to perform the tasks used to assess conservation ability in this study. The point biserial correlation data are displayed in Table 6 in a manner which shows the ranking of the tasks for the total population, for the language normal group, and for thelanguage impaired group.

TABLE 6

RANKING ON DIFFICULTY LEVEL BASED ON THE POINT BISERIAL CORRELATIONS: FROM LEAST DIFFICULT TO MOST DIFFICULT

Total Population	Language Normal	Language Impaired
Area, #1 (N=29)	Area, #1 (N=24)	Area, #1 (N=5)
Number (N=22)	Area, #2 (N=21)	Two-Dimensional Space (N=3)
Area, #2 (N=22)	Area, #3 (N=21)	Number (N=3)
Area, #3 (N=22)	Number (N=19)	Continuous Quantity (N=3)
Two-Dimensional Space (N=19)	Substance (N=17)	Substance (N=2)
Substance (N=19)	Two-Dimensional Space (N=16)	Weight (N=2)
Continuous Quantity (N=19)	Continuous Quantity (N=16)	Discontinuous Quantity (N=1)
Weight (N=17)	Length, #3 (N=16)	Area, #2 (N=1)
Length, #3 (N=17)	Weight (N=15)	Area, #3 (N=1)

TABLE 6--Continued

Total Population	Language Normal	Language Impaired
Discontinuous Quantity (N=15)	Discontinuous Quantity (N=14)	Length, #3 (N=1)
Length, #1 (N=10)	Length, #1 (N=10)	Length, #1 (N=0)
Length, #2 (N=9)	Length, #2 (N=9)	Length, #2 (N=0)

These data identify the Area #1 task as the one which is the least difficult for all groups. This task requires the child to determine whether two barns, placed on a green board in different configurations, leave the same amount of open space. Children are able to respond correctly to this task if they possess the knowledge of the number fact that 2=2. This task, therefore, may not be a test of conservation. A task needs to be devised which cannot be answered correctly with simple arithmetic concepts.

Further research should involve a larger population of language impaired children to respond to the conservation tasks. Without larger numbers, it is difficult to insure the validity of the rank ordering of the conservation tasks passed by the language impaired children. Two ways which might accomplish the increase in the numbers of the language impaired group include a longitudinal study of language impaired children or simply increasing the number of children included in the language impaired group.

One omission of this study which subsequent studies should include is the specification and codification of the non-conserving responses. This investigation produced many responses which were necessarily coded as incorrect, but which could have enhanced the knowledge base of the transition period for conservation which many of the responses implied. Non-conserving responses were those which directly referred to the perceptual features of the stimuli. For example, "I can see that it's bigger," (substance task) or "We do this in class but I forget now" are two non-conserving responses which may indicate a readiness for conservation which, if known, might facilitate educational planning. All coding of non-conserving responses would need to incorporate some mechanism for controlling or equalizing syntactic differences.

Specific Conservation Tasks Which Relate to Language

The significant point biserial correlations (Table 5) indicate that correct responses in the normal population are related most to expressive language skill. Receptive language did not appear to be a good predictor except in the conservation of area. As noted above, this relationship may be related to the child's knowledge of arithmetic rather than the ability to conserve. The strong positive correlation between receptive language and this conservation task supports the notion that conservation of area task can be solved correctly without an ability to conserve. Receptive language proficiency may be all that is necessary to correctly respond to arithmetic problems. The elimination of syntax permits receptive language to operate solely on the child's responses, thereby increasing the likelihood of a correct response.

An unanticipated statistical finding is the negative correlation between language ability and certain conservation tasks. Expressive language correlates negatively with the areas weight, discontinous, quantity and area, subtest #1 (language impaired group only). Receptive language correlates negatively with the areas normal continuous quantity, both areas, subtest #1 and area, normal subtest #2. The one negative correlation for the language impaired group as well as the one positive correlation are based on too few subjects for generalization. The data from the language normal, however, are gathered from larger samples and, therefore, the correlations could be calculated.

The negative correlations suggest that certain conservation tasks may not be as developmentally interdependent with language as others. If this is true, then curricula and instructional strategies for language facilitation may not facilitate development of conservation ability. This interpretation is not consistent with either Piaget's developmental theory or language developmental theory.

An alternative interpretation is that the continuous variable used to calculate the point biserial correlations was the percentile score, obtained from the standardized scores. The percentile was a very insensitive measure of the child's ability to conserve. That is, five and one-half year old children who displayed no conservation ability scored at the 67th percentile, while six and one-half year old children who correctly answered ten out of twelve items scored at the 70th percentile. The curvilinear standardization of children's scores within a one year span distort the reality that as children increase in age there is an increase in the correct responses on the conservation tasks. Support for this interpretation lies in the Pearson product-moment correlations. The Pearson product-moment correlations used raw scores on the total number of correct conservation responses in each group. The data contraindicate the conclusions of the point biserial correlations. The language impaired group showed significant relationships between the ability to conserve and language skills. For the language normal group, expressive language correlated only with the tasks on form C, i.e., area and length.

Further research is needed on ways to quantify conservation ability as it emerges. New evaluation schemes must be able to define small changes in the child's growth in logic. This investigation suggests that expressive language may need to be isolated before accurate measures of conservation can be derived.

Until such research is completed, correlations from this study suggest that focus should be placed on the variables of age, expressive language, and intelligence as indicators of a child's logical development.

CHAPTER VI

SUMMARY

The Variables

Twenty-five language imapired children were examined with 12 conservation tasks. The tasks were designed to assess whether the children had emerged developmentally to the point where they could conserve and, if able, could they explain the process. Responses were scored correct for the first part if the child noted the conservation and correct on the second part if the child could explain the invariant quality of the conservation task. These measures were used to establish that Jean Piaget's notion of logical development, as indicated by the ability to conserve, is different for language impaired children than it is for language normal children.

Thirty-three language normal children were examined with the same measures for comparison of conservation abilities. The normal group were similar to the language impaired population on the variable age. All children fell within the critical age range, as defined by Piaget's theory, of five and one-half to seven years of age. Intelligence was the second independent variable which was similar across groups. A nonverbal, perceptually bound intelligence test was used in order to avoid contamination by a child's skill. Children who measured in the middle range on the intelligence scale were included. Excessively high or low scores were not included because of unknown dynamics associated with extremes of intelligence.

The four variables of receptive language, age and intelligence were used as the independent variables to determine the relationship to the number of correct responses on conservation tasks. The 12 conservation tasks used as the dependent variables were: two-dimensional space; number; substance; continuous quantity; weight; discontinuous quantity; area (subtests 1,2, and 3) and length (subtests 1, 2, and 3). These tasks are modeled after the original Geneva experiments, which Piaget has used to define the tenet of conservation. For this investigation, an instrument was used which permitted quantification of the responses (a fact of little concern to Piaget during the Geneva experiments).

The Results

Pearson product-moment correlations between language and conservation scores for each group were converted to Z-scores in order to determine whether the scores of the language impaired group differed significantly from the scores of the language normal group. The difference was significant at the 0.0192 level. The null hypothesis which stated that the groups would not differ significantly, with the alpha level 0.05, was rejected.

The second null hypothesis was partially rejected because intelligence measures significantly related to the number of correct responses made by the impaired group. The level of significance of the intelligence measures for the language normal group was not significant on either the CAK--A or the CAK--C. The degree of difference was not measured. Therefore, while it seems that intelligence is more of a factor with the language impaired, caution is needed in interpretation of this datum until further evidence is available.

The final null hypothesis was rejected. Age related significantly to the number of correct conservation responses performed by both groups. This result parallels the results which were anticipated based on the developmental theories governing language and cognition.

Further analysis of the data was made with point biserial correlations. From this analysis, the twelve tasks were ranked according to difficulty for each group. Displaying the data in this manner permitted a comparison of tasks for each group in relation to the total population of 58 children. The results of this analysis were useful only for the normal language group because the low number of language imapired children, (less than 5), prohibited interpretation of the ranked difficulty of tasks for this group. Notwithstanding this fact, the results of the point biserial correlations for the language normal group show that the easiest to most difficult conservation tasks are: area (subtest 1, 2, and 3), number, substance, two-dimensional space, continuous quantity, length (subtest 3), weight, discontinous quantity, length (subtest 1 and 2).

Interpretation of the Results

Rejection of the three null hypotheses provide the curriculum and instruction specialists data by which to assist language impaired children in logical development. The impaired population cannot be expected to perform at the same pace as the normal language population. Longer time periods must be allowed for the language impaired child to attain conservation abilities. Average intelligence or better is an advantage to logical growth. The primary consideration which curriculum and instruction specialists may employ relates to the syntactic impairment in children. The relationship between expressive language and conservation ability is significant enough to imply that syntactic performance is sufficient to indicate cognitive development. This interpretation is not consistent with Piaget. His notion is that language is regulated by cognitive growth and not conversely. The correlations in this study suggest that, at least on the instrument used to collect the data, syntactic development in children may be the most important factor to consider in assisting children in developing conservation abilities.

Receptive language was used to discriminate group membership but showed less importance than expressive language in the ability to conserve. For the purposes of curriculum design and instructional strategies, receptive language is of less importance than expressive skills. If a child is able to understand the instructions of a task involving invariant quantities, the correct response depends on the child's syntactic skills. Consequently, educational programs should emphasize expression in their design.

Weakness and Need for Further Research

The results of this investigation are limited by the instruments used in data collection. The "state of the art" of quantification of conservation abilities provides only insensitive standard scores. These scores do not permit the use of statistical procedures such as regression analysis. This limits the investigation to correlational analysis. The weakness inherent in statistical procedures which do not give causation should be reduced by the study of improved measures of cognitive growth.

Syntax is available to measurement through expressive language samples which are spontaneously produced by children. Because of the highly significant relationship between language and conservation discovered in this study, future research should consider subtle indicators of transition, which children demonstrate in their syntax, that may show cognitive growth.

Longitudinal studies need to be made on language impaired children to determine whether the cognitive growth rate is regular among this group. The study described herein only shows significant relationships, it does not suggest the rate or pattern of cognitive growth. The same results might result by a larger population of language impaired children. Either technique should consider matching intelligence and age in the experimental design rather than statistically, as done in this investigation. Experimental control would yield more precise information on conservation development.

APPENDIX A

CONCEPT ASSESSMENT KIT -- CONSERVATION

FORM A

CONCEPT ASSESSMENT KIT—CONSERVATION

Marcel L. Goldschmid and Peter M. Bentler

RECORDING FORM
FORM A

SCORES			
Task	Behavior	Explanation	Total
A			
B			
C			
D			
E			
F			
Total			

NAME________________________ DATE ____________

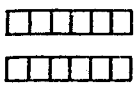
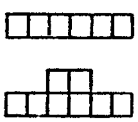
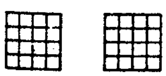
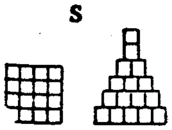
DATE OF BIRTH____________ AGE________ SEX____________

SCHOOL________________________ GRADE____________

EXAMINER________________________

COMMENTS________________________

(A) TWO-DIMENSIONAL SPACE

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 equal lines S a b  E	*Build 2 lines, each with 6 blocks of wood, saying:* *When finished ask:* *If the subject says they are both the same, say: And go on to (II)* *If he says they are not the same, say:* *Demonstrate to subject by pointing that they are the same, then, when S agrees, go on to (II)*	Watch what I do. Is there as much wood here* as there or does one have more? Yes, they are both the same. Look. This one is just as big as that one. See, they are both the same.		
II. 2 unequal lines S a b  E	*Take 2 additional blocks, saying:* *Then, say:* *Record. Then ask:* *Record, and say:*	Look. I am putting these blocks here. Now tell me. Is there as much wood here as there, or does one have more? Why? O.K. Let's do something else.	Same ☐ a has more ☐ b has more ☐	
III. 2 equal squares S  a b E	*Build 2 squares with 16 pieces of wood each, saying:* *When finished, ask:* *If the subject says they are the same, continue with (IV).* *If the subject says they are not the same, say:* *Demonstrate to subject by pointing that they are the same, then, go on to (IV)*	Watch what I do. Is there as much wood here as there, or does one have more? Look. This one is just as big as that one. See, they are both the same.		
IV. square vs. pyramid S  a b E	*Then, take the blocks from the right square and build a pyramid with a base of 5 blocks and successive levels of 4, 3, 2, 1 and 1 blocks, saying:* *When finished, ask:* *Record, then ask:* *Record.*	Watch what I do. Now, is there as much wood in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐	

*When saying the first underlined word, point to (a); when saying the second underlined word, point to (b). Follow this procedure for all underlined words.

CAK 040

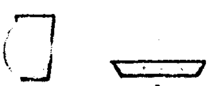
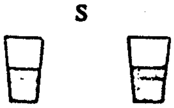
NUMBER

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
parallel red and white chips S a ●●●●●● b ○○○○○○ E	*Place 6 red chips in a straight line about 4 inches apart. Parallel to and below the red chips, place 6 white chips in corresponding position, also in a straight line, saying:* *When finished, say:* *If subject says there are as many red as white chips go on to (II)* *If he says one line has more than the other, say:* *Demonstrate to subject by pointing that they are the same, then, when he agrees, go on to (II)*	**Watch what I do.** **Are there as many <u>red</u> chips as <u>white</u> chips or are there more red chips than white chips?** **No, look. There is one red chip for every white chip. Do you see now that there are as many red chips as white chips?**		
red vs white chips S ●●●●●● ○ ○ ○ ○ ○ ○ E	*Leave the two lines of chips in a horizontal position, one line below the other, but spread out the white chips (6 inches apart), and move the red chips closer together (2 inches apart), saying:* *When finished, ask:* *Record, and ask:* *Record.*	**Watch what I do.** **Now, are there as many <u>red</u> chips as <u>white</u> chips, or is there more of one kind?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

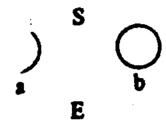
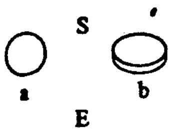
SUBSTANCE

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
2 equal balls S  a b E	*Make two equal balls of play doh (each 3 oz.), saying:* *If the subject says they are both the same, go on to (II)* *If the subject says one ball is larger, say:* *Continue to adjust the two balls until the subject says they are the same.*	**Here are two balls of play doh. There is the same amount of play doh in each ball. They are both alike. Is there as much play doh in <u>this</u> ball as in <u>that</u> one, or does one have more?** **Let's make them the same. I am taking a little bit away from this one and adding it to that one.** **Now, is there as much play doh in <u>this</u> one as in <u>that</u> one?**		
ball vs. hotdog S  a b E	*Roll one ball into a hotdog (6 inches long – use ruler), saying:* *When finished, ask:* *Record, and ask:* *Record.*	**Now watch what I do. See, I am making this ball into a hotdog.** **Now, is there as much play doh in <u>this</u> one, as in <u>that</u> one, or does one have more?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

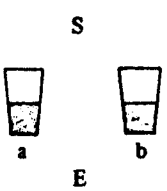
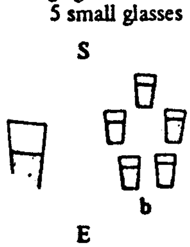
(D) CONTINUOUS QUANTITY

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 equal large glasses S  a b E	*Place the two large glasses filled with an equal amount of water (150 ml) before the child, and say:* *Then, ask:* *If the subject says they both have the same amount, go on to (II)* *If the subject says one has more, adjust the water level, saying:* *Then, ask:* *Continue to adjust the water in the two glasses until he says that they both have the same.*	**See, here are two glasses both filled with the same amount of water.** **Is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?** **Let's make them the same. See, I am pouring a little from this glass into that one.** **Now, is there as much water in <u>this</u> one as in <u>that</u> one or does one have more?**		
II. 2 unequal glasses S  a b E	*Pour 25 ml of water from an extra glass into the large glass at right, remove the extra glass, but leave it on the table, saying:* *Then ask:* *Record, and ask:* *Record.*	**Watch what I do. See, I am pouring a little water from this glass into that one.** **Now, is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?** **Why?**	Same ☐ a has more ☐ b has more ☐	
III. large glass vs. dish S  a b E	*Pour water from right glass (which has more water) into the flat dish, saying:* *When finished, ask:* *Record, and ask:* *Record.*	**Watch what I do.** **Now, does <u>this</u> one have as much water as <u>that</u> one, or does one have more?** **Why?**	Same ☐ a has more ☐ b has more ☐	
IV. 2 large glasses S  a b E	*Place the two large glasses filled with an equal amount of water (150 ml) before the child, and say:* *Then, ask:* *If the subject says they both have the same amount, go on to (V).* *If the subject says one has more, adjust the water level, saying:* *Then, ask:* *Continue to adjust the water in the two glasses until he says they both have the same.*	**See, here are two glasses both filled with the same amount of water.** **Is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?** **Let's make them the same. See, I am pouring a little from this glass into that one.** **Now, is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?**		
V. large glass vs. dish S  b E	*Pour the water from right glass into the dish, saying:* *Remove empty glass, but leave it on the table, and ask:* *Record, and ask:* *Record.*	**Watch what I do.** **Is there as much water in <u>this</u> one as in <u>that</u> one, or does one have more?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

(E) WEIGHT

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 equal balls 	*Make two equal balls of play doh (each 3 oz.), saying:* *Give the balls to the child, and say:* *(Be sure that the subject picks up the balls and weighs them in his hands.)* *If the child says they weigh the same, go on to (II).* *If the subject says one weighs more, say:* *Give balls back to subject and ask:* *Continue to adjust the two balls until he says they weigh the same.*	**Here are two balls of play doh. One ball is as heavy as the other ball.** **Is one ball as heavy as the other, or is one ball heavier than the other?** **Let's make them the same. I am taking a little bit away from this one and adding it to that one.** **Now are they the same? Is one ball as heavy as the other?**		
II. ball vs. pancake 	*Make the right ball into a pancake. Flatten the ball until the diameter is 4 inches (use ruler), saying:* *When finished, ask:* *(Do not allow the subject to pick up the ball or pancake)* *Record, and ask:* *Record.*	**Watch what I am doing. See, I am making one of the balls into a pancake.** **Now, is the ball as heavy as the pancake, or is one heavier?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

(F) DISCONTINUOUS QUANTITY

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 large glasses 	*Place the two glasses, filled with an equal amount of corn (150 ml), in front of the child, saying:* *(Level the surface in both glasses.)* *If the subject says they both have the same, go on to (II).* *If the subject says one has more, say:* *Continue to adjust the corn in the two glasses, until he says they both have the same amount.*	**See, here are two glasses both filled with the same amount of corn. Is there as much corn in this glass as in that one, or does one have more?** **Let's make them the same. See, I am pouring some corn from this glass into that one. Now, is there as much corn in this one as in that one, or does one have more?**		
II. large glass vs. 5 small glasses 	*Pour the corn from the large glass into the small glasses (arranged in a circle, close together) in equal amounts, saying:* *When finished, ask:* *Record, then ask:* *Record.*	**Watch what I do. See, I am pouring the corn from this glass into all of these glasses.** **Now, is there as much corn in this one as in all of these together, or does one side have more?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

APPENDIX B

CONCEPT ASSESSMENT -- CONSERVATION

FORM C

CONCEPT ASSESSMENT KIT—CONSERVATION

Marcel L. Goldschmid and Peter M. Bentler

RECORDING FORM
FORM C

SCORES			
Task	Behavior	Explanation	Total
A I			
A II			
A III			
B I			
B II			
B III			
Total			

NAME ______________________ DATE ______________

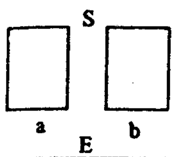
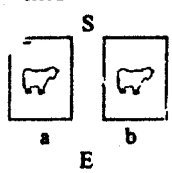
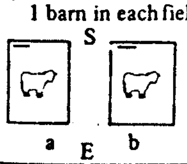
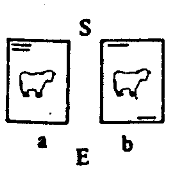
DATE OF BIRTH ______________ AGE ________ SEX ______________

SCHOOL ______________________ GRADE ______________

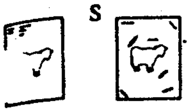
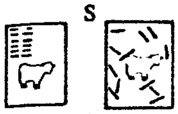
EXAMINER ______________________

COMMENTS ______________________

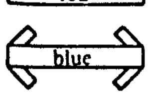
(A) AREA

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
(a) Presentation of boards 	*Place the 2 boards before S with the long sides parallel, about 2 inches apart, saying:* *Superimpose the boards for a moment, saying:* *Then, replace boards as before.*	Let's pretend that these boards are two fields of grass. See, they are the same size.		
(b) 1 cow in each field, 1 barn in left field 	*Place one cow in the center of each board, saying:* *Place a barn on left field, 2 inches from upper left corner, saying:* *Then, ask:* *Depending on subject's response, say:*	If we put a cow in each field, each cow has just as much grass to eat as the other cow. Now, Farmer Jones builds a barn on <u>this</u>* field. He has to take some of the grass away to make room for the barn. Now, show me which cow has more grass to eat. Yes (or no), that *(point to b)* cow has more grass to eat, because the barn covers up part of <u>this</u> cow's grass.		
(c) 1 cow in each field 1 barn in each field 	*Hand a barn to S, saying:* *Give help if necessary, then, say:*	Take this barn, and put it in the field so <u>this</u> cow has just as much grass to eat as <u>that</u> one. Now, every time I put a barn in one field, I will also put a barn in the other field.		
I 2 barns vs. 2 barns 	*Taking up a barn in each hand, place a second barn in each field. On the left board, put second barn close beside first one. On right board put second barn in diagonally opposite corner from the first, saying:* *When finished, ask:* *Record, and ask:* *Record.*	Watch what I do. Now, does <u>this</u> cow have just as much grass to eat as <u>that</u> one, or does one have more grass to eat? Why?	Same ☐ a has more ☐ b has more ☐	____

*When saying the first underlined word, point to (a); when saying the second underlined word, point to (b). Follow this procedure for all underlined words.

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
II 6 vs. 6 barns S  a E b	*Place 4 barns, one at a time on each board simultaneously, picking up one with your left, and one with your right hand. On left board, place barns next to each other in two rows of 3 barns each. On right board, scatter barns over entire area except near edges, as in graph, saying:* *When finished, ask:* *Record, and ask:*	**Watch what I do. You see, I am putting some more barns in each field.** **Now, does <u>this</u> cow have as much grass to eat as <u>that</u> one, or does one have more grass to eat?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____
III 12 vs 12 barns S  a E b	*Place 6 more barns in each field, following the same procedure as in item (II), saying:* *When finished, ask:* *Record, and ask:*	**Watch what I do. I am putting some more barns in each field.** **Now, does <u>this</u> cow have as much grass to eat as <u>that</u> one, or does one have more grass to eat?** **Why?**	Same ☐ a has more ☐ b has more ☐	____ ____

(B) LENGTH

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I blue vs. red stick a [red] b [blue] a [red] b [blue]	*Present the blue and red stick to the subject making sure that he sees that they are of equal length, that the 2 ends at both sides correspond, saying:* *Then, put them parallel to each other in front of the child. Move the <u>blue</u> stick by one inch to the right, and say:* *Record, and ask:* *Record.*	**You see these two sticks, they are both the same length. Is the <u>red</u> stick as long as the <u>blue</u> stick, or is it longer or shorter?** **Now, is the <u>red</u> stick as long as the <u>blue</u> stick, or is it longer or shorter?** **Why?**	Same ☐ a is longer ☐ b is longer ☐	____ ____
II red vs. blue stick a [blue] b [red] a [blue] b [red]	*Put the sticks again parallel to each other and make sure the S can see that they are of identical length.* *Then, move the <u>red</u> stick to the right by one inch, and ask:* *Record, and ask:* *Record.*	**Now, is the <u>blue</u> stick as long as the <u>red</u> stick, or is it longer or shorter?** **Why?**	Same ☐ a is longer ☐ b is longer ☐	____ ____
III blue stick with arrow vs. red stick [red] 	*Put the sticks again parallel to each other, and show him that they are of equal length. Then, put the <u>blue</u> stick between the arrowheads, so that the points of the arrows are exactly superimposed on the ends of the stick, ask:* *Record, and ask:* *Record.*	**Watch what I do.** **Now, is the <u>red</u> stick as long as the <u>blue</u> stick, or is it longer or shorter?** **Why?**	Same ☐ a is longer ☐ b is longer ☐	____ ____

APPENDIX C

DEVELOPMENTAL SENTENCE SCORING

RECORD FORM

Name:

RECORDING DATE:
BIRTH DATE:
C.A.:
D.S.S.:

	Indef. Pro.	Pers. Pro.	Prim. Verb	Sec. Verb	Neg.	Conj.	Inter. Rev.	Wh-Q	Sent. Point	To

APPENDIX D

PEABODY PICTURE VOCABULARY TEST

FORM A

Peabody Picture Vocabulary Test

by Lloyd M. Dunn, Ph.D.

FORM a

INDIVIDUAL TEST RECORD

NAME ______ (last) ______ (first) ______ (initial) SEX: M F (circle) GRADE ______ (or phone)

SCHOOL ______ (or agency or address) TEACHER ______ (or counselor or supervisor)

EXAMINER ______ TIME ______ (min.) CODE ______ (or race or descent)

AGE DATA

Date of testing ______ (year) ______ (month) ______ (day)

Date of birth . . ______ (year) ______ (month) ______ (day)

Age . . . . ______ (years) ______ (months)

TEST SCORES

Raw score (from page 3) . . . . ______

Intelligence quotient (I.Q.) . . . . . . ______

Percentile score (%ile) . . . . ______

Mental age (M.A.) . . . . ______

CONVERSION OF MONTHS TO NUMERALS FOR USE IN RECORDING AGE DATA

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No. of Month:	1	2	3	4	5	6	7	8	9	10	11	12

OTHER TEST DATA

Names of tests	Date	CA	Score	Type of score
PPVT, Form B				

LANGUAGE BACKGROUND

Language of the home: ______ (if other than standard English)

Quality of language:	☐ good for age	☐ fair for age	☐ poor for age
Quantity of speech:	☐ talkative	☐ average	☐ taciturn
Intelligibility of speech:	☐ good	☐ fair	☐ poor

REASON FOR TESTING ______

AGS

Published by

AMERICAN GUIDANCE SERVICE, INC.

Publishers' Building, Circle Pines, Minnesota 55014

SCORE SHEET FORM

a

Suggested Starting Points (see manual page 8)

Age Category	Begin with:	Age Category	Begin with
below 3-3	Plate No. 1	9-6 to 11-5	Plate No. 6
3-3 to 4-2	Plate No. 15	11-6 to 13-5	Plate No. 7
4-3 to 5-5	Plate No. 25	13-6 to 15-5	Plate No. 8
5-6 to 7-5	Plate No. 40	15-6 to 17-5	Plate No. 9
7-6 to 9-5	Plate No. 50	above 17-6	Plate No. 10

BASAL: 8 consecutive correct responses

CEILING: 6 errors in 8 consecutive responses

*TO RECORD ERRORS: Make oblique strokes through the geometric figures. Every eighth figure is

Plate No.	Word	Key Resp.	Errors*
1	car	(4)____	○
2	cow	(3)____	□
3	baby	(1)____	△
4	girl	(2)____	✣
5	ball	(1)____	♡
6	block	(3)____	☆
7	clown	(2)____	◇
8	key	(1)____	○
9	can	(4)____	□
10	chicken	(2)____	△
11	blowing	(4)____	✣
12	fan	(2)____	♡
13	digging	(1)____	☆
14	skirt	(1)____	◇
15	catching	(4)____	○
16	drum	(1)____	□
17	leaf	(3)____	△
18	tying	(4)____	✣
19	fence	(1)____	♡
20	bat	(2)____	☆
21	bee	(4)____	◇
22	bush	(3)____	○
23	pouring	(1)____	□
24	sewing	(1)____	△
25	wiener	(4)____	✣

Plate No.	Word	Key Resp.	Errors*
26	teacher	(2)____	♡
27	building	(3)____	☆
28	arrow	(3)____	◇
29	kangaroo	(2)____	○
30	accident	(3)____	□
31	nest	(3)____	△
32	caboose	(4)____	✣
33	envelope	(1)____	♡
34	picking	(2)____	☆
35	badge	(1)____	◇
36	goggles	(3)____	○
37	peacock	(2)____	□
38	queen	(3)____	△
39	coach	(4)____	✣
40	whip	(1)____	♡
41	net	(4)____	☆
42	freckle	(4)____	◇
43	eagle	(3)____	○
44	twist	(2)____	□
45	shining	(4)____	△
46	dial	(2)____	✣
47	yawning	(2)____	♡
48	tumble	(2)____	☆
49	signal	(1)____	◇
50	capsule	(1)____	○

Plate No.	Word	Key Resp.
51	submarine	(4)____
52	thermos	(4)____
53	projector	(3)____
54	group	(4)____
55	tackling	(3)____
56	transportation	(1)____
57	counter	(1)____
58	ceremony	(2)____
59	pod	(3)____
60	bronco	(4)____
61	directing	(3)____
62	funnel	(4)____
63	delight	(2)____
64	lecturer	(3)____
65	communication	(2)____
66	archer	(4)____
67	stadium	(1)____
68	excavate	(1)____
69	assaulting	(4)____
70	stunt	(1)____
71	meringue	(1)____
72	appliance	(3)____
73	chemist	(4)____
74	arctic	(3)____
75	destruction	(4)____

RAW SCORE CALCULATIONS

Ceiling item .... ______
Less errors .... ______
Raw score .... ______

identical to facilitate the determination of the basal or ceiling.

Errors*	Plate No.	Word	Key Resp.	Errors*	Plate No.	Word	Key Resp.	Errors*	Plate No.	Word	Key Resp.	Errors*
□	76	porter	(3)____	☆	101	graduated	(3)____	△	126	dormer	(2)____	◇
△	77	coast	(2)____	◇	102	hieroglyphic	(2)____	✣	127	coniferous	(2)____	○
✣	78	hoisting	(4)____	○	103	orate	(1)____	♡	128	consternation	(4)____	□
♡	79	wailing	(1)____	□	104	cascade	(3)____	☆	129	obese	(3)____	△
☆	80	coil	(2)____	△	105	illumination	(4)____	◇	130	gauntlet	(4)____	✣
◇	81	kayak	(3)____	✣	106	nape	(1)____	○	131	inclement	(1)____	♡
○	82	sentry	(2)____	♡	107	genealogist	(2)____	□	132	cupola	(1)____	☆
□	83	furrow	(4)____	☆	108	embossed	(2)____	△	133	obliterate	(2)____	◇
△	84	beam	(1)____	◇	109	mercantile	(4)____	✣	134	burnishing	(3)____	○
✣	85	fragment	(3)____	○	110	encumbered	(2)____	♡	135	bovine	(1)____	□
♡	86	hovering	(2)____	□	111	entice	(4)____	☆	136	eminence	(4)____	△
☆	87	bereavement	(3)____	△	112	concentric	(3)____	◇	137	legume	(3)____	✣
◇	88	crag	(4)____	✣	113	vitreous	(3)____	○	138	senile	(4)____	♡
○	89	tantrum	(2)____	♡	114	sibling	(1)____	□	139	deleterious	(2)____	☆
□	90	submerge	(1)____	☆	115	machete	(2)____	△	140	raze	(4)____	◇
△	91	descend	(3)____	◇	116	waif	(4)____	✣	141	ambulation	(2)____	○
✣	92	hassock	(2)____	○	117	cornice	(1)____	♡	142	cravat	(1)____	□
♡	93	canine	(1)____	□	118	timorous	(3)____	☆	143	impale	(2)____	△
☆	94	probing	(1)____	△	119	fettered	(1)____	◇	144	marsupial	(4)____	✣
◇	95	angling	(1)____	✣	120	tartan	(2)____	○	145	predatory	(3)____	♡
○	96	appraising	(3)____	♡	121	sulky	(3)____	□	146	incertitude	(1)____	☆
□	97	confining	(4)____	☆	122	obelisk	(4)____	△	147	imbibe	(2)____	◇
△	98	precipitation	(4)____	◇	123	ellipse	(2)____	✣	148	homunculus	(3)____	○
✣	99	gable	(1)____	○	124	entomology	(2)____	♡	149	cryptogam	(4)____	□
♡	100	amphibian	(1)____	□	125	bumptious	(4)____	☆	150	pensile	(3)____	△

TEST BEHAVIOR

Examples needed:	☐ only 1	☐ 2 or 3	☐ over 3
Types of response:	☐ S. called numbers	☐ Subject pointed	☐ Examiner pointed
Rapport:	☐ easily attained	☐ slowly attained	☐ poor rapport
Guessing:	☐ guessed when asked	☐ resisted guessing	☐ prone to guess
Speed of response:	☐ fast	☐ average	☐ slow
Attention span:	☐ very attentive	☐ average	☐ distractible
Perseveration:	☐ none noted	☐ some	☐ frequent
Need for praise:	☐ little needed	☐ some needed	☐ much needed
Shyness:	☐ friendly	☐ slightly shy	☐ very shy
***Effort:**	☐ good effort	☐ fair effort	☐ perfunctory effort

PHYSICAL CHARACTERISTICS

Hearing: need to repeat stimulus words	☐ never	☐ seldom	☐ often
apparent hearing acuity. .	☐ good	☐ fair	☐ poor
hearing aid	☐ S. did not own one	☐ S. owned but did not wear one	☐ S. wore one
Vision: distance of eyes from page	☐ under 8"	☐ average (8" - 20")	☐ over 20"
apparent visual acuity ...	☐ good	☐ fair	☐ poor
glasses	☐ S. did not own glasses	☐ S. owned but did not wear glasses	☐ S. wore glasses
Motor activity:	☐ hyperactive	☐ average	☐ hypoactive
Sedation:	☐ none	☐ slight	☐ heavy

RECOMMENDATIONS

____

____

____

____

____

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____

____

PERFORMANCE EVALUATION

***Do you believe that the test performance of the subject has fairly represented his or her ability? ☐ Yes ☐ No. If not, why?**

____

____

____

____

____

____

____
Examiner's signature

Litho in U.S.A.

APPENDIX E

RAVEN PROGRESSIVE MATRICES

SETS A, A_B, B

Answer Sheet for

RAVEN PROGRESSIVE MATRICES - 1947

Sets A, A_B, B

Name...Sex.................Age............

School..Grade........................

Test Begun.........................Test Ended..............Total Time...............

A			A_B			B		
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		

Total Score________________Percentile________

APPENDIX F

LETTER DISTRIBUTED TO PARENTS
CONSENT FORM

NORTHERN SUBURBAN SPECIAL EDUCATION DISTRICT
760 Red Oak Lane, Highland Park, Ill. 60035
831-5100

April 18, 1977

Dear Parents:

On the recommendation of Dr. Stanley T. Bristol and the NSSED Records Committee, permission was given to Mr. Tom Atchison to obtain test result information on children enrolled in our Early Childhood program and Child Development classes. Mr. Atchison is completing his doctorate at Loyola University, and will be using the test results for his dissertation.

Dr. Margaret Atchison, Program Consultant at NSSED's Early Childhool Center in Glencoe, has been named Coordinator for this research project. The children participating in the project will be assessed on two developmental instruments which will be administered by Dr. Margaret Atchison:

1. The Raven Coloured Matrices
2. The Concept-Assessment Kit-Conservation.

In addition, we will obtain information from the Speech and Language Clinicians on the Developmental Sentence Scoring and the Peabody Picture Vocabulary Test.

The identity of the children will be protected, as their names will NOT be used.

We would like to begin the research this week, and therefore would appreciate your signing the permission form for your child to participate.

If you have any questions regarding this project, please feel free to contact me at NSSED: 831-5100 or at the ECC: 835-2238.

Sincerely,

Margaret Atchison

Margaret Atchison, Ph.D.
Program Consultant
Developmental Learning Services

MA:pg

- -

NORTHERN SUBURBAN SPECIAL EDUCATION DISTRICT
760 Red Oak Lane, Highland Park, Ill. 60035

Dear Sirs:

The undersigned, being the parent(s) or guardian of ______________________, who is enrolled in classes conducted by NSSED, do hereby consent to said student's participating in the research project described above. I understand that all information is confidential, and that the results will be used in the doctoral dissertation of Tom Atchison from Loyola University.

Date:________________ ______________________________________
Parent or Guardian

____
Parent or Guardian

APPENDIX G

GENERAL STATISTICS FOR LANGUAGE IMPAIRED AND LANGUAGE NORMAL SAMPLES

Language Impaired Group N=25

Variable	Mean	Range	Standard Error	Standard Deviation
Receptive Language Raw Score	55.560	26.000 44.000-- 70.000	1.339	6.696
Expressive Language Raw Score	6.020	7.190 1.560-- 8.750	0.392	1.960
Intelligence Raw Score	15.160	11.000 11.000-- 22.000	0.704	3.520
CAK--C Form A Percent	49.240	82.000 18.000-- 100.00	3.899	
CAK--C Form C Percent	35.560	52.000 12.000-- 64.000	2.849	14.471
Age in Months	74.040	18.000 66.000-- 84.000	1.251	6.255

Language Normal Group N=33

Variable	Mean	Range	Standard Error	Standard Deviation
Receptive Language Raw Score	62.848	28.000 51.000-- 79.000	1.119	6.428
Expressive Language Raw Score	10.620 1.020-- 16.240	15.220	0.477	2.740
Intelligence Raw Score	16.152	13.000 11.000-- 24.000	0.619	3.554
CAK--C Form A Percent	57.758	82.000 18.000-- 100.00	3.389	19.466
CAK--C Form C Percent	62.576	85.000 15.000-- 100.00	4.511	25.915
Age in Months	75.545	17.000 66.000-- 83.000	1.043	5.990

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APPROVAL SHEET

The dissertation submitted by Thomas A. Atchison has been read and approved by members of the School of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

December 5, 1977
DATE

Mary Jane Gray
SIGNATURE OF ADVISER