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ABSTRACT

Both associative and conceptual learning are presumed to be of importance in reading at all developmental levels. However, it is hypothesized in the present study that there is a stronger relationship between beginning reading and associative learning than between beginning reading and conceptual learning. Conversely, it is hypothesized that there is a stronger relationship between later reading and conceptual learning than between later reading and associative learning. A total of 108 subjects from Grades 2, 4, and 6 were used in the study. An equal representation of good, average, and poor readers at each grade level and for both sexes was obtained. The essential findings of the study were that there is no significant difference between the performances of good, average, and poor readers on (1) an associative learning task at the first grade level; (2) an associative conceptual learning task at the fourth grade level; nor (3) a learning task at the sixth grade level. Finally, there is no significant difference between the performance of boys and girls on associative and conceptual learning tasks. (Author/JH)

Technical Report No. 217

APPLICATION OF JENSEN'S BIDIMENSIONAL MODEL OF LEARNING TO THE READING PROCESS

Report from the Project on Individually Guided Instruction in Elementary Reading in Program 2

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Statement of Focus

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Individually Guided Instruction in Elementary Reading Project in Program 2. General objectives of the Program are to establish rationale and strategy for developing instructional systems to identify sequences of concepts and cognitive skills, to identify or develop instructional materials associated with the concepts and cognitive skills, and to generate new knowledge about instructional procedures. Contributing to these Program objectives, the Reading Project staff, in cooperation with area teachers, prepared a scope and sequence statement of reading skills for the elementary school as a first step in the development of an instructional program. From this outline, assessment procedures and group placement tests have been developed, and existing instructional materials have been keyed to the outline. Research is conducted to refine the program and to generate new knowledge which will be incorporated into the system.

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ABSTRACT

Associative learning and conceptual learning, the two basic processes postulated in Jensen's model, are believed to be cognitive behaviors of importance to the reading process. Some researchers have attempted to explain reading as the process of both associating symbolic stimuli of one perceptual mode with symbolic stimuli of another perceptual mode. Others have stressed the relationship of conceptual factors to reading.

Both associative and conceptual learning are presumed to be of importance in reading at all developmental levels. However, it is hypothesized in the present study that there is a stronger relationship between beginning reading and Level I (associative) learning than between beginning reading and Level II (conceptual) learning. Conversely, it is hypothesized that there is a stronger relationship between later reading and Level II (conceptual) learning than between later reading and Level I (associative) learning.

A total of 108 subjects were used in the study, with 36 children from each of grades 2, 4, and 6. Within each grade 18 boys and 18 girls participated. an equal representation of good, average, and poor readers at each grade level and for both sexes was obtained. Reading ability, grade level, and sex of the subjects were the independent variables in the study.

The dependent variables in the study were the total number of correct responses on the Level I (associative) and Level II (conceptual) learning tasks. Each subject was administered both learning tasks. The order of presentation of the tasks was counterbalanced to control for the effects of

the order of presenting the learning tasks to the subjects.

The data were analyzed by analysis of variance. The essential findings of the study were that there is (a) no significant difference between the performances of good, average, and poor readers on a Level I (associative) learning task at the first grade level; (b) no significant difference between the performance of good, average, and poor readers on a Level I(associative) and Level II (conceptual) learning task at the fourth grade level; (c) no significant difference between the performances of good, average, and poor readers on a Level II (conceptual) learning task at the sixth grade level; (d) no significant difference between the performance of boys and girls on Level I (associative) and Level II (conceptual) learning tasks.

Chapter I

REVIEW OF THE LITERATURE

Introduction

The reading process *per se* has been the subject of little rigorous empirical investigation. Although there has been a myriad of studies in reading, most have focused on the comparison of two or more teaching methods (Levin, 1966); few studies have focused attention on the psychological processes involved in reading which appear to differentiate good and poor readers. Little is understood about the intrinsic individual differences, operationalized in psychological terms, that account for the observed differences in performance on a standardized test of reading ability. Intrinsic individual differences, as opposed to extrinsic individual differences, are those which are inherent in learning and cannot be identified independent of the learning process. Extrinsic individual differences can be identified independent of the learning process (Jensen, 1967). Individual differences in performance are explained in terms of deficient "intellectual," "word attack," or "comprehension" abilities. As helpful as this may be to the teacher or parent, these global constructs contribute little to understanding the psychological processes involved in reading.

Most psychological-process research in reading in the past has used the paired-associate verbal learning paradigm. The earliest investigation of the relationship between paired associate learning and reading ability was conducted by Arthur Gates in 1930. Gates devised four tests to measure a combination of associative capacity and acquired techniques in learning. Gates' four tests of association can be briefly described here:

(1) Visual - Visual Symbols. Test A1.

Ten cards, each displaying a line drawing of a familiar object and a geometric figure. The subject is shown the geometric figure and asked to name the object that has been presented with it in the line drawing.

(2) Test A2.

Ten cards, each displaying a line drawing of a familiar object and a more complex symbol, like a four letter word in a foreign language. Procedure is the same as in A1.

(3) Auditory - Visual Symbols. Test B1.

Ten cards, each displaying a whimsical visual figure which is presented while a word (i.e., man, dog, etc.) is enunciated. The subject is shown the figure and is asked to give the word that was associated with it.

(4) Test B2.

Ten cards, each displaying a word-like figure to be associated with a spoken word (i.e., nut, top, etc.). Procedure is the same as in B1. (Gates, 1935)

Using Gates' four tests of association, the Word Learning section of the Van Wagenen Reading Readiness Test (the subject hears and learns the English word for each of 5 foreign words printed on cards), and the Verbal Opposites of the Detroit Tests of Learning Aptitude (a list of 96 words, arranged in order of difficulty, for which the subject supplied appropriate antonyms), Stauffer investigated the performance of poor readers on associative and memory span tests. Raymond (1955) did a companion study to that done by Stauffer. She investigated the performance of fifty male readers, all achieving in reading at least two years in advance of their mental age expectancy as measured by tests of associative learning and memory span. Following the work of Raymond in 1955, no investigations of the relationship of paired associate learning and reading ability were made until 1961. At that time, Otto found that there were significant differences in the number of trials required by good, average, and poor readers to master a paired associate list, with the number of trials to criterion decreasing in the order good, average, poor.

The present research seeks to go beyond the limitation of the associative model of learning implicit in paired associate learning tasks by investigating the applicability of Arthur Jensen's bidimensional model of learning to the reading process. In place of a uniprocess association model of learning, Jensen postulates <u>two</u> genotypically distinct basic processes underlying the learning process. These basic processes are (a) Level I (associative) and (b) Level II (conceptual) learning. Level I learning is the neural registration and consolidation of stimulus inputs and the formation of associations.

Since there is little transformation of the input, there is a high correspondence between the forms of the stimulus input and the form of the response output. Level II learning involves a self-initiated elaboration and transformation of the stimulus input before it results in an overt response. Utilizing Jensen's bidimensional model of learning, this experimenter will investigate the learning patterns of good, average, and poor readers of average intelligence at grades two, four, and six.

Associative Learning and Reading

Reading is a skill rather than a body of curricular content (Levin, 1966). To be more precise, reading comprises component cognitive skills; i.e., skills which are associated in one way or another with language, thinking, or information processing (Venezky, Calfee and Chapman, 1968). To Levin, the development of a curriculum for acquiring this skill is different from the construction of a curriculum in history or English. Content areas such as these, which possess a certain circumscribed body of knowledge, require that curriculum experts and researchers decide what information is to be presented and the optimal method of presentation. In teaching children to read, educators have no information to present, *per se*, but they must devise exercises and materials for the most efficient development of a complex perceptual and cognitive skill (Levin, 1968).

To the disappointment and frustration of many reading researchers, curriculum specialists, and teachers there is no taxonomy of the cognitive behaviors necessary for the development of reading proficiency. Calfee, Venezsky, and Chapman (1968) have proposed a preliminary analysis of skills which most reading researchers would agree are necessary to the mastery of beginning reading. These include: (a) the ability to follow directions and carry out various tasks, (b) oral language skills, and (c) the acquisition of letter-sound relationships. Under the rubric of letter-sound relationships, attention is focused upon decoding skills and pronunciation strategies.

Pronunciation strategies are the approaches individuals utilize to pronounce unfamiliar words; decoding skills are the requisite skills essential for the acquisition of the letter-sound code. Linguists such as Leonard Bloomfield, Clarence Barnhart, and Charles Fries, along with reading researchers such as Frank Wilson and C. W. Flemming (1938) were among the first theoreticians to examine the relationship of letters and their sound values to reading performance. Bloomfield and Barnhart (1961) regarded decoding skills as being of utmost importance in reading languages with alphabetic writing systems, i.e., writing systems in which each letter represents a unit speech sound or phoneme, so that the way of writing a word is related to the speech sounds which make up that word. To read alphabetic writing systems, the individual must associate the phonemes of one's language with the written marks (graphemes) which represent these phonemes. The accomplished reader of English, according to Bloomfield and Barnhart, "...had an overpracticed and ingrained habit of producing the phonemes of one's language when one sees the written marks which conventionally represent these phonemes." (1961, p. 26) Bloomfield and Barnhart recognize that English writing or orthography, although alphabetic, is not entirely so. Many examples of this lack of grapheme/phoneme correspondence exist in the English language. The letter c, as an example, corresponds to /s/ when it occurs before e, i, or y plus a consonant; in most other positions it corresponds to /k/. The spelling k is silent in initial positions before e, i, or y plus a consonant; in most other positions it corresponds to /k/. Initial gh always corresponds to /g/ as in ghost, ghoul, but gh in final and medial positions have other pronunciations besides /g/, for example, though and enough.

Fries (1962) considered the process of learning to read in one's native language as a transfer from language signals represented by auditory patterns to identical language signals represented by patterns of graphic shapes. To Fries, this process of transfer is not the learning of a new language code, new "words", new meanings or new grammatical structures. It is the process of associating auditory signs for language signals already learned and visual signs for these same language symbols which are unknown.

Fries, Bloomfield, and Barnhart were not the only theoreticians who explained reading as the process of associating symbolic stimuli of one perceptual mode with symbolic stimuli of another perceptual mode. Anderson and Dearborn (1952) described the reading process as a simple associative learning process where the association is "...between the sight of the word and the child's responses to the sound of it" (p. 138).

Other reading researchers (Gates, 1930; Stauffer, 1948; Raymond, 1955; Otto, 1961; and Giebink, 1968) utilizing the paired-associate verbal learning paradigm have investigated the relationship between paired associate learning and reading ability. The earliest investigation was conducted by Arthur Gates in 1930. Gates devised four tests to measure associative learning and reading ability. Gates' conclusions were:

> Other things being equal, a poor showing in these tests does indicate a handicap for an important phase of reading, namely, the task of learning words (p. 448).

Using Gates' test of association, Stauffer (1948) investigated the performance of poor readers on associative learning and memory span tests. He worked with 51 male subjects between 9.0 and 11.0 chronological age with scores above 90 on the Revised Stanford-Binet and very retarded in reading. He concluded with four specific observations that pertained to the assumption that retarded readers tend to make relatively low scores on tests involving the use of visual, auditory and voco-motor associations.

Raymond (1955) did a companion study to that one done by Stauffer. She investigated the performance of reading achievers on associative learning and memory span tests. She worked with 50 male subjects between 9.0 and 11.0 chronological age, with Kuhlman-Anderson I.Q.'s between 90 and 110, and a reading score at least two years in advance of mental age expectancy. Raymond used three tests used by Stauffer (taken from Gates) to investigate associative learning. She concluded that reading achievers make superior scores on tests employing visual, auditory, and voco-motor association.

Otto (1961) found that there were significant differences in the number of trials required by good, average, and poor readers to master a paired-associate list. Otto devised an associative learning task which was used with 108 subjects selected from a population of 2900 elementary school children. The subjects met the following criteria: (1) group I.Q. scores between 95 and 110; (2) reading test scores falling in one of three specified categories denoted as good, average or poor; (3) grade placement at grade 2, 4, or 6; and chronological age in the normal range for grade level. The subjects were required to match a common geometric form and a consonant-vowel-consonant trigram (fep, miv, wuc, yad, gox). The trigrams were taken from the Archer list (1960).

The subjects were told they were to learn a new name for the geometric forms. After a period of pre-training, each geometric form was presented for 4 seconds, followed by a 4 second rest. After two trials each trigram was produced individually and the subject was asked to tell the experimenter what geometric form the CVC trigram represented. Otto found that good, average, and poor readers - in that order - require increasing more trials to master a list of paired-associates.

Giebink (1968) selected twelve boys and twelve girls from the total population of each of the first three grades of a semi-rural community school system to constitute a sample of 72 subjects. Sex, intelligence, and visuo-motor ability were controlled in assigning subjects to the treatment groups. As in the Otto study, the subjects were required to pair oral responses to visual stimuli. Giebink concluded:

> Subject to the limitation of sampling only two particular kinds of a multitude of possible paired associate tasks, the hypothesis that there is a relationship between general associative ability and reading ability was supported (p. 418)

Knowledge of Letter and/or Letter-Sound Relationships and Reading Achievement

Chall (1967), while not specifically labeling beginning reading as an associative process, reviewed 17 studies that related knowledge of the letters and/or of letter-sound relationships and reading achievement. Eleven of these 17 studies (Wilson et al., 1938, Wilson and Fleming, 1938, Gates et al., 1939, Durrell and Murphy, 1953, Rudisill, 1957, Nicholson, 1958, Olson, 1958, Gavel, 1958, Chall, 1958, Feuers, 1961, and Weiner and Feldmann, 1963) were predictive studies relating pupils' knowledge of letters and/or letter-sound relationships and reading achievement. The findings of these studies indicates that at the early stages of reading - grades 1, 2, and 3 - the relationship between letter and/or phonics knowledge are quite high (correlations range from .3 to .9). Chall's (1958) study of second grade subjects taught beginning reading with a sight meaning emphasis coupled with moderate phonics yielded correlations of .91 between phonics knowledge and oral reading as measured by the Gray Oral Paragraphs Test, .90 between phonics knowledge and spelling as measured by the Metropolitan Reading Test, .71 between phonics knowledge and reading as measured by the Metropolitan Reading Test, and .92 between phonics knowledge and silent reading as measured by the New York Test of Growth in Reading. Cognizant of the hazards or drawing conclusions from seventeen studies conducted by different researchers over a twenty-five year period, Chall delineated five conclusions. In light of the scope of the present study, the most important of her conclusions is the postulation of a substantial relationship in the primary grades between letter and/or phonics knowledge and reading achievement regardless of whether the initial teaching emphasizes decoding or meaning. Chall concludes:

> In the primary grades, letter and/or phonics knowledge appears to have a greater influence on reading achievement than mental ability (MA, IQ, or language measures similar to those used on general intelligence tests). Almost every study that correlated letter and/or phonics knowledge and mental ability with reading achievement reported higher correlations for letter and/or phonics knowledge. Even when IQ was held constant, a significant relationship between letter and/or phonics knowledge and reading achievement was reported (p. 150).

A study by Calfee, Venezsky and Chapman (1967) completed after Chall's review was published yields further evidence regarding the positive relationship between knowledge of letter-sound correspondence (or "LSC patterns") and reading ability. Calfee, Venezsky, and Chapman presented a list of 40 synthetic words covering a variety of predictable spelling patterns to third, sixth, eleventh and twelfth graders, and to college students. The subjects were required to pronounce wach word as it was presented by slide projector. Responses were recorded and a phonetic transcription made of each response. It was found that good readers made more consistent and more appropriate responses to the synthetic words than poor readers. Third graders' performances of the pronunciation task was more closely related to reading achievement than was I.Q.

Stages of Reading Development

In the past two decades there has emerged in reading research, educational psychology, and linguistics the theory that there is a distinction between beginning and later reading in more than such nebulous constructs as "purpose", "emphasis" or the number of "concepts" to which the reader is exposed. Historically, reading has been viewed as a complex process involving the meaningful response to verbal symbols. The goal of beginning reading was the obtaining of meaning from the printed page. William S. Gray wrote in 1937:

> A broader view of the nature of reading is that it involves the recognition of the important elements of meaning in their essential relations, including accuracy and thoroughness in comprehension. This definition, while implying a thorough mastery of word recognition, attaches major importance to thought-getting (p. 26).

Soffietti (1955) criticizes Gray's and other "meaning" emphasis definitions as incomplete in that they stress "meaning," the ultimate goal of reading, to the exclusion of the mechanics reading involves. He suggests that such definitions are not operational definitions, and that, therefore, they have little value as working definitions from which to develop a methodology (p. 77).

Chall's (1967) interviews with twenty-five proponents of different beginning reading approaches indicate that researchers, authors, and editors view beginning and later reading as basically similar processes. The basal reader and language experience proponents were most adamant, admitting that if any difference existed it was only in the number of concepts understood. Six of the nine proponents of a phonics approach to beginning reading also said there is no basic difference between beginning and mature reading; only two said there was a definite difference.

Recent research would appear to cast doubt on the belief that there is no difference between beginning and later reading. The research of Holmes and Singer (1961) and Singer (1962) support the hypothesis that children draw upon different skills in reading at different levels and that a knowledge of sound-letter relationships facilitates beginning reading, which contributes to a more rapid progression to the later stages. Singer's work indicates that the factors underlying power and speed of reading change between the fourth grade and the high school level. Chall's (1967) summary of the Holmes and Singer research concludes that at the fourth grade level more auditory word recognition (phonetic association) is involved in reading, while conceptual and visual factors play the more important role at high school level. Holmes and Singer (1961), although finding an auditory word recognition factor among high school students, indicate this is of much less importance than at fourth grade.

Following Holmes and Singer's line of research, but utilizing Jensen's bidimensional model of learning, this researcher will examine the notion that associative learning, as measured by Jensen's Level I learning task, is more significantly related to the acquistion of early reading skills than to their subsequent elaboration, i.e., the development of comprehension and interpretive skills, and that conceptual learning, as measured by Jensen's Level II learning task, is more related to the elaborated reading skills called upon in later reading than to the acquisition of early reading skills.

Digit Memory and Reading Ability

Assuming Jensen's hypothesis that digit memory tasks are "pure" tests of associative learning (Jensen, 1969), the relationship between associative learning, i.e., digit memory, auditory memory span, or the retention of temporal order -- depending upon the nomenclature used by the researcher -- and reading ability is inconclusive.

Generally, researchers have utilized the Auditory Memory Span Test of the Stanford-Binet or the test od Digit Span from the Wechsler Intelligence Scale for Children. Although it is desirable that all research on the same question yield the same results, the research on auditory memory span and its relationship to reading ability reveals a surprising lack of consistency. Research recently completed by Huelsman (1970) demonstrates this lack of consistent research findings. In a review of 20 studies investigating the low and high subtests characteristic of disabled readers, Huelsman reports that 12 of the 20 studies indicate that low scores on digit span tests were characteristic of poor readers. None of the 20 studies indicate that low digit span scores were characteristic of good readers. Huelsman suggested eight reasons that could account for lack of consistency in studies that yield themselves to pattern analysis.

(1) There has been serious disagreement in defining reading disability.

(2) Some of the studies were limited to boys, and there may be a sex difference in subtest patterning on the WISC.

(3) Some investigators selected subjects from their own clinic populations, and these samples vary from clinic to clinic,

probably depending upon both clients' socio-economic level and the amount of the fees assessed the client.

(4) Age differences appear to be important in influencing the performance of subjects on the WISC subtests, and subjects' ages range widely in some studies.

(5) Some researchers compared their subject's mean scores with those of the standardized sample without adjusting for general IQ differences.

(6) The number of subjects varied considerably from study to study; e.g., Sheldon and Garton (1959) studied a sample of seven subjects while Birch and Belmont (1966) studied 150 subjects.

It would appear from Huelsman's review that a positive relationship exists between associative ability and reading ability. Since there is a wide range of scores represented in the studies he reviewed, no attempt was made to investigate the changes in this relationship, if such changes exist, from first grade to sixth grade. This investigator hypothesizes that there is a stronger relationship between associative learning ability (Level I learning) and reading ability at grade 2 than at grade 6.

Conceptual Learning and Reading

The postion that reading is a skill that draws upon conceptual learning factors has long been taken by reading researchers and educational psychologists. Thorndike (1917) was one of the first educational psychologists to equate reading with reasoning:

> ...reading is a very elaborate procedure, involving a weighing of each of many elements in a sentence, their organization in the proper relations one to another, the selection of certain of their connotations and the rejection of others, and the cooperation of many forces to determine final response (p. 323).

Stauffer (1969) has assembled the most cogent review of the interrelationship of the thinking and reading process extrapolated from the writings of different authorities representing different schools of thought. He delineates four aspects related to both thinking and to intelligent, mature reading: declaring purposes, reasoning, judging and refining and extending ideas, and concludes that these three steps are similar to problem-solving behavior observed by the psychologist Vinacke. Stauffer quotes Vinacke as saying that problem solving consists of the following processes:

> ...apprehension or recognition of the problem, together with effort to deal with it; some manipulation or exploration of the situation; some degree of control, or direction, or performance; the understanding or mastery of intermediate requirements or steps; and emotional responses representing some degree of personal involvement in the situation (p. 23).

Braun (1963) investigated the relationship between performance on a concept formation test developed by Reed (1957) and reading achievement of 50 boys at the third and fifth grade levels and 39 boys at seventh grade level selected at random from the Oak Park (Michigan) Public Schools. The Reed materials included 20 concepts, with six stimulus cards per concept. Four words were typed in a horizontal line on each of the 3 x 5 cards and included one word that had something in common with one word on each of the other cards. After seeing each card in succession and having it read to him the subject was asked to tell what the concept was that appeared on every card. The cards were read to the subject a second time, if necessary. All words utilized in the test were in the vocabulary of the subjects as was determined by referring to the frequency level reported by Thorndike and Lorge in The Teacher's Word Book of 30,000 Words. The subjects were permitted to ask the meaning of any word in the test whose meaning was not familiar to him. Reading achievement was determined at the third grade level by performance on the Gates Advanced Primary Reading Test and at fifth and seventh grade level by performance on the comprehension section of the Gates Reading Survey. Braun's conclusions were that (a) there is a positive relation between concept formation ability and reading ability in third, fifth, and seventh grade boys; (b) the magnitude of the relation between concept formation and reading is greater than between reading and intelligence; (c) overachievers in reading perform significantly better on a test of concept formation than under-achievers in reading; (d) the relationship between reading and concept formation is much higher at seventh grade than at third grade. The last finding is in accord with Reed's (1957) finding that higher level abstractions, as measured by a concept formation test, are more necessary for success in later reading than in primary reading. In later reading the reader must integrate a series of concepts in order to abstract the main idea, and he must be able to make meaningful inferences not explicitly stated in the material he reads.

Conceptual learning is presumed to be of importance in reading at all levels. In the present study, however, it is hypothesized that there is a stronger relationship between conceptual learning ability (Level II learning) and reading ability in later reading (i.e., at the sixth grade level), when cognitive dimensions of reading such as inferential comprehension and evaluation are called upon, than in beginning reading.

The Raven's Progressive Matrices and Reading Ability

In Jensen's bidimensional model of learning the Raven's Progressive Matrices (Raven 1957) was used to measure Level II (conceptual learning). The Progressive Matrices Test, not widely known or used in the United States, consists of 60 perceptually presented problems. Each problem consists of a design or "matrix" from which a part has been removed. The examinee is asked to decide which of the available options correctly completes the matrix. For normal subjects over 8 years old, the matrices in Sets A, B, C, D, and E are drawn in black and white.

In 1947 (Raven, 1947) sets A, Ab, and B of the Coloured Progessive Matrices were constructed. The Coloured Progressive Matrices was utilized in the Jensen bidimensional model of learning to measure Level II learning. The revised construction of the Coloured Progressive Matrices gave, for children of 5 to 11 years of age, a wider dispersion of scores and reduced the frequency of chance solutions. To attract and hold the subject's attention, each problem is printed on a brightly colored background. The use of color makes the nature of the problem more obvious without in any way contributing to its solution (Burke, 1958).

The Coloured Progressive Matrices has been utilized as an indicator of brain damage (Dils, 1960), and as a tool for evaluating the intelligence of deaf children (Oleron, 1952), cerebral palsied children (Taibil, 1952), and mentally retarded children (Stacey and Gill, 1955). At the present time there have been no published investigations of the relationship between reading achievement and performance on the Coloured Progressive Matrices.

Hypotheses Tested

The basic purpose of this study is to investigate the applicability of Jensen's Level I (associative) and Level II (conceptual) bidimensional model of learning to the reading process. Jensen's model, originally developed to explain intrinsic individual differences in the actual processes of learning of children from various socio-economic classes, has never been applied to the reading process, at least as indicated in the published literature.

Jensen's bidimensional model of learning developed from his investigations of the learning abilities of low socio-economic status, or culturally disadvantaged, children and middle and upper middle class children of Mexican-American, Negro and Caucasian parentage (Jensen, 1961; 1966; 1967-1968 (a); and 1968 (b). A discussion of the evolution of this model is presented in two articles published in 1968 (Jensen, 1968c, 1968d). Jensen's conclusions about the interaction of environmental and hereditary factors and learning ability, socio-economic class and learning, and the supposed failure of compensatory education were presented in the Spring, 1969, <u>Harvard</u>

Education Review (Jensen, 1969). Since the focus of the present study is upon the application of Jensen's model to reading, its special use in investigating socio-economic class differences in learning will not be reviewed.

Because of the recency of Jensen's bidimensional model of learning, there is no published research investigating the ability patterns of good, average, and poor readers on Jensen's Level I and Level II learning tasks. Studies investigating the associative ability of good, average, and poor readers have been made utilizing a paired-associate paradigm, a form of associative learning not as "pure" as digit memory according to Jensen (1969, p. 111). The Experimenter will use Jensen's bidimensional model of learning, which comprises a digit memory task to measure Level I (associative) learning and the Raven's Coloured Progressive Matrices to measure Level II (conceptual) learning, in testing the following hypotheses:

(1) There will be a positive relationship between the reading ability of second graders and their performance on a Level I (associative) learning task.

(2) There will be no relationship between the reading ability of fourth and sixth graders and their performance on a Level I (associative) learning task.

(3) There will be no relationship between the reading ability of second and fourth graders and their performance on a Level II (conceptual) learning task.

(4) There will be a positive relationship between reading ability of sixth graders and their performance on a Level II (conceptual) learning task.

(5) There will be no significant difference between the performance of boys and girls on the Level I (associative) or Level II (conceptual) learning tasks.

Chapter II

METHOD

In Chapter I various hypotheses related to reading achievement and Level I (associative) and Level II (conceptual) learning were stated. In the following sections the method by which these hypotheses were tested is described.

Subjects

Thirty-six children from each of Grades 2, 4, and 6 were tested in the experiment. Within each grade 18 boys and 18 girls participated. An equal representation of good, average, and poor readers at each grade level and for both sexes was obtained.

Background

Subjects were chosen from three schools located in or near Madison, Wisconsin. All second grade subjects were selected from the total second grade enrollment of the only elementary school in a small, semi-rural community located 20 miles from Madison, and a public elementary school in Madison. The fourth grade subjects were taken from the same two elementary schools. The sixth grade subjects were selected from the total sixth grade enrollment of the only middle-school in the earlier mentioned semi-rural community and a parochial elementary school in Madison. The combined enrollment of the three schools is about 1800. There appeared to be no marked contrasts in such factors as cultural background, national origin, and income between the populations served by the three schools supplying subjects for the experiment. In all, 108 subjects served in the experiment. All subjects were tested between February 15 and May 15, 1970.

Intelligence

An attempt was made to hold the intellectual capacity of the subjects within the average range by eliminating high and low deviant scores. With this in mind, only children with a SRA Primary Mental Abilities Test I.Q. score between 90 and 115 were considered for selection as subjects. A majority of the subjects was administered the Primary Mental Abilities Test (PMA) in October, 1970. These tests were administered as part of the regular school program. Two second graders, twelve fourth graders, and nine sixth graders were administered the PMA in April, 1970. These subjects were administered the PMA at this time because they had been given group intelligence tests other than the PMA as part of their regular school program.

Reading Level

The children who met the I.Q. criterion were further divided into three reading levels: good, average, and poor. The determination of reading level was based upon performance on the Stanford Achievement Test. The placement of the second and fourth graders was determined by their performance on the Word Meaning, Word Study and Paragraph Meaning subtests; sixth graders by their performance on the Word Study and Paragraph Meaning subtests. Raw scores on these subtests were converted into stanine equivalents, which divide the distributions into nine subdivisions of approximately equal range. Thus, operationally defined, good readers were those subjects whose average performance on the above mentioned subtests placed them in the seventh, eighth, or ninth stanine; average readers had scores which fell in the fifth stanine; and poor readers had scores which fell in the first, second, or third stanine. Children whose average score fell in the fourth or sixth stanine were eliminated as potential subjects to avoid overlap between the good and poor readers. The Stanford Achievement Test was administered as a part of the regular school testing. A second estimate of the subjects' reading achievement was obtained by asking the subjects' teachers to evaluate reading performance as good, average, or poor on the basis of past teaching experience. Prospective subjects were eliminated if teacher evaluation was not congruent with Stanford Achievement placement. For example, a child designated as an "average" reader by his performance on the Stanford Achievement Test would be eliminated as a potential subject if his teacher evaluated his reading performance as "good" or "poor."

Grade Level

An equal number of second, fourth and sixth grade subjects was included in the study. A second grade group was selected on the assumption that associative factors play an important role in reading success at this level, and a sixth grade group was selected on the assumption that conceptual factors play the pronounced role at this grade level. The fourth grade group was included to achieve a degree of developmental continuity.

Age

As of September 1, 1969, the chronological age of the subjects was restricted to the following range for each grade level: (1) Grade 2: age 6-10 to 7-10; (2) Grade 4: age 8-10 to 9-10; (3) Grade 6: age 10-10 to 11-10. This control was implemented to eliminate subjects whose chronological age was not in the normal range for grade level.

Task

Level I (associative) learning was tested by the administration of Jensen's Listening-Attention Test and Memory for Numbers Test. Both of these tests were presented by tape recording. The tape, prepared by Jensen and his associates, contained all instructions and exercises for the Listening-Attention Test and Memory for Numbers Test. The Listening-Attention Test was administered before the Memory for Numbers Test.

On the Listening-Attention Test the child listens as the reader reads a number and places an "X" on that number on a test booklet before him. The test form comprised 10 columns of numbers with each column containing 10 pairs of numbers (see Appendix C). This test was utilized to exclude from the sample those subjects who were not attending to or who were experiencing difficulty hearing the recorded test. Five second graders who did not achieve 100% accuracy on the test were eliminated as potential subjects. All other subjects achieved 100% accuracy on the test. These high scores can perhaps be attributed to the fact that subjects were closely monitored by the experimenter and his assistant.

The Memory for Numbers Test contains three components: standard digit recall, as in the Wechsler Intelligence Scale for Children, the

Wechsler Adult Intelligence Scale, or the Stanford-Binet; repeated digit recall, in which the subjects hear the digits repeated three times before they are asked to write the sequence of digits heard; delayed digits, in which the subjects wait 10 seconds to record the digits presented to them. In each of these three components of the Memory for Numbers Test one digit is spoken per second, and there is a ceiling of 9 digits. Three sample exercises preceded each of the three components of the Memory for Numbers Test. The subjects recorded their responses on Xeroxed copies of the test booklets developed by Jensen. The tests were scored according to the system used by Jensen in his own research utilizing this paradigm. Only digits recalled by the subjects in correct position are scored. For example, a four digit series of 1-2-3-4 recalled as 1-2-4-3 was scored 2. Each component has a possible 39 items. There is a total of 117 items on the Memory for Numbers Test. Each item is given a score of one. A sample of the procedure used to score the Memory for Numbers Test is presented in Appendix D.

As on the digit memory tasks, the Coloured Progressive Matrices were presented to small groups of subjects and proctored by both the experimenter and an assistant. The 1962 (Ravens, 1962) printing of Sets A, Ab, and B of the Matrices was used in all testing. Each set is comprised of 12 matrices of increasing difficulty. There is a total of 36 matrices in the test. Each matrix is given a score of one. Since there are no sample matrices in the test booklet, the experimenter constructed two sample matrices to serve as examples of the types of items appearing in the Coloured Progressive Matrices. Reproductions of these two matrices appear in the Appendix. Instructions were adapted from the Guide to Using the Coloured Progressive Matrices. (For the complete set of instructions see Appendix A).

Procedure

Each subject was administered both the test of Level I (associative) and Level II (conceptual) learning. Two controls were placed on the administration of these tasks. First, to control for the effects of the order of presenting the learning tasks to the subjects, the order of presentation of the tasks was counterbalanced. An equal number of randomly selected second, fourth, and sixth graders at each of the three levels of reading ability was presented the Level II learning tasks first while the other half was administered the Level I task first. Subjects within each grade level were randomly placed in test groups. Second, to control for the possibility of diurnal differences in learning all subjects were administered the learning tasks between 9:00 A.M. and 11:30 A.M. Forty-eight hours separated all testing sessions. If the Level I learning task was administered on a Monday, the Level II task was administered the following Wednesday.

Subjects were tested in an isolated room within each school building. The modal size of the second grade groups was six children; fourth and sixth grade groups were larger with no group larger than ten. During the testing sessions, the subjects were seated around a large table with the experimenter and his assistant at both ends. All subjects were told that the experimenter was interested in how boys and girls in their grade learn. The children were then given the test instructions. Instructions for the Level I learning task were presented on a tape prepared by Jensen and his associates. Level II instructions were presented orally by the experimenter; and two experimenter-developed matrices drawn on 24" x 18" paperboard were shown to the subjects. Instructions were given to the subjects as to what they were required to do to complete the matrix correctly. (See Appendix A for instructions).

The children were cautioned before testing not to give away their answer by saying the digits in the Level I task or the number of the correct matrix in the Level II task. Subjects were reminded to keep their answer sheets covered.

To insure that the second grade subjects did not lose their places on the Level II learning task, all subjects progressed through the Coloured Matrices together; i.e., the experimenter waited until all subjects had finished matrix A1 before giving them instructions to progress to matrix A2. The subjects were continually monitored to insure that no one had lost his place. Fourth and sixth graders were instructed to work at their own speed. No limits were placed upon the time the subjects had to complete the task. Upon finishing, each subject raised his hand, his test was collected, and he was permitted to leave the testing room quietly.

Summary

One hundred and eight subjects, chosen from a total population of about 900 second, fourth, and sixth graders in three elementary schools, served in the experiment. All subjects used in the study met the following criteria:

(1) An IQ score of between 90 and 115 on the SRA Primary Mental Abilities Test;

(2) Stanford Achievement scores falling in one of three specified categories denoted good, average, or poor;

(3) Grade placement at grades 2, 4, and 6;

(4) Chronological age in the normal range for grade level;

(5) Teacher corroboration of the subjects' reading performance on the Stanford Achievement Test.

A sample of subjects containing an equal representation of good, average, and poor readers at each grade level and for both sexes was administered the tests of Level I and Level II learning posited in Jensen's bidimensional model of learning.

Chapter III

RESULTS AND DISCUSSION

As was indicated in Chapter II, two measures were utilized to analyze the Level I (associative) and Level II (conceptual) learning ability of a sample of good, average, and poor readers, boys and girls, at the second, fourth, and sixth grade level. Level I (associative) and Level II (conceptual) learning were the dependent variables under consideration; reading ability, grade level and sex were the independent variables. The analysis was performed by the program NYBUL, Version IV (Finn, 1968) on a Univac 1108 computer. It was pointed out in Chapter II that an attempt was made to hold intelligence within the average range by drawing subjects from a pool of children having Primary Mental Ability I.Q. scores in the range of 90 to 115. To determine if the between group differences to be demonstrated are not due to between group differences in intelligence as measured by the PMA an analysis of variance of the differences between I.Q. for each group was performed. Table 1 presents mean I.Q. scores for each of the three main independent variables: reading level, grade level and sex. Table 2 presents an analysis of variance of the differences between I.Q. means for each group. This analysis of variance of I.Q., reading level, grade level and sex indicates a significant difference in I.Q. over the three reading ability levels.

Table 1

Mean Primary Mental Abilities I.Q.

Reading Level			Grade Level			Sex	
Good	Average	Poor	Second	Fourth	Sixth	Boys	Girls
107.11	104.09	102.69	104.28	104.72	104.88	104.53	104.73

Table 2

Analysis of Variance by I.Q., Reading Level, Grade Level and Sex of Subject

Source	MS	df	F-ratio	P <
Grade	0.5278	2	0.0094	.9906
Sex	11.3426	1	0.2030	.6534
Reading Level	180.7529	2	3.2351	.0440*
Grade x Sex	51.5245	2	0.9222	.4014
Reading x Grade	130.1797	4	2.33	.0620
Reading x Sex	2.1004	2	0.0376	.9632
Reading x Grade x Sex	35.6399	4	0.6379	.6369
Error (within cell)	55.872057	90	-	-

* $p < .05$

To test the five hypotheses, the sums and differences of the subjects' performance on a Level I (associative) and Level II (conceptual) learning task and the three main variables of reading level, grade level, and sex were analyzed. This analysis is presented in Tables 3 and 4. The analysis of variance of the sum and difference seeks to discern if a difference in direction in performance on the two learning tasks is statistically significant across grade level, ability level, and sex. These analyses test all five hypotheses simultaneously.

Table 3

Analysis of Variance of Sum of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks

Source	MS	df	F	P
Grade	14168.0647	2	49.84	.0001
Sex	41.5648	1	0.15	.70
Reading	118.8756	2	0.42	.66
Grade x Sex	175.6897	2	0.62	.55
Grade x Reading	357.4543	4	1.26	.29
Reading x Sex	127.7310	2	0.45	.64
Reading x Sex x Grade	508.3783	4	1.79	.14
Error Variance	284.2619	90		

Table 4

Analysis of Variance of Differences of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks

Source	MS	df	F	P
Grade	4866.2870	2	20.83	.0001
Sex	222.4537	1	0.95	.33
Reading	38.3362	2	0.16	.85
Grade x Sex	49.7658	2	0.21	.37
Grade x Reading	73.3031	4	0.31	.87
Reading x Sex	234.0676	2	1.00	.37
Reading x Sex x Grade	337.2814	4	1.44	.23
Error Variance	233.6735	90		

The analyses of variance of the difference is utilizes to test for statistically significant differences in performance on the Level I and Level II tasks across grade and ability levels. The analysis of variance of the sum was used to test the fifth hypothesis. Since this hypothesis is concerned with whether the performance of males (or females) is uniformly superior to that of females (or males) and not uniformly different, an analysis of variance of the sums was computed.

As none of the $\underline{F}$-ratios are significant on the analysis of variance of the sum and differences of the Level I and Level II learning tasks and the three main variables of reading level, grade level, and sex, one can have confidence that the hypotheses relating to the Level I and Level II learning ability of good, average, and poor readers will be rejected.

Five hypotheses were tested. Each hypothesis is restated, relevant data presented, and interpretation and discussion given. The hypotheses are presented in the order in which they were delineated in Chapter I.

Hypothesis 1

The first hypothesis concerned the performance of second graders on a Level I (associative) learning task. It was:

1. There will be a positive relationship between the reading of second graders and their performance on a Level I learning task.

Test of hypothesis:

The analysis of variance of the sum and differences of the mean raw scores on the Level I (associative) and Level II (conceptual) learning task indicates that the scores on the Level I learning task across reading ability levels at the second grade are not significantly different. Differences between the mean scores of good, average, and poor readers on the Level I learning task at the second grade exist, but are not statistically significant. The mean raw score of good readers is 43.83; average readers, 44.68; and poor readers, 37.65. Results are presented in Table 5. It appears that those subjects achieving in reading - the good and average readers - perform better on the Level I learning task than those subjects who are not, but the difference is not statistically significant. Tables 7 and 8 present the pertinent analysis of variance. The slight superiority of average readers at the second grade level can not be explained from an examination of the statistical analysis.

Discussion:

Although not statistically significant, the tendency toward poorer performance by poor readers on the associative learning task when compared to good and average readers is in agreement with the research

Table 5

Mean Correct Responses of Second, Fourth and Sixth Graders on the Level I (associative) Learning Task

Grade	Reading Ability		
	Good	Average	Poor
Grade 2	43.83	44.68	37.65
Grade 4	65.43	61.00	63.06
Grade 6	68.43	73.66	74.50

Table 6

Mean Correct Responses of Second, Fourth, and Sixth Graders on the Level II (conceptual) Learning Task

Grade	Reading Ability		
	Good	Average	Poor
Grade 2	26.00	25.32	20.72
Grade 4	29.37	28.16	28.25
Grade 6	31.18	32.66	31.12

Table 7

Analysis of Variance of Sum of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks: Reading

Source	MS	df	F	P
Reading	118.87	2	0.42	.66

Table 8

Analysis of Variance of Differences of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks: Reading

Source	MS	df	F	P
Reading	38.33	2	.16	.85

Huelsman (1970) reviewed on the performance of disabled readers on the Wechsler Intelligence Scale for Children subtests.

He found that in 12 of the 20 studies reviewed, disabled readers performed significantly poorer on the Digit Span subtest than did achieving readers. None of the research reviewed by Huelsman indicated that disabled readers performed better on the digit memory subtest than did achieving readers.

Hypotheses 2 and 3

Two separate hypotheses concerning the performance of fourth graders on a Level I and a Level II learning task were stated. They were:

2. There will be no relationship between the reading ability of fourth and sixth graders and their performance on a Level I (associative) learning task.

3. There will be no relationship between the reading ability of second and fourth graders and their performance on a Level II (conceptual) learning task.

Test of Hypothesis:

The two hypotheses are discussed together since the researcher hypothesized that at grade 4, reading ability would be neither significantly related to Level I nor Level II learning ability. The mean correct responses of fourth grade subjects on the two learning tasks are presented in Table 5 and 6. Good readers have a mean raw score of 31.18; average readers, 32.66; poor readers, 31.12. Again, average readers perform better than good readers and the difference between good and poor readers is negligible. The results of the analysis of variance of these factors are presented in Tables 9 and 10.

The data support the acceptance of these two hypotheses. Neither Level I (associative) nor Level II (conceptual) learning has been shown to have any significant effect upon the reading ability of fourth graders. It appears that at fourth grade good readers can be either superior Level I or Level II learners. Examining the mean correct responses of fourth graders on the Level I learning task, good readers gave a mean raw score of 65.43, average readers, 61.00, and poor readers, 63.09. In other words, poor readers perform better on this task than do average readers. On the Level II learning task, good readers have a mean raw score of 31.18; average readers, 32.66; and poor readers, 31.12. Therefore, the average readers perform slightly better than the good readers on this task. It is possible that the ceiling effect of the Raven's Coloured Progressive Matrices is operating at the fourth grade level as well as at the sixth grade level to diminish differences on the Level II (conceptual) task between the three reading ability levels.

Discussion:

The lack of a significant relationship between either Level I or Level II learning and reading ability demonstrated at grade 4 also occurs at the second and sixth grade. As mentioned in the discussion of the first hypothesis, good readers are not significantly superior to either average or poor readers on either task. The mean raw scores for the Level I and Level II learning tasks of good, average, and poor second grade readers are presented in Tables 5 and 6.

Table 9

Analysis of Variance of Sum of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks: Grade X Reading

Source	MS	df	F	P
Grade x Reading	357.4543	4	1.26	.29

Table 10

Analysis of Variance of Difference of Correct Responses on Level I (associative) and Level II (conceptual) Learning Tasks: Grade X Reading

Source	MS	df	F	P
Grade x Reading	73.3031	4	0.31	.87

Again, at the sixth grade level there is also no significant difference between the Level I and Level II learning ability of good, average, and poor readers. On both learning tasks, poor readers have improved relative to good and average readers. There is a more apparent improvement in Level I learning. The ceiling effect of the Raven's Coloured Progressive Matrices possibly accounts for the diminished differences in Level II learning.

Grade level was found to be a very powerful variable in this study. Statistically significant scores existed in the performance of the subjects on the two learning tasks as they progress from second to sixth grade. The relevant mean response scored are given in Table 11. An analysis of covariance, with I.Q. as the covariate, was performed to determine if intelligence accounted for more of the increase in performance on the two tasks that did maturity. The results of the analysis of covariance with I.Q. treated as a covariant are presented in Table 12 and 13.

Table 11

Mean Correct Responses by Grade Level
on the Level I and Level II Learning Tasks

Type of Learning	Grade 2	Grade 4	Grade 6
Level I	42.05	63.16	72.20
Level II	24.01	28.59	31.65

Table 12

Analysis of Co-Variance of Sum of Correct Responses
on the Level I and Level II Learning Tasks:
Grade Level

Source	df	MS	F	P
Grade Level	2	14168.0647	49.84	.0001

Table 13

Analysis of Co-Variance of Difference of Correct Responses on the Level I and Level II Learning Tasks: Grade Level

Source	df	MS	F	P
Grade Level	2	4866.2870	20.83	.0001

The finding that grade level was an important factor in the difference in mean raw scores in good, average, and poor readers was to be expected. Consistent differences due to a maturity factor are usually found across grade levels on learning tasks of any kind. As is apparent in Table 11, grade is a very significant variable for both Level I and Level II learning tasks. In fact, the analysis of covariance indicates that maturity accounts for more of the increase on both tasks than does I.Q.

Hypothesis 4

One hypothesis, the fourth of this study, concerned the relationship between the reading ability of sixth graders and their performance on a Level II (conceptual) learning task. It was:

4. There will be a positive relationship between reading ability of sixth graders and their performance on a Level II (conceptual) learning task.

Test of the hypothesis:

The mean number of correct responses of sixth grade subjects on the Level II learning task is presented in Table 6. There is no significant difference between the performance of good, average, and poor readers on the Level II learning task. As with the average second grade readers on the Level I learning task, the mean correct responses of the average reader at the sixth grade was slightly higher than the average mean responses of the good readers.

Discussion:

One explanation that seems plausible in accounting for this non-significant relationship is the presence of a ceiling effect on the Raven's Coloured Progressive Matrices. With a total possible raw score of 36 on the Coloured Progressive Matrices, the mean raw score of good readers was 31.18; average readers, 32.66; and poor readers, 31.12. It appears that the items on the Coloured Progressive Matrices lacked the necessary spread in difficulty to differentiate the conceptual ability of good, average, and poor readers, if, indeed, such a difference exists. Perhaps utilization of Raven's Progressive Matrices (1947) for subjects over 8 years of age, with 60 items rather than 36 could have more effectively tapped any existing difference in Level II (conceptual) learning of good, average, and poor readers at sixth grade.

A scattergram depicting this ceiling effect at grade 6 is presented in Figure I. Two figures depicting the distribution of raw scores on the Raven's Progressive Matrices at grades 2 and 4 are presented in Figures 2 and 3 for comparative purposes. As can be seen from this table, the raw scores of 28 of the 36 sixth grade subjects fell between 32 and 36, the maximum score. Good readers have a mean raw score of 30.35; average readers, 32.44; and poor readers, 32.09. It was felt

Figure 1

DISTRIBUTION OF RAW SCORES OF SIXTH GRADE SUBJECTS ON THE RAVEN'S PROGRESSIVE MATRICES

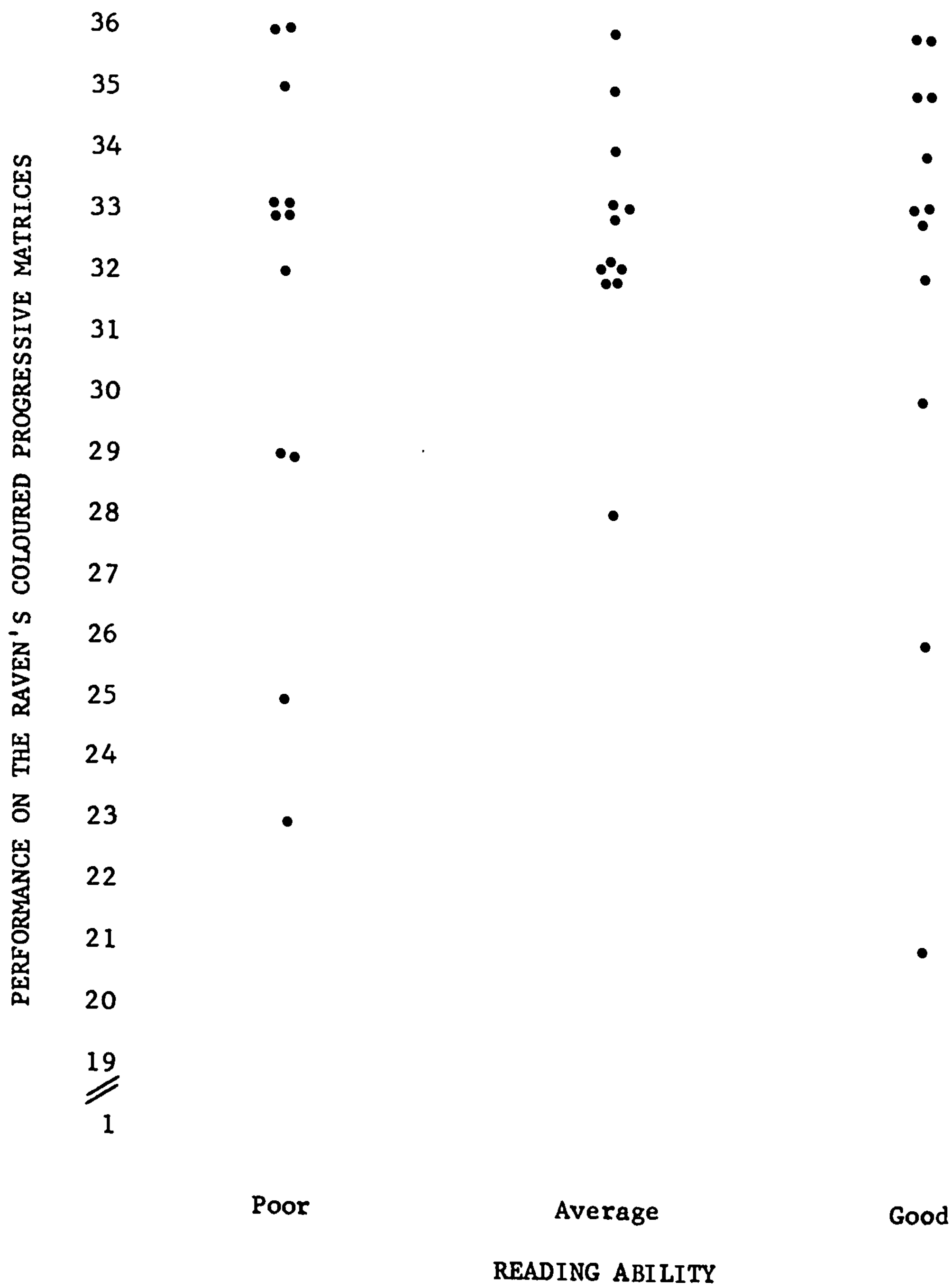


Figure 2

DISTRIBUTION OF RAW SCORES OF SECOND GRADE SUBJECTS ON THE RAVEN'S PROGRESSIVE MATRICES

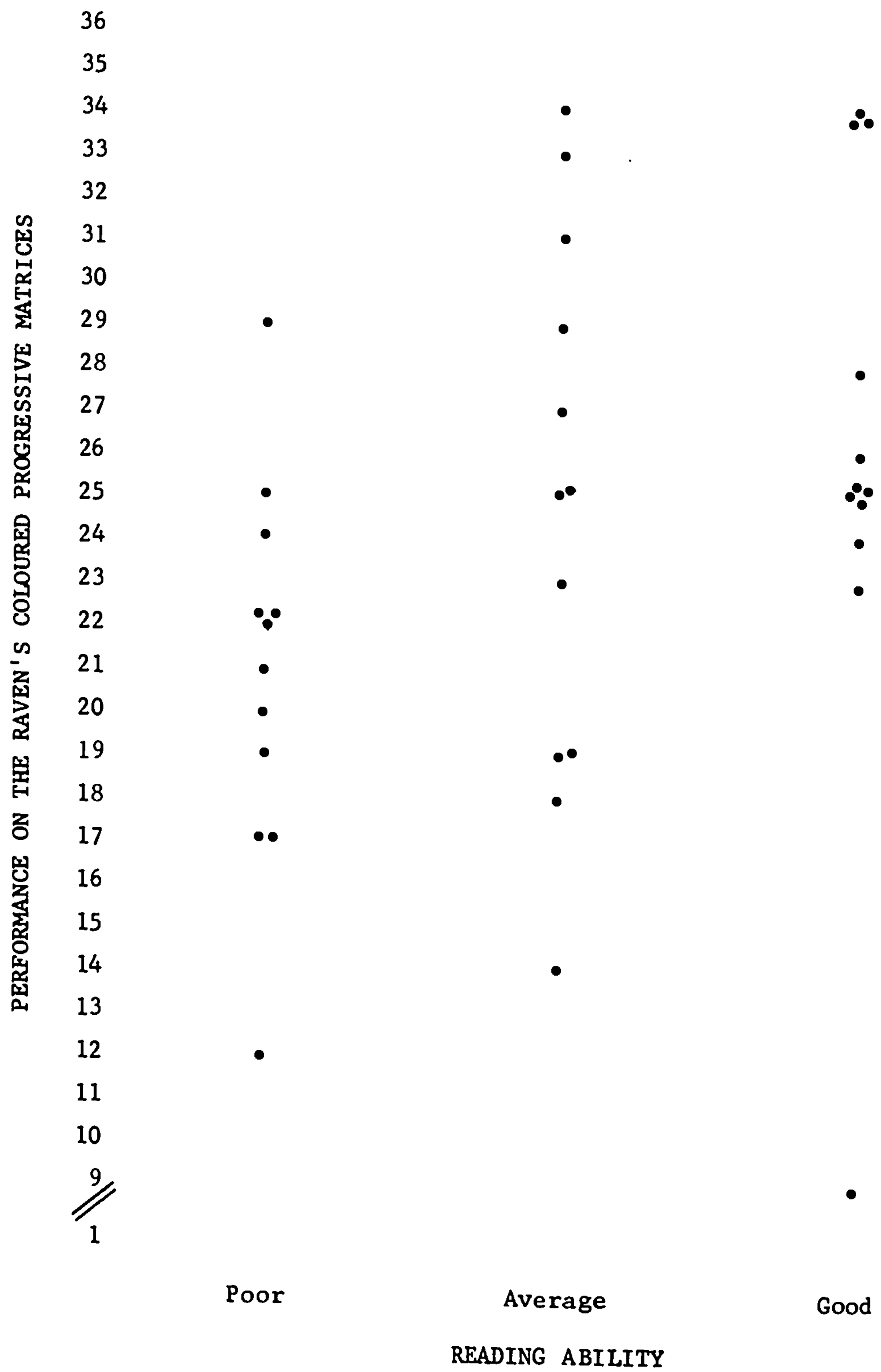
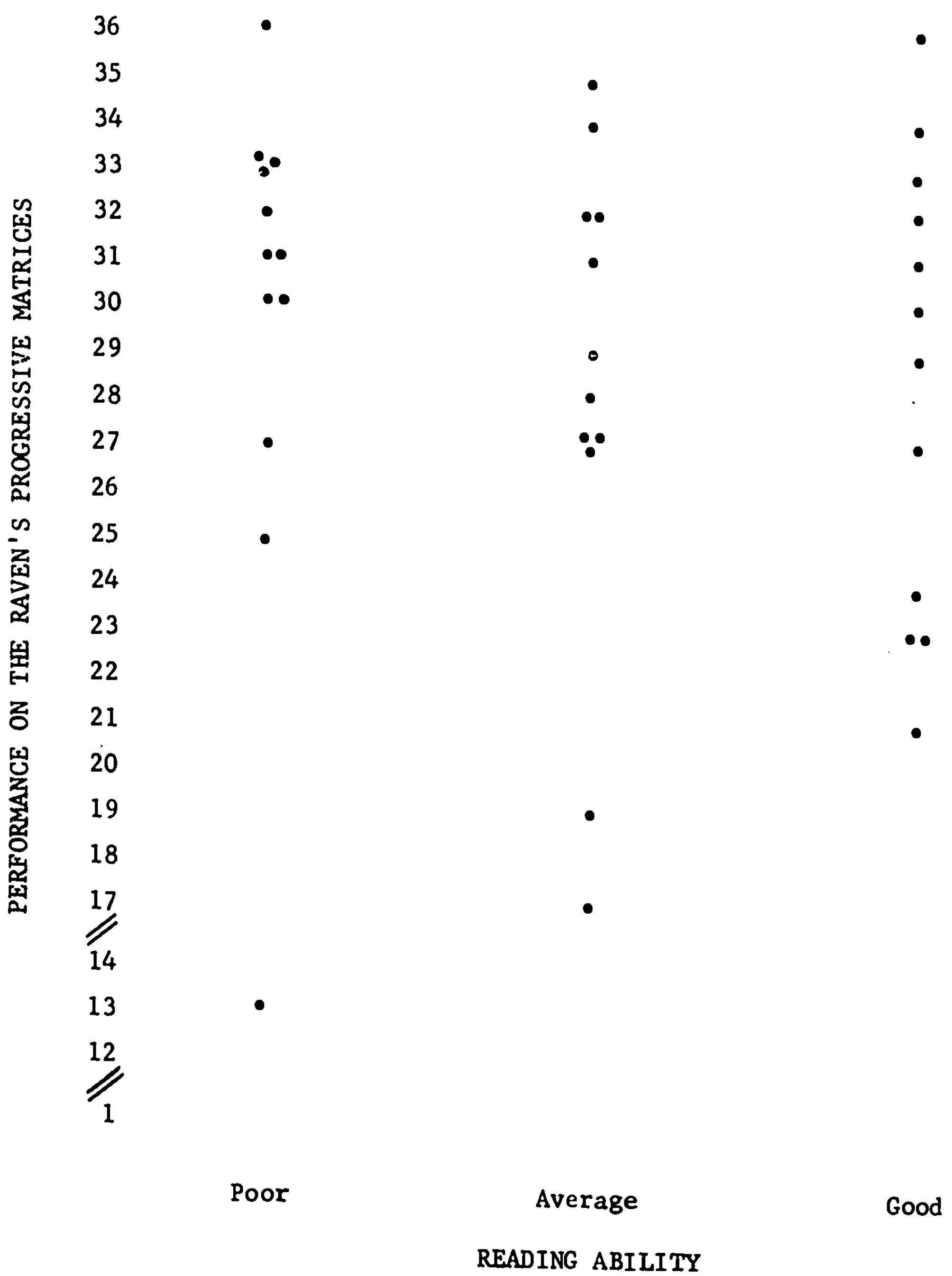


Figure 3

DISTRIBUTION OF RAW SCORES OF FOURTH GRADE SUBJECTS ON THE RAVEN'S PROGRESSIVE MATRICES



that a statistical transformation of these raw scores would not change the relationship between Level II (conceptual) learning and reading found in the analyses of these data.

Hypothesis 5

The last hypothesis stated in Chapter II concerned the difference between boys' and girls' responses on a Level I (associative) and Level II (conceptual) learning tasks. It was:

5. There will be no significant difference between the performance of boys and girls on the Level I (associative) or Level II (conceptual) learning tasks.

Test of the hypothesis:

The mean number of correst responses of boys and girls on the Level I and Level II learning tasks are presented in Table 14. The mean number of correct responses of boys was 58.72 on the Level I learning task and 29.25 on the Level II learning task. The mean number of correct responses for girls was 59.56 on the Level I learning task and 26.93 on the Level II learning task. The results of the analysis of variance of these factors are presented in Tables 15 and 16. The data support the acceptance of the null hypothesis. The subject's sex has no significant effect upon his Level I (associative) and Level II (conceptual) learning ability.

Table 14

Performance on Level I (associative) and Level II (conceptual) Learning Tasks by Sex and Reading Ability

Level I (associative) Learning

	Good	Average	Poor
Boys	61.00	59.48	55.69
Girls	57.47	60.07	61.11

Table 14 (continued)

Level II (conceptual) Learning

	Good	Average	Poor
Boys	29.19	30.60	27.95
Girls	28.51	26.84	25.45

Table 15

Analysis of Variance of Sum of Correct Responses on the Level I and Level II Learning Tasks: Sex

Source	MS	df	F	P
Sex	41.5648	7	0.15	.70

Table 16

Analysis of Variance of Difference of Correct Responses on the Level I and Level II Learning Tasks: Sex

Source	MS	df	F	P
Sex	222.4537	7	0.95	.33

Chapter IV

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary and Conclusions

The postulation of Jensen's bidimensional model of learning and its subsequent utilization in his attempt to explain intrinsic individual differences in the learning processes of children from various social classes is recognized as an important contribution to the study of individual differences in learning. No published research exists which investigates the ability patterns of good, average and poor readers on Jensen's Level I and Level II learning tasks.

Associative learning and conceptual learning, the two basic processes postulated in Jensen's model, are believed to be cognitive behaviors of importance to the reading process. Researchers such as Fries (1962), Bloomfield and Barnhart (1961), and Anderson and Dearborn (1952) have explained reading as the process of associating symbolic stimuli of one perceptual mode with symbolic stimuli of another perceptual mode. Others, like Thorndike (1917), Reed (1957), and Braun (1963) have stressed the relationship of conceptual factors to reading.

Both associative and conceptual learning are presumed to be of importance in reading at all developmental levels. However, it is hypothesized in the present study that there is a stronger relationship between beginning reading and Level I (associative) learning, as measured by Jensen's Memory for Numbers Test, than between beginning reading and Level II (conceptual) learning, as measured by Raven's Coloured Progressive Matrices. Conversely, it is hypothesized that there is a stronger relationship between later reading and Level II (conceptual) learning than between later reading and Level I (associative) learning.

The present research was designed to test the applicability of Jensen's bidimensional model of learning to the reading process. The answers to the following questions were sought: (a) Will good readers at the second grade level, as operationalized by performance on the Stanford-Achievement Test, perform significantly better than average and poor readers on Jensen's Level I (associative) learning task? (b) Will good readers at the fourth grade level perform equally well on Level I (associative) and Level II (conceptual) learning tasks? (c) Will good readers at the sixth grade level perform significantly better than average and poor readers on Jensen's Level II (conceptual) learning task? (d) Will there by any significant difference between the performance of boys and girls on Jensen's Level I and Level II learning tasks?

To answer these questions 108 subjects selected from three elementary schools were administered Jensen's Memory for Numbers Test to tap Level I learning. Thirty-six children from each of grades 2, 4, and 6 were tested in the experiment. Within each grade 18 boys and 18 girls participated. An equal representation of good, average, and poor readers at each grade level and for both sexes was obtained. An attempt was made to hold the intellectual capacity within the average range by eliminating high and low deviant scores. Age controls were also placed on the subjects to eliminate subjects whose chonological age was not in the normal range for grade level.

Each subject was administered both the test of Level I and Level II learning. Two controls were placed on the administration of these tasks. The order of presentation of the tasks was counterbalanced to control for the effects of the order of presenting the tasks to the subjects. To control for the possibility of diurnal differences in learning all subjects were administered the learning tasks between 9:00 A.M. and 11:30 A.M.. Forty-eight hours separated all testing sessions.

Level I (associative) learning was tested by the administration of Jensen's Listening-Attention Test and Memory for Numbers Test. Both tests were presented by tape recorder. The Listening-Attention Test was utilized as a vehicle to eliminate from the sample those subjects who were not attending to or who were experiencing difficulty hearing the recorded test. The Memory for Numbers Test contains three components: standard digit recall, repeated digit recall and delayed digit recall.

The dependent variables were the number of correct responses out of a possible 117 derived from performance on the three components of the Memory for Numbers Test and the number of correct responses out of a possible 36 on the Coloured Progressive Matrices. These data were analyzed by analysis of variance. No significant differences were found (a) between the performances of good, average, and poor readers at the first grade level on the Level I (associative) learning task, (b) between the performance of good, average, and poor readers at the sixth grade level on the Level II (conceptual) learning task, (c) between the performances of good, average, and poor readers at the fourth grade level on both Level I (associative) and Level II (conceptual) learning, and (d) between the performances of boys and girls on both learning tasks.

It must be concluded, therefore, that Jensen's bidimensional model of learning utilizing the existing instruments has little, if any, relevance for investigating the intrinsic individual differences that account for observed differences in reading performance of good, average, and poor readers at grades 2, 4, and 6.

Implications

Implications for Further Research

Although the findings of this study indicate that Jensen's bidimensional model of learning lacks applicability in investigating the factors that underlie individual differences in reading performance, this does not preclude the possibility that differences in associative and conceptual learning exist at different grade and ability levels. Several modifications in instrumentation and scoring could result in a more sensitive procedure of tapping these differences.

First, circumvent the problems inherent in a digit memory scoring system that credits only digits in positional order as correct by deriving an additional score which credits digits in proper serial order as correct even though they are in incorrect positional order. For example, in the Jensen system of scoring, a five digit series of 1-2-3-4-5 recalled as 2-3-4-5-1 was scored 0. Utilizing a scoring system that also takes into account correct serial order, the above recalled series would be scored 4. A subject who recalls in serial order four of the five digits presented him is exhibiting a high degree of associative learning which should be taken into account when deriving a score for associative learning ability.

Second, the scoring problems inherent in utilizing Jensen's Memory for Numbers Test as a test of associative learning in reading research could be avoided by replacing it with a paired-associate learning task. Perhaps digit memory, even though labeled a "purer" test of association by Jensen does not approximate the reading process as closely as does a paired-associate learning task.

In a paired-associate learning task either the stimulus or response term of the response term of the paired-associate list is word-like in nature. Generally, a stimulus term is presented to the subject who is required to recall the correct response term. It is the opinion of this researcher that this process is more analogous to associating phoneme to grapheme or word meaning to word configuration than the recall of digit string. Recitation of digit strings may be more analogous to the spelling task than to the reading task.

Third, to avoid the ceiling effect on the Level II (conceptual) learning test at the sixth grade level, the Raven's Progressive Matrices (1947), Sets I and II, rather than the Coloured Progressive Matrices could be administered. In the first set there are 12 problems and in the second set, 48. By providing the subjects with more items of increasing difficulty perhaps the ceiling effect would be eliminated.

The absence of a significant relationship between associative learning and beginning reading and conceptual learning and later reading found by this experimenter does not preclude the possibility that such relationships exist. In light of the earlier comments in this discussion alluding to weaknesses in the instruments used in measuring associative and conceptual learning, and the problems inherent in scoring a digit memory task on the basis of positional order only, such relationships could emerge if the requisite instruments for detecting such differences are employed in future research.

It should be added that group testing of both digit span as done by Jensen (1968(a), 1969) and reading achievement measures is relatively imprecise, and at least where the former is concerned, may detract through social psychological and personality factors from the assessment of a putatively "pure" associative capacity. In light of these confounding influences, individual testing is to be recommended.

Appendices A through E have been deleted from this paper, but are available on microfilm from Memorial Library, University of Wisconsin, Madison, Wisconsin.

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