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GRADUATE COLLEGE

THE EFFECTS OF SOCIOECONOMIC STRATA, SEX AND READING ACHIEVEMENT LEVEL ON THE AUDITORY-VISUAL INTEGRATION PERFORMANCE OF SIXTH GRADERS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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1976

THE EFFECTS OF SOCIOECONOMIC STRATA, SEX AND READING ACHIEVEMENT LEVEL ON THE AUDITORY-VISUAL INTEGRATION PERFORMANCE OF SIXTH GRADERS

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CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

Introduction

An important step in understanding the complex nervous system of man has been the identification of mechanisms which integrate information from the different sensory modalities. The capacity to assimilate and organize multimodal information undergirds man's potential superiority over lower forms of life. It enables people to exhibit a variety of behavioral patterns to constantly changing environmental conditions. This evolutionary process was characterized succintly by Sherrington when he wrote:

> The naive would have expected evolution in its course to have supplied us with more various sense organs for ampler perception of the world...The policy has rather been to bring by the nervous system the so-called 'five' into closer touch with one another... A central clearing house of sense has grown up... Not new senses, but better liaison between old senses is what the developing nervous system has in this respect stood for.[1]

The present study examined the principle of sensory integration, specifically, auditory-visual integration as

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[1]Charles S. Sherrington, Man on His Nature (Cambridge, England: Cambridge University Press, 1951), pp. 287-289.

it related to the development of reading skills in children. This is not to imply that children with reading disability constitute a single homogeneous group. Different individuals may derive their reading inadequacy from biological, social and emotional circumstances. Rather, the intent is to imply that one of the several possible causes for difficulties in learning to read could be a mechanism inadequacy in the ability to integrate auditory and visual stimuli.

Statement of the Problem

The problem was to determine whether there were statistically significant differences in the mean raw scores of sixth graders on an auditory-visual integration task, when grouped by socioeconomic strata, sex and reading achievement level.

Purpose of the Study

Many studies in recent years have reported significant positive relationships between auditory-visual integration and reading achievement, chronological age, intelligence and socioeconomic strata (SES). No study has attempted to control for all the independent variables used in this investigation. The results of this study should permit a clearer, more complete picture of the influence that these factors may exert on the effects between auditory-visual integration and reading development.

Hypotheses

1. There is no statistically significant difference between the mean raw scores of sixth grade children from middle and low SES on an auditory-visual equivalency task.

2. There is no statistically significant difference between the mean raw scores of male and female sixth grade students on an auditory-visual equivalency task.

3. There is no statistically significant difference between the mean raw scores of sixth grade high and low reading achievers on an auditory-visual equivalency task.

4. There is no statistically significant difference between the mean raw scores of sixth grade male students from middle and low SES on an auditory-visual equivalency task.

5. There is no statistically significant difference between the mean raw scores of sixth grade female students from middle and low SES on an auditory-visual equivalency task.

6. There is no statistically significant difference between the mean raw scores of male and female sixth grade students from middle SES on an auditory-visual equivalency task.

7. There is no statistically significant difference between the mean raw scores of male and female sixth grade students from low SES on an auditory-visual equivalency task.

8. There is no statistically significant difference between the mean raw scores of sixth grade high reading achievers from middle and low SES on an auditory-visual equivalency task.

9. There is no statistically significant difference between the mean raw scores of sixth grade low reading achievers from middle and low SES on an auditory-visual equivalency task.

10. There is no statistically significant difference between the mean raw scores of sixth grade high and low reading achievers from middle SES on an auditory-visual equivalency task.

11. There is no statistically significant difference between the mean raw scores of sixth grade high and low reading achievers from low SES on an auditory-visual equivalency task.

12. There is no statistically significant difference between the mean raw scores of male sixth grade high and low reading achievers on an auditory-visual equivalency task.

13. There is no statistically significant difference between the mean raw scores of female sixth grade high and low reading achievers on an auditory-visual equivalency task.

14. There is no statistically significant difference between the mean raw scores of sixth grade male and female high reading achievers on an auditory-visual equivalency task.

15. There is no statistically significant difference between the mean raw scores of sixth grade male and female low reading achievers on an auditory-visual equivalency task.

Operational Definitions

Integration was defined as the capacity to assimilate and organize information received via one modality and utilize it in a second modality.[2]

Auditory-Visual Integration (A-V) was indicated by the child's ability to equate a temporarily structured set of auditory stimuli with a spatially distributed set of visual ones.[3]

Middle socioeconomic strata was defined as a family unit with a calculated score between 30 and 54 on the Hollingshead Four Factor Scale.

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[2]Herbert G. Birch and Lillian Belmont, "Auditory-Visual Integration in Normal and Retarded Readers," American Journal of Orthopsychiatry 34 (May 1964): 852-861.

[3]Ibid.

Low socioeconomic strata was defined as a family unit with a calculated score between 8 and 29 on the Hollingshead Four Factor Scale.

High Reading Achievement was defined as scoring at the 85% tile or above on the following two subtests of the California Tests of Basic Skills (CTBS): Reading Vocabulary and Comprehension.

Low Reading Achievement was defined as scoring at the 15% tile or below on the two above mentioned subtests of the CTBS.

Limitations of the Study

In order to be in compliance with Public Law 93-380, 93rd Congress, H.R. 69, the FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT OF 1974, a parent authorization form (appendix A) was sent home with every sixth grade child in the school system being used. Only the children of those parents who returned the authorization form were considered for the study.

Only sixth grade students were used in this study. As a result, the findings can be generalized only to that population.

Assumptions of the Study

Investigations of intersensory integration have employed tests of cross-modal transfer to establish degrees of intersensory development. Although there are several procedures available for studying cross-modal transfer, a

procedure involving the matching of equivalent stimuli when they are presented successively is a popular index of intersensory integration. It was this method that was used originally in the Birch and Belmont Studies as well as subsequent investigations by Beery, Sterritt and Rudnick, Bossing, Ford and Kahn.[4]

Kerlinger stated that "Content validation consists essentially in judgment." Alone or with others, one judges the representativeness or sampling adequacy of the content of a measuring instrument.[5] It was therefore assumed that the equivalency method utilized in this study was a valid measure of auditory-visual integration.

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[4]Ibid.; Herbert G. Birch and Lillian Belmont, "Auditory-Visual Integration, Intelligence, and Reading Ability in School Children," Perceptual and Motor Skills 20 (January 1965): 295-305; Judith W. Beery, "Matching of Auditory and Visual Stimuli by Average and Retarded Readers," Child Development 38 (March 1967): 827-833; Graham M. Sterritt and Mark Rudnick, "Auditory and Visual Rhythm Perception in Relation to Reading Ability in Fourth Grade Boys," Perceptual and Motor Skills 22 (March 1966): 859-864; Lewis L. Bossing, "A Comparison of Integration between Auditory and Visual Modalities of Middle and Low SES Children at Ages Seven and Nine Years." Unpublished doctoral dissertation, George Peabody College for Teachers, 1972; Marguerite P. Ford, "Auditory-Visual and Tactual-Visual Integration in Relation to Reading Ability," Perceptual and Motor Skills 24 (March 1967): 831-841, and Dale Kahn, "The Development of Auditory-Visual Integration and Reading Achievement." Unpublished doctoral dissertation, Columbia University, 1965. (Dissertation Abstracts 26, May 1965, 65-12, 349).

[5]Fred N. Kerlinger, Foundations of Behavioral Research (New York: Holt, Rinehart and Winston, Inc., 1973), pp. 458-459.

Design of Study

Subjects

Subjects for the study included 80 sixth grade children attending the Midwest-Del City school system. The school attendance area was large enough to provide a sufficient number of children for sampling from both middle and low socioeconomic strata.

The sample included ten children selected on the basis of each of the following independent variables: socioeconomic strata (middle and low), sex (male and female), and reading achievement (high and low). Only children demonstrating intelligence quotients within the 85-115 range and who possessed an adequate level of perceptual development were included.

Description of Instruments

Piagetian Conservation Tasks

Elkind summarized some of his research growing out of Piaget's theory of perceptual development:

> In general, our findings support Piaget's view that perception, as well as intelligence, is not entirely innate but is rather progressively constructed through the gradual development of perceptual regulations.[6]

In addition, Elkind suggested that perceptual regulations are a necessary pre-condition to successful beginning

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[6]David Elkind, "Perceptual Development in Children," American Scientist (September-October 1975), p. 541.

reading. He and Piaget stated that a majority of children can be expected to have perceptual regulations by the age of six or seven. This age approximates the same age that children develop from the pre-operational level to the concrete operational level of thinking.[7]

Piaget has developed six conservation tasks (appendix B) which can give an indication of how far a child has moved into the stage of concrete operational thought.[8] The question of a subject's perceptual competence appeared relevant to a study dealing with auditory-visual integration skills. Therefore, the following six Piagetian Conservation Tasks were used to screen each subject's perceptual development: (1) Conservation of number; (2) Conservation of liquid amount; (3) Conservation of solid amount; (4) Conservation of area; (5) Conservation of length; and (6) Conservation of weight.

Peabody Picture Vocabulary Test

Since several investigations have noted a relationship between auditory-visual integration and intelligence, all subjects were screened with the Peabody Picture Vocabulary test (PPVT).[9]

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[7]Ibid., pp. 533-534.

[8]Jean Piaget, The Origins of Intelligence in Children (New York: International Universities Press, 1952).

[9]Lloyd M. Dunn, Expanded Manual for the Peabody Picture Vocabulary Test (Circle Pines, Minnesota: American Guidance Service, Inc., 1965).

The PPVT was designed to provide an estimate of a subject's verbal intelligence through measuring his hearing vocabulary. Since subjects were not required to read, the scale was especially fair for non-readers and remedial reading cases.

Content validity was built into the test when a complete search was made of Webster's New Collegiate Dictionary for all words whose meaning could be depicted by a picture. The restriction was the omission of words which could not be illustrated. Since a good cross section was obtained of words in common use today in the United States, and since care was taken to keep the final selection of response and decoy items unbiased, the final product was assumed to meet adequate standards for a picture vocabulary test.[10]

Congruent validity can be defined as the extent to which PPVT scores compare with scores on other vocabulary and intelligence tests. Correlations between 1960 Binet mental age scores and PPVT mental age scores ranged from .82 to .86 with a median of .83. Correlations between PPVT and WISC (full scale) range from .30 to .84 with a median of .61.[11]

Alternate form reliability coefficients for the PPVT were obtained by calculating Pearson Product-Moment Correlations on the raw scores of the standardization subjects for Form A and B at each level. The reliability

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[10] Ibid., p. 32.

[11] Ibid., p. 33.

coefficients for the sixth grade age range were: eleven years old--.81; twelve years old--.78.[12]

Four Factor Index of Social Position

A. B. Hollingshead's Two Factor Index of Social Position[13] has been widely used, but pertinent criticism directed toward it indicated that it needed revision. The major points of criticism were: it was now dated; the range of occupations used were too narrow; and the family's status position was based only on data about the head of the household. The Four Factor Index of Social Position[14] was designed to meet these deficiencies.

The new index of social position is premised upon four basic assumptions: (1) a status structure exists in our society; (2) positions in this structure are determined primarily by occupation and education; (3) occupation and education may be scaled and combined so that a researcher can quickly, reliably, and meaningfully estimate the social status of individuals and members of nuclear families in our society;[15] and (4) the status structure may be divided into meaningful strata.

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[12]Ibid., pp. 30-32.

[13]August B. Hollingshead, Two Factor Index of Social Position (privately printed, 1965 Yale Station, New Haven, Conn. 06520), 1957.

[14]August B. Hollingshead, Four Factor Index of Social Position (New Haven, Connecticut: Department of Sociology, Yale University, Working Paper).

[15]Robert W. Hodge and Donald J. Treiman, "Class Identification in the United States," American Journal of Sociology, 73: 535-547, 1968.

The new index takes into consideration the fact that social status is a multidimensional concept. It assumes also that primary factors indicative of social standing or status position are the occupation an individual engages in and the years of schooling he or she has achieved. Two additional items of importance are sex and marital status. Thus, the four factors taken into consideration in the new index are: education, occupation, sex and marital status.

The educational scale is premised upon the assumption that men and women who possess different levels of education have different tastes and tend to exhibit different behavior patterns. The amount of formal education a person has completed is scaled as follows:

Level of School Completed	Score
less than seventh grade	1
junior high school (9th grade)	2
partial high school (10th or 11th grade)	3
high school graduate (whether private preparatory, parochial, trade, or public school)	4
partial college (at least one year) or specialized training	5
standard college or university graduation	6
graduate professional training	7

The occupation a person ordinarily pursues during gainful employment is graded on a 9-step scale. Wherever possible the scale has been keyed to the occupational groups used by the United States Census in 1970 and the three-digit

code assigned by the census is given.[16] The occupational titles assigned by the census are not precise enough to delineate several occupational groups, especially proprietors of businesses, the military, farmers, and families dependent upon welfare. Therefore, the occupational scale has departed from the occupational titles and codes used by the census for a number of occupational groups.

The 9-step scale for occupational groups is correlated highly with the prestige scores for occupations developed by the National Opinion Research Center (NORC) and used in its General Social Survey.[17] The Pearsonian Product Moment Coefficient of Correlation between the 9-step occupational scale and the NORC prestige scores for 436 occupational groups was $r = .927$. The coefficient of determination was $r^2 = .860$.[18]

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[16]Stanley Greene, John Prieve and Richard Morrison, "The 1970 Census of Population Occupational Classification System," The Statistical Reporter, Bureau of the Budget, December 1969, No. 70-6, pp. 77-84. For detailed instructions, see Bureau of the Census, 1970 Census of Population, Alphabetical Index of Industries and Occupations, Washington, D.C., U.S. Government Printing Office, 1972. See also, Bureau of the Census, 1970 Census of Population, Classified Index of Industries and Occupations, Washington, D.C., U.S. Government Printing Office, 1971.

[17]See National Data Program for the Social Sciences, Code Book for the Spring 1974 General Social Survey, July 1974, conducted by the National Opinion Research Center of the University of Chicago, data distributed by the Roper Public Opinion Research Center, Williams College, pp. 117-134.

[18]Hollingshead, p. 8.

The status score of an individual or a nuclear family unit is estimated by combining data on marital status, education and occupation. The status score of an individual is calculated by multiplying the scale value for occupation by a weight of five (5) and the scale value for education by a weight of three (3). The resulting products are then added together yielding a single number representing the socio-economic strata of the family unit. To determine the socio-economic status of a family where both the husband and wife work, the scores for each spouse are summed and the total is divided by two.

Computed scores range from a high of 66 to a low of 8. This range remains constant whether the score is computed on the occupation of one or two members of a family unit. The computed scores for a series of individuals or nuclear families may be arranged on a continuum or divided into groups of scores. The grouped scores encompass the major strata symbolic of social standing in contemporary American society. Hollingshead reports that meaningful groups of scores for estimating the position of an individual or a nuclear family in the status structure are as follows:[19]

Social Strata	Range of Computed Scores
I. (upper-upper) Major business and professional	66-55
II. (upper-middle) Medium business, minor professional technical	54-40
III. (middle) Skilled craftsmen, clerical, sales workers	39-30
IV. (lower-middle) Machine operators, semiskilled workers	29-19
V. (lower-lower) Unskilled laborers, menial service workers	18-8

[19] Ibid., p. 23.

When the scores are aggregated, individuals and nuclear families with scores that fall into a range of scores are presumed to be in the stratum the index assigns to it. The assumption of a meaningful correspondence between a stratum and the social behavior of individuals or nuclear family groups was validated originally by the use of factor analysis.[20]

Comprehensive Tests of Basic Skills

The Comprehensive Tests of Basic Skills, Expanded Edition, Form S (CTBS/S) is a series of batteries for kindergarten through grade 12. At levels 2 and 3, the levels appropriate for sixth grade students, the batteries contain seven tests in three basic skill areas: Reading, Language and Mathematics. Three additional tests--Reference Skills, Science and Social Studies--are not included in the Total Battery score.

The reading tests have two subparts, namely, vocabulary and comprehension. In the former, the student identifies synonyms. In the latter, he reads a poem, story, or article and answers questions about it.

Very close attention is given to the question of content validity. The Bloom[21] taxonomy for the cognitive

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[20] August B. Hollingshead and F. C. Redlick, Social Class and Mental Illness (New York: John Wiley and Sons, 1958), pp. 387-397.

[21] Benjamin S. Bloom, ed., Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain. (New York: David McKay Co. Inc., 1956).

domain provides a basis for the classification of the objectives, each of which is stated in terms of student behavioral patterns.

A complete classification of the objectives for each test is shown in the Test Coordinator's Handbook,[22] which includes two-dimensional tables of specifications for each test at each level. One dimension, processes, is coded so that a direct relationship with an objective is established. The dimension, content, is sufficiently descriptive to identify without trouble the materials used in the test items. Most important of all, each test item is classified according to the particular process or content involved in it. Since it is identified by a number, any reviewer can examine the item and verify its classification.

An additional strength supporting the degree of content validity of the CTBS/S is that classroom teachers, supported by curriculum specialists, were used to write the original test items. Reliability coefficients for the CTBS/S, Level 2, sixth grade reading battery are as follows: Reading Vocabulary .94; Reading Comprehension .93; and Total Reading .96.[23]

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[22] Comprehensive Tests of Basic Skills, Expanded Edition, "Test Coordinator's Handbook," Published by CTB/McGraw-Hill, Del Monte Research Park, Monterey, California 93940.

[23] Comprehensive Tests of Basic Skills, Expanded Edition, Form S all Levels, "Technical Bulletin No. 1" Published by CTB/McGraw-Hill, Del Monte Research Park, Monterey, California 93940.

Auditory-Visual Integration Test

A method of equivalence developed by Birch and Belmont was used to measure auditory-visual integration as defined in this study. The original test required the subjects to identify ten visual dot patterns which corresponded to the patterning of ten rhythmic auditory stimuli. Three visual dot pattern choices were available for each item.

The instrument (appendix C) used in this study was developed by Kahn. It consists of ten new items added to the original Birch and Belmont instrument in order to increase the reliability and ceiling of the measure. A test-retest reliability coefficient of .90 was reported for Kahn's group of fifth graders. The total number of correct judgments constituted the subject's score and no correction was made for guessing.

Statistical Treatment of the Data

Data collected in this study were compared by the use of fifteen *t*-tests. The independent variables were socioeconomic strata (middle and low), sex (male and female), and reading achievement (high and low). The dependent variable was the results of Kahn's auditory-visual integration test. The null hypotheses will be rejected at the .05 level of confidence.

CHAPTER II

REVIEW OF RELATED LITERATURE

One of the more contemporary methods used in studying the development of learning ability in animals and humans is to measure the transfer of stimulus information across sense modalities. Many recent investigations refer to a study by Semmes, Weinstein, Ghent and Teuber,[1] as being the first to employ cross-modal transfer specifically to examine learning.

Travers defined cross-modal transfer as the extent to which material learned through one sense modality transfers to learning through another sense modality.[2] Various labels are used to refer to transfer across sense modalities, such as cross-modal transfer, intersensory transfer, and intersensory integration. Within this study, these terms will be considered synonymous and will be used interchangeably.

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[1]Josephine Semmes, Sidney Weinstein, Lila Ghent and Hans-Lukas Teuber, "Performance on Complex Tactual Tasks after Brain Injury to Man: Analysis of Locus of Leison," The American Journal of Psychology 67 (February 1954): 220-240.

[2]Robert Morris William Travers, Essentials of Learning (New York: The Macmillan Company, 1967).

There are three somewhat different ways cross-modal transfer can be used to study development and behavior. In one procedure, equivalent stimuli are presented simultaneously in two sensory modalities, and the subjects are required to match the two correctly. The second procedure requires the subjects to match stimuli presented successively rather than simultaneously. The third procedure requires the subjects to practice or perform a task in one modality and then to perform a similar task in another modality. The second type of procedure was utilized in the present study of intersensory integration.

Transfer Between Auditory and Visual Modalities

One of a group of early studies dealing with transfer between the auditory and visual modes was conducted by Weissman and Crockett. They used college students to investigate transfer from auditory to visual perception. Their hypothesis suggested that positive transfer would occur from auditory experience to visual perception. Subjects consisted of 16 male and 14 female college students. Experimental materials were two lists of five-letter nonsense words. Fifteen subjects learned one list and its paired associates; the other 15 subjects, the second list. The 30 subjects learned to a criterion of 20 perfect trials in the auditory modality. Following a 24 hour wait period, the time required by each subject to recognize the learned list was compared with that of the unlearned list. Results indicated that transfer did occur from auditory training to visual perception, but the

processes mediating the transfer were not clarified. The transfer may have been due to a set whereby the subjects with the concerted training in visual recognition of words were able to generalize from auditory experience to the visual perception of words.[3]

Gebhard and Mowbray studied the ability of adults to match rates of visual stimulation and auditory stimulation cross-modally and intra-modally. They asked subjects to match rates of intermittent white light and white noise (a wide band of sound at 1 cps intervals). Their results revealed that cross-modal rate matching was less accurate than intra-modal rate matching. They also found that subjects made fewer errors when flicker (visual) was matched to flutter (auditory) than when flutter was matched to flicker.[4]

A study by Cole, Charover, and Ettlinger attempted to answer the question of whether adults who learned a rhythm discrimination in the auditory modality would learn the same rhythm discrimination more rapidly in the visual modality. These examiners found no evidence to support the transfer of rhythm from the auditory to visual channels. It is suggested that results such as these might imply that

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[3]Stuart L. Weissman and Walter H. Crockett, "Intersensory Transfer of Verbal Material," The American Journal of Psychology 70 (February 1957): 283-285.

[4]J.W. Gebhard and G.H. Mowbray, "On Discriminating the Rate of Visual Flicker and Auditory Flutter," The American Journal of Psychology 72 (April 1959): 521-529.

discrimination learning of complex material is largely modality specific.[5]

A lengthy investigation by Asher dealt with transfer between audition and vision in both sequences. The transfer task was the learning of a second or foreign language by college undergraduates. It was found that transfer was usually higher from vision to audition than from audition to vision. The transfer data appeared to be accounted for with what was labeled "Phonetic fit hypothesis," and "Central mediation hypothesis of sensory processes." The first hypothesis describes positive transfer as a function of the congruent match between the spoken and written language; the greater the congruency, the higher the probability of positive transfer between sensory channels. The central mediation concept suggests that the direction and amount of transfer is a function of data processed not at the sensory receptor level, but at some centralized location in the brain.[6]

Three studies involving the intersensory integration of learning sets were reviewed and, as has frequently been the case, findings were contradictory. These studies dealt primarily with transfer of learning sets between the auditory and visual modalities by preschool children. In the first of

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[5]M. Cole, S. L. Charover and G. Ettlinger, "Cross-modal Transfer in Man," Nature 191 (4794), 1961: 1225-1226.

[6]John J. Asher, "Vision and Audition in Language Learning," Perceptual and Motor Skills 19 (1), 1964: 255-299.

these studies, Gardner and Judisch described a procedure to determine whether pretraining in a visual discrimination task would facilitate learning of a similar auditory task. Sequences of different colored lights and tonechime sequences were the stimuli. Responses were to push colored lights according to the sequence of stimuli presented. Of the three groups of subjects tested, two of the three groups demonstrated intersensory transfer from the visual to auditory mode, the other group showed no transfer. Intersensory transfer of a learned principle, thus, can be demonstrated, even in young children.[7]

Another study published in that same year investigated the question of whether the performance of preschool subjects on a tactile discrimination task would be facilitated by auditory and visual pretraining. Of three groups, one had auditory pretraining, one had visual pretraining, while members of the third (control) group were only familiarized with the equipment. The experimental procedures were similar to those described above. Results indicated that the (1) auditory and visual pretraining facilitated performance in a tactile discrimination task for preschool children and (2) visual pretraining was more effective in facilitating performance in the tactile task than was auditory pretraining.[8]

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[7]B.D. Gardner and J.M. Judish, "Intersensory Transfer of Training in Young Children," Perceptual and Motor Skills 20 (1), 1965: 802.

[8]Elaine V. Houck, D. Bruce Gardner and Donna Ruhl, "Effects of Auditory and Visual Pretraining on Performance in a Tactile Discrimination Task," Perceptual and Motor Skills 20 (2), 1965: 1057-1063.

A study by Cayce attempted to answer the question of whether a learning set that had been formed within either the auditory or the visual sense modality would affect task learning in the alternate modality. Preschool subjects were divided into an auditory-visual group and a visual-auditory group. Results revealed that neither experimental group showed intersensory transfer or learning sets. It was concluded that prior training in one sense modality did not affect learning set formation in a second sense modality.[9]

Holmgren, Arnoult, and Manning hypothesized that there would be positive transfer in both sequences between the auditory and visual modes if the assignment of responses to stimuli was the same for both tasks, and that there would be negative transfer in both sequences if the assignment of responses to stimuli was different in task two than in task one. The results clearly supported both these hypotheses pertaining to cross-modal transfer in undergraduate students used for the study. Two possible explanations for these findings appeared likely: (1) transfer is produced in the central nervous system by a process of perceptual coding, and (2) transfer is based upon specific past learning which mediates a similarity relationship between the stimuli of task one and the stimuli of task two.[10]

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[9]Charles Thomas Cayce, "Transfer of Learning Sets Across Sense Modalities in Preschool Children." Unpublished doctoral dissertation, University of Mississippi, 1968. (Dissertation Abstracts, 29, 1968, 68-14, 347).

[10]Gary L. Holmgren, Malcolm D. Arnoult and Winton H. Manning, "Intermodal Transfer in a Paired Associates Learning Task," Journal of Experimental Psychology 71 (2), 1966: 254-259.

Auditory-Visual Integration and Reading Ability

A significant number of studies have demonstrated an important usage of sensory integration research concerning the visual and auditory systems; performance on auditory-visual integration tasks has been correlated with reading ability. Several investigators have demonstrated that auditory-visual integration is at least moderately correlated with reading achievement. Even when subjects are equal in auditory memory, visual and auditory discrimination, and intelligence, poor readers seem to be significantly more impaired in integration skills than are good readers.[11]

The first work in this area appears to have been a study by Birch and Belmont. Later investigations used the Birch-Belmont test, or variations of it, in replication studies or studies with slightly different variables. Birch and Belmont studied the relationship of auditory-visual integration to reading retardation in 200 nine- and ten-year old children from Scotland. One hundred fifty of the subjects were retarded readers and 50 were normal readers. Only male subjects were used in the study due to known sex differences in reading retardation. The auditory-visual integration of the subjects was studied by a method of equivalence. They were asked to identify a visual dot pattern from among three presented, with subjects judging sameness in a pattern of

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[11] J. R. Evans, "Auditory and Auditory-Visual Integration Skills as They Relate to Reading," The Reading Teacher 22 (July 1969): 625-629.

auditory stimulation. Taps were sounded with one-half second pauses creating short intervals and one second pauses creating long intervals. The visual stimuli (three sets of dots) were presented immediately following the auditory presentation. Results showed the retarded readers significantly less able to make judgments of auditory-visual equivalence than normal readers. Within the two groups of readers, those children with lower auditory-visual performances tended to have lower reading scores. These findings were interpreted to indicate that the development of auditory-visual integration has specific relevance to reading, although it is not the sole factor underlying reading incompetence.[12]

Other studies, employing similar procedures, yielded some meaningful information. One by Beery, which used a modified version of the Birch-Belmont test, produced results that were highly consistent with the earlier findings. She concluded that

> Since tests of A-V integration appear useful both in predicting and in discriminating normal and subaverage readers when IQ is controlled, further research with such tools may be quite productive.[13]

A study by Rudnick, Sterritt, and Flax, also using a modified version of the Birch-Belmont test, produced results that led the examiners to conclude that

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[12]Herbert G. Birch and Lillian Belmont, "Auditory-Visual Integration in Normal and Retarded Readers," American Journal of Orthopsychiatry 34 (May 1964): 852-861.

[13]Judith W. Beery, "Matching of Auditory and Visual Stimuli by Average and Retarded Readers," Child Development 38 (March 1967): 832.

> Visual perceptual abilities decline in importance from third to fourth grade, while general intelligence and auditory and/or cross-modal perceptual abilities become more important in relation to individual differences in reading ability as the child moves from third to fourth grade.[14]

This study was designed to further explore the relation between perceptual tests and reading achievement. The auditory stimuli were presented via earphones and the visual stimuli were delivered via a blinking light. This test was found to correlate more strongly with reading ability than the original Birch-Belmont test.

The results of a study by Kahn indicated that auditory-visual integration correlated .51 with chronological age and from .37 to .57 with reading achievement. The subjects were 350 boys, 70 per grade, randomly chosen from the second through sixth grades. A lengthened form of the Birch-Belmont auditory-visual test was administered. Kahn concluded that the development of auditory-visual integration was an important correlate in reading achievement, especially in the acquisition of vocabulary.[15]

Two investigations used a modified version of the Birch-Belmont test in a slightly different manner. They modified the test in order to study four sensory integration

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[14]Mark Rudnick, Graham M. Sterritt and Morton Flax, "Auditory and Visual Rhythm Perception and Reading Ability," Child Development 38 (2), 1967: 581.

[15]Dale Kahn, "The Development of Auditory-Visual Integration and Reading Achievement." Unpublished doctoral dissertation, Columbia University, 1965. (Dissertation Abstracts 26, May 1965, 65-12, 349.

skills: visual-visual, visual-auditory, auditory-visual, and auditory-auditory. This test used a telegraph key concealed behind a screen for auditory and dots for visual stimuli. The four skills were studied as they related to reading competence. It was found that visual-auditory and auditory-visual skills were significantly related to later reading achievement with the auditory-visual skill being more important. A significant relationship was found to exist between letter naming and auditory-visual and visual-auditory matching.[16,17]

Birth and Belmont studied the development of auditory-visual equivalence in children aged five through twelve years of age and the relation of such equivalence to intellectual status and emergence of reading skills. They found that intersensory functioning improved with age, within the ages considered, and that the level of auditory-visual proficiency was positively related to intellectual level.[18]

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[16]Siegmar Muehl and Shirley Kremenak, "Ability to Match Information Within and Between Auditory and Visual Sense Modalities and Subsequent Reading Achievement," Journal of Educational Psychology 57 (4), 1966: 230-239.

[17]Shirley White Kremenak, "An Investigation of the Relationships Among Reading Achievement, Reading Readiness and the Ability to Match Within and Between the Visual and Auditory Sensory Modalities." Unpublished doctoral dissertation, The University of Iowa, 1965. (Dissertation Abstracts 26, 1966, 66-3453).

[18]Herbert G. Birch and Lillian Belmont, "Auditory Visual Integration, Intelligence, and Reading Ability in School Children," Perceptual and Motor Skills 20 (January 1965): 295-305.

In another investigation, both auditory-visual integration and tactual-visual integration were measured for nine-year-old boys. The auditory-visual test was similar to the Birch-Belmont test except that it was extended to 20 items and the pencil tapping was not viewed by the subjects. The tactual-visual test required the subject to explore a raised form tactually and then visually inspect four items successively from which he was asked to make a match. In both tests, the subjects were asked to make choices as the test progressed. Subjects were not allowed to go back to select an earlier exposed form or to reexamine the auditory or tactual stimuli. The results of this study showed that auditory-visual integrative skills were significantly related to intelligence and reading achievement, whereas tactual-visual skills were not. The two intersensory tasks were not significantly related to each other.[19]

A more recent study by Bossing compared the auditory-visual integration and visual-auditory integration of low socioeconomic strata children, seven and nine years of age, with the auditory-visual and visual-auditory integration of middle socioeconomic strata children of similar ages. His subjects were 40 seven-year-old children and 40 nine-year-old children. Twenty subjects at each age level were from middle SES and 20 were from low SES. The results of the

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[19]Marguerite P. Ford, "Auditory-Visual and Tactual-Visual Integration in Relation to Reading Ability," Perceptual and Motor Skills 24 (March 1967): 831-841.

study indicated a significant difference between the middle and low SES children at both ages, for auditory-visual and visual-auditory integration tasks.[20]

Summary

Numerous studies have been presented demonstrating that auditory-visual integration skills are closely related to reading skills, which in turn is known to be an important variable in school achievement and intelligence test performance. Although Bossing's research[21] revealed a significant difference in auditory-visual integration between middle and low SES groups, it did not deal with the variables of sex ratios or reading achievement levels within the socioeconomic strata. Kahn,[22] Ford,[23] Birch and Belmont[24] used only males in their studies dealing with auditory-visual integration and reading achievement, reportedly to eliminate sex differences, which have been shown to exist in reading retardation, and because reading disturbance is significantly more frequent in boys than in girls. It would therefore seem that a clear need exists for an investigation of the interrelatedness between

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[20]Lewis L. Bossing, "A Comparison of Integration Between Auditory and Visual Modalities of Middle and Low SES Children at Ages Seven and Nine Years." Unpublished doctoral dissertation, George Peabody College for Teachers, 1972.

[21]Ibid.

[22]Kahn.

[23]Ford.

[24]Birch and Belmont, "Normal and Retarded Readers."

these variables in order to further clarify the relationships between auditory-visual integration skills and reading ability.

CHAPTER III

PROCEDURES AND RESULTS

Procedures of Subject Selection and Data Collection

A form (appendix A) was sent home with 1506 sixth graders in the Mid-Del School System. This number represented the total sixth grade enrollment in the system. Of this number, 971, or sixty-five percent, were returned approved as evidenced by the signature of a parent.

The school enrollment cards of each of the 971 approved children were checked for information necessary for determining socioeconomic status. This search yielded 285 children who were classified on Hollingshead's Four Factor Index of Social Position as low social strata (computed scores ranging from 8-29). The same instrument classified 479 children as middle social strata (computed scores ranging from 30-54).

Scores from the reading vocabulary, comprehension and total reading subtests of the California Tests of Basic Skills were obtained on the 764 middle and low socioeconomic strata children. High and low reading achievers were retained based on their national percentile scores in each of the

three above mentioned subtests. High reading achievers scored at the 85th percentile or above and low reading achievers at the 15th percentile or below. These high and low reading achievers were further divided into eight groups. Table 1 indicates the number of children available for the final two screening procedures.

TABLE 1

NUMBER OF SUBJECTS AVAILABLE, BY GROUPS, FOR SCREENING ON THE PIAGETIAN CONSERVATION TASKS AND THE PEABODY PICTURE VOCABULARY TEST

Reading Achievement Level	Male		Female	
	Middle SES	Low SES	Middle SES	Low SES
High Readers	50	22	52	17
Low Readers	14	19	12	18

The children within each of the eight groups were assigned sequential numbers. A table of random numbers was used to assign a priority rank to each eligible child within each group. The children were then individually administered the six Piagetian Conservation Tasks (appendix B) and the Peabody Picture Vocabulary Test, Form B. Subjects who

were able to conserve on five of the six conservation tasks, and whose measured intelligence quotient was beteen 85 and 115, were then administered the auditory-visual integration test (appendix C). A subject unable to pass the conservation and/or intelligence criteria was eliminated, and the subject with the next higher priority rank within that cell was selected. This procedure was followed until each of the eight cells had ten subjects with auditory-visual integration scores. Table 2 indicates the specific number of children eliminated from each group, and the reason for their elimination.

TABLE 2

NUMBER OF CHILDREN ELIMINATED FROM EACH GROUP AND REASON FOR ELIMINATION

SES and Sex	Reason for Elimination					
	Non-conservers		I.Q. above 115		I.Q. below 85	
	High Readers	Low Readers	High Readers	Low Readers	High Readers	Low Readers
Middle SES Males	--	2	6	--	--	1
Females	--	1	3	--	--	1
Low SES Males	--	4	2	--	--	3
Females	--	5	3	--	--	2
Total	--	12	14	--	--	7

College students trained in the administration of the conservation tasks were used for that part of the screening. To insure tester reliability, each tester attended a pre-test training session.

Analysis of Data

The statistical analyses were performed on the raw scores (appendix D) from the auditory-visual integration test. The first step in the data analysis procedures was to compute the descriptive statistics for each of the groups (table 3). Next, the descriptive statistics for the combined groups necessary to answer the proposed hypothesis were computed.

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR EACH SINGLE TEST GROUP

	Socioeconomic Strata							
	Middle				Low			
	High Reading Group		Low Reading Group		High Reading Group		Low Reading Group	
	Male (n=10)	Female (n=10)	Male (n=10)	Female (n=10)	Male (n=10)	Female (n=10)	Male (n=10)	Female (n=10)
Mean	18.2	17.6	15.0	10.6	15.5	16.9	12.4	12.8
Standard Deviation	1.23	2.01	2.83	2.63	3.17	1.97	4.79	2.62

To determine significant differences, fifteen t-tests were computed between the grouped cell means in two samples of equal size.[1] F-ratios of variance were computed and found to be significant on six of the fifteen comparisons. To compensate for heterogeneity of variance, the following procedure described by Edwards was followed:

> . . . with equal n's and heterogeneity of variance, we may calculate t in the usual way, but the obtained value of t should be evaluated in terms of the tabled value for ½ the number of degrees of freedom we would have with homogeneity of variance.[2]

A t-value of 2.08 is necessary to reject the null hypothesis at the .05 alpha level with 20 degrees of freedom. Ten degrees of freedom require a t-value of 2.23 to reject the null hypothesis at the .05 alpha level.

Hypothesis 1 stated no statistically significant differences exist between the mean raw scores of sixth grade children from middle and low SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 1.14, $p > .05$ (table 4). Hypothesis 1 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of sixth grade children from middle and low SES on an auditory-visual equivalency task.

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[1] Joy Paul Guilford, Fundamental Statistics in Psychology and Education, 4th ed., (New York: McGraw-Hill Book Co., 1965), p. 184.

[2] Allen Louis Edwards, Experimental Design in Psychological Research, 4th Ed., (New York: Holt, Rinehart and Winston, Inc., 1972), p. 108

Hypothesis 2 stated no statistically significant differences exist between the mean raw scores of male and female sixth grade students on an auditory-visual equivalency task. Treatment of the data yielded a t-value of .96, $p > .05$ (table 4). Hypothesis 2 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of male and female sixth grade students on an auditory-visual equivalency task.

TABLE 4

MEAN, STANDARD DEVIATIONS AND t-VALUES OF SUBJECTS' SCORES ON THE AUDITORY-VISUAL EQUIVALENCY TASK WHEN GROUPED BY SES, SEX AND READING LEVEL

	SES		t	Sex		t	Reading Level		t
	Middle (n=40)	Low (n=40)		Male (n=10)	Female (n=40)		High (n=40)	Low (n=40)	
$\bar{X}$	15.35	14.40	1.14	15.28	14.48	.96	17.05	12.70	6.42*
S.D.	3.73	3.65		3.76	3.69		2.35	3.58	

*Statistically significant at the .01 alpha level (corrected for heterogeniety of variance).

Hypothesis 3 stated no statistically significant differences exist between the mean raw scores of sixth grade high and low reading achievers on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 6.42, $p < .01$ (table 4). Hypothesis 3 was rejected and interpreted to mean there is a significant difference between the mean raw scores of sixth grade high and low reading achievers on an auditory-visual equivalency task. The difference was in favor of the high reading achievers.

Hypothesis 4 stated no statistically significant differences exist between the mean raw scores of sixth grade male students from middle and low SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 2.35, $p < .05$ (table 5). Hypothesis 4 was rejected and interpreted to mean there is a significant difference between the mean raw scores of sixth grade male students from middle and low SES on an auditory-visual equivalency task. The difference was in favor of the middle SES students.

Hypothesis 5 stated no statistically significant differences exist between the mean raw scores of sixth grade female students from middle and low SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of .64, $p > .05$ (table 5). Hypothesis 5 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of sixth grade female students from middle and low SES on an auditory-visual equivalency task.

Hypothesis 6 stated no statistically significant differences exist between the mean raw scores of male and female sixth grade students from middle SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 2.22, $p > .05$ (table 5). Hypothesis 6 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of male and female sixth grade students from middle SES on an auditory-visual equivalency task.

Hypothesis 7 stated no statistically significant differences exist between the mean raw scores of male and female sixth grade students from low SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of .77, $p > .05$ (table 5). Hypothesis 7 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of male and female sixth grade students from low SES on an auditory-visual equivalency task.

Hypothesis 8 stated no statistically significant differences exist between the mean raw scores of sixth grade high reading achievers from middle and low SES on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 2.42, $p < .05$ (table 6). Hypothesis 8 was rejected and interpreted to mean there is a significant difference between the mean raw scores of sixth grade high reading achievers from middle and low SES on an auditory-visual equivalency task. The difference was in favor of the high reading achievers from the middle SES.

TABLE 5

MEAN, STANDARD DEVIATIONS AND t-VALUES OF SUBJECTS' SCORES ON THE AUDITORY-VISUAL EQUIVALENCY TASK WHEN GROUPED BY SES AND SEX

	Males		t	Females		t	Middle SES		t	Low SES		t
	Middle (n=20)	Low (n=20)		Middle (n=20)	Low (n=20)		Male (n=20)	Female (n=20)		Male (n=20)	Female (n=20)	
$\bar{X}$	16.60	13.95	2.35*	14.10	14.85	.64	16.60	14.10	2.22	13.95	14.85	.77
S.D.	2.68	4.26		4.25	3.08		2.68	4.25		4.26	3.08	

*Statistically significant at the .05 alpha level (corrected for heterogeniety of variance).

Hypothesis 9 stated no statistically significant differences exist between the mean raw scores of sixth grade low reading achievers from middle and low SES on an auditory-visual equivalency task. Treatment of the data yielded a *t*-value of .18, $p > .05$ (table 6). Hypothesis 9 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of sixth grade low reading achievers from middle and low SES on an auditory-visual equivalency task.

Hypothesis 10 stated no statistically significant differences exist between the mean raw scores of sixth grade high and low reading achievers from middle SES on an auditory-visual equivalency task. Treatment of the data yielded a *t*-value of 6.17, $p < .01$ (table 6). Hypothesis 10 was rejected and interpreted to mean there is a significant difference between the mean raw scores of sixth grade high and low reading achievers from middle SES on an auditory-visual equivalency task. The difference was in favor of the high reading achievers from middle SES.

Hypothesis 11 stated no statistically significant differences exist between the mean raw scores of sixth grade high and low reading achievers from low SES on an auditory-visual equivalency task. Treatment of the data yielded a *t*-value of 3.49, $p < .01$ (table 6). Hypothesis 11 was rejected and interpreted to mean there is a significant difference between the mean raw scores of sixth grade high and low reading achievers from low SES on an auditory-visual

TABLE 6

MEAN, STANDARD DEVIATIONS AND t-VALUES OF SUBJECTS SCORES ON THE AUDITORY-VISUAL EQUIVALENCY TASK WHEN GROUPED BY SES AND READING LEVEL

	High Reading		t	Low Reading		t	Middle SES		t	Low SES		t
	Middle (n=20)	Low (n=20)		Middle (n=20)	Low (n=20)		High Reader	Low Reader		High Reader	Low Reader	
$\bar{X}$	17.90	16.20	2.42*	12.80	12.60	.18	17.90	12.80	6.17**	16.20	12.60	3.49**
S.D.	1.65	2.67		3.31	3.76		1.65	3.31		2.67	3.76	

*Statistically significant at the .05 alpha level (corrected for heterogeniety of variance).
**Statistically significant at the .01 alpha level (corrected for heterogeniety of variance).

equivalency task. The difference was in favor of the high reading achievers from low SES.

Hypothesis 12 stated no statistically significant differences exist between the mean raw scores of male sixth grade high and low reading achievers on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 2.89, $p < .05$ (table 7). Hypothesis 12 was rejected and interpreted to mean there is a significant difference between the mean raw scores of male sixth grade high and low reading achievers on an auditory-visual equivalency task. The difference was in favor of the male high reading achievers.

Hypothesis 13 stated no statistically significant differences exist between the mean raw scores of female sixth grade high and low reading achievers on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 7.26, $p < .01$ (table 7). Hypothesis 13 was rejected and interpreted to mean there is a significant difference between the mean raw scores of female sixth grade high and low reading achievers on an auditory-visual equivalency task. The difference was in favor of the female high reading achievers.

Hypothesis 14 stated no statistically significant differences exist between the mean raw scores of sixth grade male and female high reading achievers on an auditory-visual equivalency task. Treatment of the data yielded a t-value of .53, $p > .05$ (table 7). Hypothesis 14 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of sixth grade male and female

TABLE 7

MEAN, STANDARD DEVIATIONS AND t-VALUES OF SUBJECTS' SCORES ON THE AUDITORY-VISUAL EQUIVALENCY TASK WHEN GROUPED BY SEX AND READING LEVEL

	Males		t	Females		t	High Reader		t	Low Reader		t
	High Reader (n=20)	Low Reader (n=20)		High Reader (n=20)	Low Reader (n=20)		Male (n=20)	Female (n=20)		Male (n=20)	Female (n=20)	
$\bar{X}$	16.85	13.70	2.89*	17.25	11.70	7.26**	16.85	17.25	.53	13.70	11.70	1.82
S.D.	2.72	4.05		1.97	2.79		2.72	1.97		4.05	2.79	

*Statistically significant at the .05 alpha level (corrected for heterogeniety of variance).

**Statistically significant at the .01 alpha level (corrected for heterogeniety of variance).

high reading achievers on an auditory-visual equivalency task.

Hypothesis 15 stated no statistically significant differences exist between the mean raw scores of sixth grade male and female low reading achievers on an auditory-visual equivalency task. Treatment of the data yielded a t-value of 1.82, $p > .05$ (table 7). Hypothesis 15 was accepted and interpreted to mean that no significant differences existed between the mean raw scores of sixth grade male and female low reading acheivers on an auditory-visual equivalency task.

In investigating the fifteen differences between grouped raw score means on the auditory-visual equivalency task, seven statistically significant differences were found. High reading achievers scored higher than low reading achievers. Male students from middle socioeconomic strata scored higher than male students from low socioeconomic strata. High reading achievers from middle socioeconomic strata scored higher than high reading achievers from low socioeconomic strata. Middle socioeconomic strata high reading achievers scored higher than middle socioeconomic strata low reading achievers. Low socioeconomic strata high reading achievers scored higher than low socioeconomic strata low reading achievers. Male high reading achievers scored higher than male low reading achievers. Female high reading achievers scored higher than female low reading achievers.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to investigate the differences between the auditory-visual integration ability of sixth grade students when such variables as socioeconomic status, sex, intelligence, conservation ability and reading achievement were controlled.

Nine-hundred-seventy-one sixth-grade subjects were selected from the Mid-Del Elementary Public School System. After being screened for middle and low socioeconomic status on Hollingshead's Four Factor Index of Social Position, and high and low reading achievement on the California Tests of Basic Skills, 205 subjects remained. These subjects were further divided into eight categories: (1) female, low SES, low reading achiever; (2) female, middle SES, low reading achiever; (3) female, low SES, high reading achiever; (4) female, middle SES, high reading achiever; (5) male, low SES, low reading achiever; (6) male, middle SES, low reading achiever; (7) male, low SES, high reading achiever, and (8) male, middle SES, high reading achiever.

Subjects were randomly selected from each of the eight groups and individually administered six conservation tasks and the Peabody Picture Vocabulary Test, Form B. If the subject was able to conserve on five of six tasks and the measured intelligence quotient was between 85-115, the subject was individually administered an auditory-visual integration test. The auditory-visual integration raw scores from ten subjects within each of the eight groups (total n=80) were utilized in the statistical analyses.

The study included the analyses of differences in the mean auditory-visual integration scores of subjects grouped on the basis of middle and low SES; males and females; and high and low reading achievers. Analyses were also made between the mean differences in auditory-visual integration scores on subjects grouped on the basis of SES and sex; reading achievement and SES; and reading achievement and sex. The fifteen t-tests yielded seven statistically significant differences at the .05 alpha level.

The results indicated that subjects' auditory-visual integration skills were not significantly different when they were grouped on the single variables of socioeconomic status or sex. This was not the case when subjects were grouped on the basis of their reading achievement level. High achievers made significantly higher auditory-visual integration scores than low achievers. In combining the variables of SES, sex and reading achievement level, every analysis involving the

mean difference between "high reading achievers" and "low reading achievers" yielded significance.

No significant differences in auditory-visual integration skills were found between male and female high reading achievers, or male and female low reading achievers, without regard for SES. Middle SES males did score significantly higher than low SES males.

Conclusions

The following conclusions were derived from the results of the study:

1. Auditory-visual integration ability was not influenced by socioeconomic status as a single factor. However when the variables of sex and socioeconomic status are combined, middle socioeconomic status male subjects had significantly higher auditory-visual integration skills than low socioeconomic status male subjects.

2. Auditory-visual integration ability was not influenced by sex as a single factor. This suggests that utilizing male subjects only, when investigating the differences between auditory-visual integration and reading achievement, is questionable.

3. Auditory-visual integration ability was significantly higher in high reading achievers than in low reading achievers.

4. Auditory-visual integration ability was significantly higher for male high reading achievers than for male

low reading achievers.

5. Auditory-visual integration ability was significantly higher for female high reading achievers than for female low reading achievers.

6. Auditory-visual integration ability was significantly higher for middle socioeconomic status high reading achievers than for middle socioeconomic status low reading achievers.

7. Auditory-visual integration ability was significantly higher for low socioeconomic status high reading achievers than for low socioeconomic status low reading achievers.

8. The high reading achievers from middle socioeconomic status had significantly greater auditory-visual integration skills than any other group of subjects.

Recommendations

The following recommendations were made for further research:

1. Design similar studies to be made at both higher and lower grade levels.

2. Design a longitudinal study to investigate the relationships between improvement in reading achievement and gains in auditory-visual integration ability.

3. Design a study to investigate the relationships between conservation, intelligence and auditory-visual integration.

4. Investigate the relationships between auditory-tactile integration and reading ability in blind students who have learned to read by braille.

5. Investigate the relationships between auditory-visual integration and reading ability in a handicapped population such as mentally retarded children, learning disabled or speech impaired children.

6. Investigate the relationship between conservation and low reading achievement.

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APPENDIX A

PARENT AUTHORIZATION FOR RELEASE OF INFORMATION AND TESTING FORM

PARENT AUTHORIZATION FOR RELEASE OF INFORMATION AND TESTING

The Mid-Del School System has agreed to assist Mr. Michael King in a doctoral research study designed to examine the reading abilities of sixth grade students. The study will involve two phases:

(1) Reviewing from each student's personal school folder the results of standardized achievement tests and enrollment information

(2) If you child is selected, he/she will be given an individually administered battery of tests which will require no more than 90 minutes of school time.

If you consent to your sixth grader participating in this study, please sign and return this form to your child's teacher.

In compliance with Public Law 93-380, 93rd Congress, H.R. 69, enacted August 21, 1974.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT OF 1974

_____ has my permission to release the educational
School Site
records (except privileged information) of:

_____	6th	1975-76
Name of Student	Grade	Year

to Michael King. The reason for said release is as follows: doctoral research study designed to examine the reading abilities of sixth grade students. I understand that a copy of the records released will be furnished by the school if requested.

_____
Parent's Signature

_____
Date Signed

ABSOLUTELY NO PERSONAL INFORMATION WILL BE IDENTIFIABLE IN THE RESEARCH REPORT.

APPENDIX B

ADMINISTERING THE PIAGETIAN TASKS

(PROCEDURES AND INTERPRETATION)

April 14, 1976

Michael King, M.S.
3404 Bella Vista
Midwest City, Oklahoma 73110

Dear Mr. King:

I hereby give my permission for you to place a copy of Administering the Piagetian Tasks within the appendices of your doctoral dissertation.

Gene Shepherd, Ed.D.
College of Education
University of Oklahoma

ADMINISTERING THE PIAGETIAN TASKS[1]

(Procedures and Interpretations)

The Piagetian tasks are designed to differentiate among pre-operational and concrete operational learners. These are tasks, not tests; therefore, relax, observe and listen to the child. The materials can be easily gathered (i.e.: pill vials for the conservation of volume; plastic drinking straws for length; houses or hotels from a game like "Monopoly" for barns).

Early during the administering of each task, the child must agree to "sameness" (i.e.: same number of red and black checkers; same amounts of clay). If the child will not agree to sameness and if the objects cannot be equalized to the satisfaction of the child that sameness does exist, the task must be aborted.

After the child agrees to sameness, the administrator performs some action on the objects. Following the action the child must then be asked the questions related to conservation: more than; less than; or the same as. If the child can perceive sameness, the cognitive operation of conservation exists. Conservation is a characteristic of concrete operational learners.

The directions for administering each task follows:

1. TASK: Conservation of Number

   Objects Required: 1. six identical black checkers
   2. six identical red checkers

Setting: Have the child line six black checkers in one row and six red checkers in another row.

red:



black:



Agreement to Sameness: Ask if the child agrees that there are the same number of red checkers as there are black checkers. If the child does not perceive sameness and objects cannot be manipulated to the child's satisfaction, the task must be aborted at this point.

Action: After agreement to sameness, stack the red checkers, one on top of the other, leaving the black checkers in their original row placement.

red:



black:



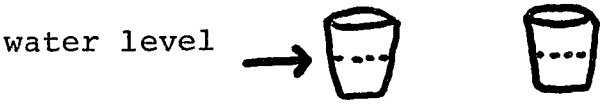
Questions Related to Conservation: Ask the child, "Are there more red checkers, less red checkers or the same number of red checkers as there are black checkers?"

Interpretation: If the answer is "yes," the child is able to conserve number. If the answer is "no," the child is unable to conserve number.

2. TASK: Conservation of Liquid Amount

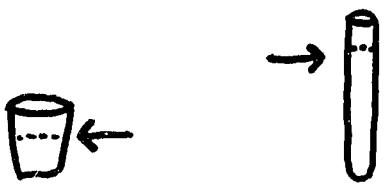
Objects Required: 1. two transparent containers of equal size
2. one transparent container which is taller and more slender than the two containers mentioned above
3. enough liquid to fill the two equal containers about one-half full
4. eyedropper

Setting: Pour the same amount of liquid into two containers of equal size.



Agreement to Sameness: Ask if the child agrees that the containers are the same size and that they contain the same amount of liquid. If the child does not perceive sameness and objects cannot be manipulated (i.e., use of eyedropper to increase or partially remove liquid present in containers) to the child's satisfaction, the task must be aborted at this point.

Action: After agreement to sameness, pour the liquid into a taller, thinner container. If the administrator is willing to risk a spill, let the child do it; personal involvement by the child is advantageous.



Questions Related to Conservation: Ask the child, "Is there more liquid, less liquid, or the same amount of liquid in the tall container as there is in the other container?"

Interpretation: If the answer is "yes," the child is able to conserve liquid amount. If the answer is "no," the child is unable to conserve liquid amount.

3. TASK: Conservation of Solid Amount

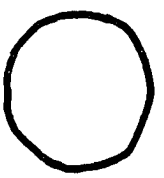
Objects Required: 1. two equal amounts of clay which differ in color

Setting: Roll two equal amounts of clay into balls of equal size. For discussion purpose, two colors of clay (i.e., blue and red), may be used.



Agreement to Sameness: Ask if the child agrees that there is the same amount of blue clay as there is red clay. If the child does not perceive sameness and objects cannot be manipulated (i.e., portions of clay removed from one of the balls) to the child's satisfaction, the task must be aborted at this point.

Action: After agreement to sameness, deform the piece of red clay by rolling it into a "snake" form.

blue:  red: 

Questions Related to Conservation: Ask the child: "Is there more red clay, less red clay or the same amount of red clay as there is blue clay?"

Interpretation: If the answer is "yes," the child is able to conserve solid amount. If the answer is "no," the child is unable to conserve solid amount.

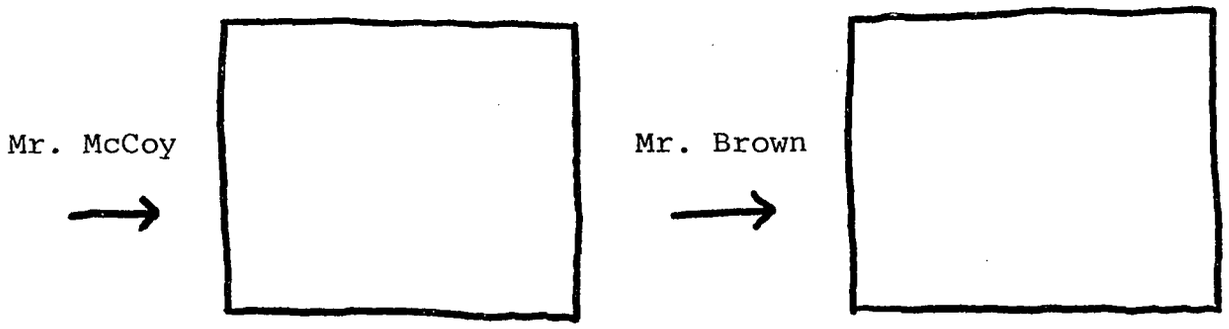
4. TASK: Conservation of Area

Objects Required: 1. two identical fields of grass (i.e., green construction paper squares and rectangles)

2. eight identical barns (i.e., hotels from game of "Monopoly")

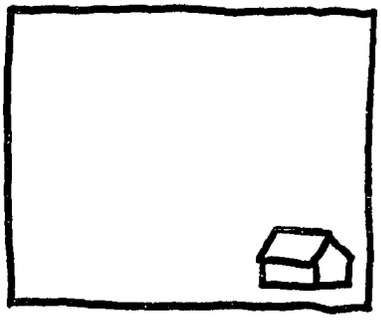
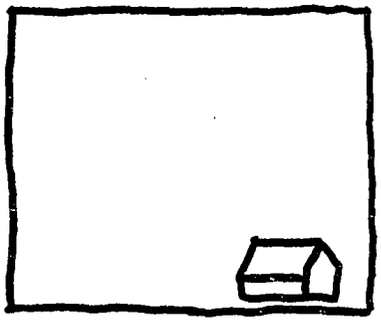
3. scissors (possibly required for trimming fields)

Setting: Show the child two fields of grass of equal size. Explain to the child that Mr. McCoy, a farmer, owns one field of grass and Mr. Brown, another farmer, owns the other field of grass.



Agreement to Sameness: Ask if the child agrees that there is just as much grass in Mr. McCoy's field as there is in Mr. Brown's field. If the child does not perceive sameness and objects cannot be manipulated (i.e., allow the child to trim either field as required) to the child's satisfaction, the task must be aborted at this point.

Action: After agreement to sameness, place an identical barn in an identical position on each field, explaining to the child that both Mr. McCoy and Mr. Brown have built a barn on their fields.

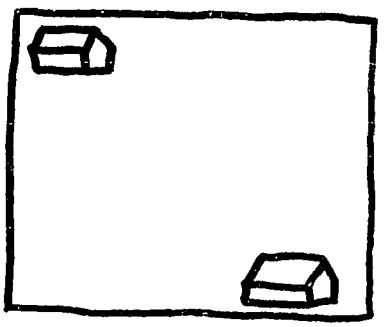
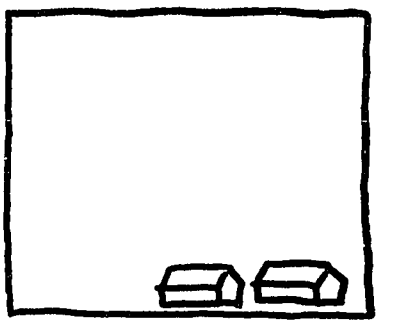
Mr. McCoy  Mr. Brown 

Agreement to Sameness: Ask the child if the barns are identical in size. Agreement to sameness must be reached or the task must be aborted. It is permissible for the child to examine the barns to determine their sameness.

Questions Related to Conservation: After the child has agreed to the sameness of the field size, and barns, ask the child: "Is there more grass, less grass or the same amount of grass in Mr. McCoy's field as there is in Mr. Brown's field?"

Interpretation: At this point, the administrator should merely record the child's response.

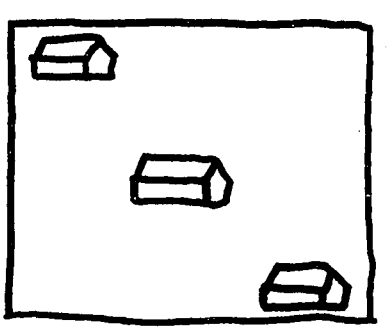
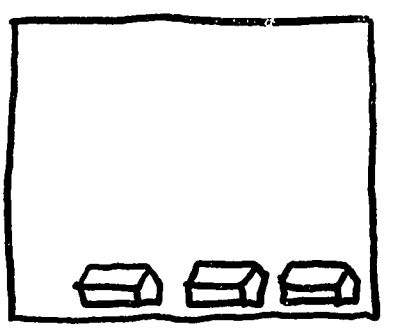
Action: After the child has responded, place another barn next to the existing barn in Mr. Brown's field, and then place a second barn in Mr. McCoy's field in the diagonal corner to the existing barn. Explain to the child that Mr. Brown built a second barn next to his first barn, and that Mr. McCoy built a second barn across the field from his first barn.

Mr. McCoy  Mr. Brown 

Questions Related to Conservation: Ask the child: "Is there more grass, less grass or the same amount of grass in Mr. McCoy's field as there is in Mr. Brown's field?"

Interpretation: At this point, as before, the recording of the child's response is all that is required.

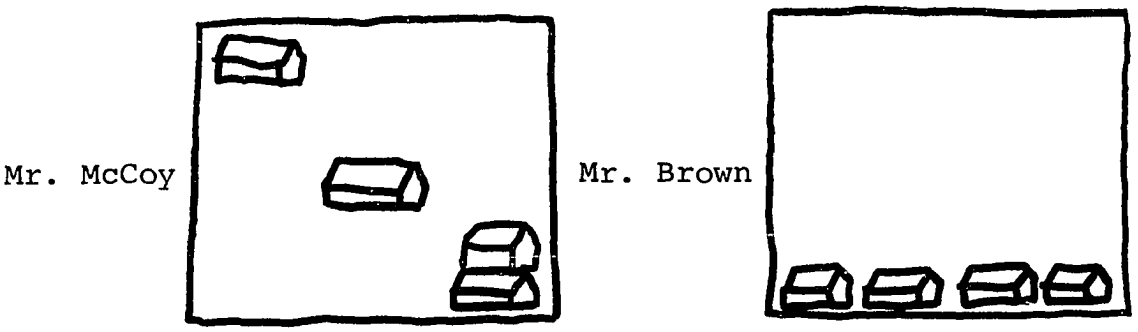
Action: After the child has responded, place another barn next to the existing two barns in Mr. Brown's field, and then place a third barn in the center of Mr. McCoy's field. Explain to the child that both Mr. Brown and Mr. McCoy built a third barn in each of their fields. Explain that Mr. Brown built his third barn next to the other two barns, and that Mr. McCoy built a third barn in the center of his field.

Mr. McCoy  Mr. Brown 

Questions Related to Conservation: Ask the child: "Is there more grass, less grass or the same amount of grass in Mr. McCoy's field as there is in Mr. Brown's field?

Interpretation: If the answer is "yes," the child conserves area. If the answer is "no," the child is unable to conserve area.

NOTE: If the child continually counts the barns, it is possible that the child is conserving number rather than area. To verify conservation of area, place a fourth barn in Mr. Brown's field next to the three existing barns, and then place a fourth barn in Mr. McCoy's field on top of an existing barn, making a two-story barn.



Repeat the question: "Is there more grass, less grass or the same amount of grass in Mr. McCoy's field as there is in Mr. Brown's field?" If the answer is that there is more grass in Mr. McCoy's field or that there is less grass in Mr. Brown's field, the child conserves area. If the answer is inconsistent with either of these two statements, the child is unable to conserve area.

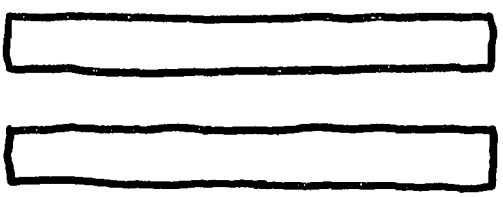
5. TASK: Conservation of Length

Objects Required: 1. two identical rods (i.e., dowel rods, plastic drinking straws)

2. two toy cars which are identical except for color

Setting: Place two rods of equal length side by side. These two rods represent two roads.

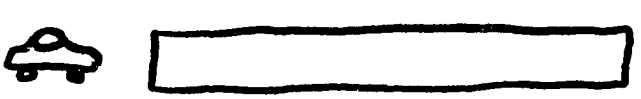
two roads:



Agreement to Sameness: Ask if the child agrees that both roads are the same length. If the child does not perceive sameness and objects cannot be manipulated (i.e., the rods cut or moved) to the child's satisfaction, the task must be aborted at this point.

Action: After agreement to sameness, place an identical toy car at the beginning of each road, explaining to the child that both cars are going to start at the same time and travel at the same speed until each car reaches the end of its road. For discussion purposes, the cars may be two different colors (i.e., yellow and green).

green:



yellow:



Questions Related to Conservation: Ask the child, "If both cars start at the same time and travel at the same speed, will the yellow car reach the end of its road before, after or at the same time as the green car reaches the end of its road?"

Interpretation: At this point, merely record the child's answer.

Action: Move one of the rods so that it extends beyond the other rod. Place the cars at the beginning of the roads once more. Place the yellow car (or equivalent) at the beginning of the extended rod.

green: 

yellow: 

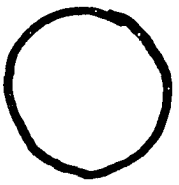
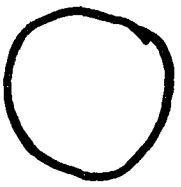
Questions Related to Conservation: Ask the child, "If both cars start at the same time and travel at the same speed, will the yellow car reach the end of its road before, after or at the same time as the green car reaches the end of its road?"

Interpretation: If the answer is "yes," the child is able to conserve length. If the answer is "no," the child is unable to conserve length.

6. TASK: Conservation of Weight

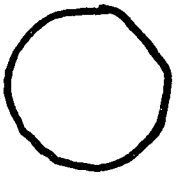
Objects Required: 1. two equal amounts of clay which differ in color

Setting: Form two proportionally equal balls of clay containing the same amount. For discussion purposes, two colors of clay (i.e., red and blue) may be used.

blue:  red: 

Agreement to Sameness: Ask if the child agrees that there is the same amount of blue clay as red clay. If the child does not perceive sameness and objects cannot be manipulated (i.e., portions of clay removed from one ball) to the child's satisfaction, the task must be aborted at this point. If the child does agree to sameness, the child should not be allowed to touch the clay again during the administering of this task.

Action: Flatten the blue clay into a "pancake" shape.

blue:  red: 

Questions Related to Conservation: Ask the child, "Is there more blue clay, less blue clay or the same amount of blue clay as there is of red clay?"

Interpretation: If the answer is "yes," the child is able to conserve weight. If the answer is "no," the child is unable to conserve weight.

1. These directions were prepared by Cecilia Faulconer and Gene Shepherd. The authors reserve all publication rights. Any use must have author's approval.

APPENDIX C

AUDITORY-VISUAL INTEGRATION TEST, INSTRUCTIONS AND TEST ITEMS

Appendix C

Instructions Used for Administering the Auditory-Visual Integration Scale

---

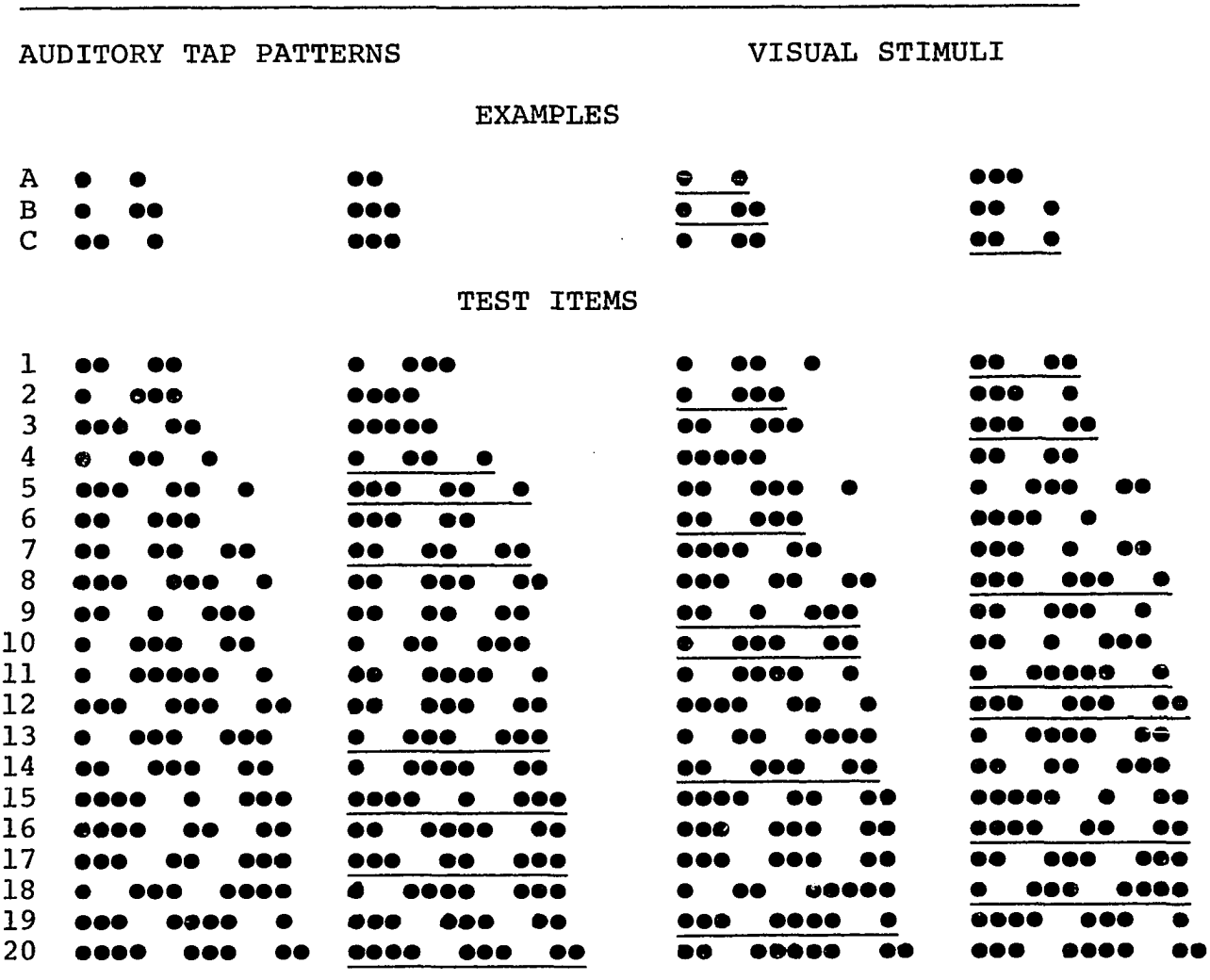
The subject and examiner will be seated at opposite sides of the examining table facing one another. The examiner will say: "I am going to tap out some patterns. Listen." Using the edge of the table and a ruler, the examiner taps out examples, a, b, and c (Appendix A) pausing from 3 to 5 seconds between examples. The examiner's arm and shoulder movements will be hidden by a cardboard screen placed in front of the subject.

The subject will then be shown the response card containing the visual dot patterns for example (a) and will be told: "Each pattern you hear is going to be like one of the three dot patterns you see here." Examiner then points to the card and says, "Let me show you. Listen!" The examiner once again taps out example (a) and then asks the subject, "Which one of these did you hear?" If the subject makes the incorrect choice, the examiner will say, "No, it's this one," and point to the correct choice. The same procedure will be followed for examples (b) and (c), except in these cases the three visual dot patterns for each item will not be exposed until after the auditory rhythm has been tapped. Following the three examples, the 20 test items will be given.

The subject will be told: "Listen carefully and pick out the dots which look like the taps you hear." Following this, the specific multiple-choice item containing the choice appropriate for the given auditory pattern will be shown to the subject. Only first choices will be accepted and no changes in response will be permitted.

APPENDIX C

Auditory-Visual Integration Test Items



APPENDIX D

RAW SCORE DATA

AUDITORY-VISUAL INTEGRATION RAW SCORES FOR THE EIGHT TEST GROUPS

Reading Achievement Level	Middle SES		Low SES	
	Male	Female	Male	Female
High	18	19	17	14
	20	16	14	19
	19	15	9	17
	17	20	14	17
	20	15	16	16
	18	16	19	20
	18	19	14	19
	18	19	14	15
	18	17	19	17
	16	20	19	15
Low	17	13	17	11
	17	12	9	15
	10	10	10	15
	14	13	7	13
	15	11	4	11
	17	8	17	13
	14	7	14	8
	19	9	12	11
	16	15	18	17
	11	8	16	14

CALIFORNIA TESTS OF BASIC SKILLS, PEABODY PICTURE VOCABULARY TEST AND AUDITORY-VISUAL INTEGRATION SCORES ON ALL MALE SUBJECTS

Subject Code	SES	CTBS (national percentiles)			PPVT IQ	A-V Integration Score
		Vocabulary	Comprehension	Total		
01	Middle	89	93	93	107	18
02	Middle	89	96	95	112	20
03	Middle	89	89	91	115	19
04	Middle	94	99	99	105	17
05	Middle	85	89	85	95	20
06	Middle	85	85	85	111	18
07	Middle	98	96	98	114	18
08	Middle	98	85	89	115	18
09	Middle	89	85	87	107	18
10	Middle	98	85	88	101	16
21	Low	94	85	88	112	17
22	Low	94	93	95	111	14
23	Low	89	85	87	95	9
24	Low	85	89	88	112	14
25	Low	87	87	86	115	16
26	Low	89	93	93	115	19
27	Low	86	96	88	114	14
28	Low	87	85	85	111	14
29	Low	94	89	93	115	19
41	Middle	13	14	12	94	17
42	Middle	9	15	12	94	17
43	Middle	11	15	15	86	10
44	Middle	11	10	9	105	14
45	Middle	9	5	6	93	15
46	Middle	6	3	3	99	17
47	Middle	9	6	7	104	14
48	Middle	11	15	15	86	19
49	Middle	15	14	15	104	16
50	Middle	15	8	10	87	11
61	Low	5	14	7	88	17
62	Low	6	3	3	105	9
63	Low	6	8	6	91	10
64	Low	15	5	10	105	7
65	Low	5	1	1	88	4
66	Low	14	4	9	105	17
67	Low	15	14	15	85	14
68	Low	8	12	8	100	12
69	Low	13	14	12	94	18
70	Low	15	5	10	97	16

CALIFORNIA TESTS OF BASIC SKILLS, PEABODY PICTURE VOCABULARY TEST AND AUDITORY-VISUAL INTEGRATION SCORES ON ALL FEMALE SUBJECTS

Subject Code	SES	CTBS (national percentiles)			PPVT IQ	A-V Integration Score
		Vocabulary	Comprehension	Total		
11	Middle	85	85	85	111	19
12	Middle	87	87	86	109	16
13	Middle	87	89	88	101	15
14	Middle	89	93	93	98	20
15	Middle	89	85	88	102	15
16	Middle	98	98	99	114	16
17	Middle	89	85	86	105	19
18	Middle	94	85	88	93	19
19	Middle	86	89	88	107	17
20	Middle	89	98	97	115	20
31	Low	85	93	85	115	14
32	Low	89	85	86	109	19
33	Low	89	93	93	111	17
34	Low	85	99	97	115	17
35	Low	89	85	86	111	16
36	Low	89	89	91	91	20
37	Low	94	98	98	111	19
38	Low	85	85	85	111	15
39	Low	86	85	85	109	17
40	Low	89	85	86	108	15
51	Middle	13	14	12	92	13
52	Middle	11	10	9	100	12
53	Middle	11	15	15	86	10
54	Middle	6	5	4	87	13
55	Middle	4	9	6	85	11
56	Middle	5	12	7	97	8
57	Middle	9	12	10	87	7
58	Middle	9	10	8	88	9
59	Middle	9	6	7	93	15
60	Middle	15	10	11	87	8
71	Low	9	12	9	114	11
72	Low	13	14	12	87	15
73	Low	15	14	15	85	15
74	Low	5	1	2	97	13
75	Low	13	5	7	89	11
76	Low	4	12	6	89	13
77	Low	6	10	7	86	8
78	Low	3	9	6	87	11
79	Low	11	14	11	86	17
80	Low	3	9	6	94	14