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The Effects of Some Aspects of Spatial Relation and Abstract Reasoning On The Reading Comprehension Scores of Black and Iranian College Students

presented by

Mildred Verneda Mason

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Ph.D degree in _____

ADMINISTRATION AND HIGHER EDUCATION

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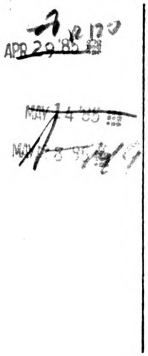

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THE EFFECT OF SOME ASPECTS OF SPATIAL RELATION AND ABSTRACT REASONING ON THE READING COMPREHENSION SCORES OF BLACK AND IRANIAN COLLEGE STUDENTS

By

Mildred Verneda Mason

A DISSERTATION

Submitted to
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for the degree of

DOCTOR OF PHILOSOPHY

Department of Education

ABSTRACT

THE EFFECT OF SOME ASPECTS OF SPATIAL RELATION AND ABSTRACT REASONING ON THE READING COMPREHENSION SCORES OF BLACK AND IRANIAN COLLEGE STUDENTS 1977-78

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Chairman: Walter F. Johnson
Director of Study: Lawrence Lezotte

Problem

The purpose of this study was to investigate relationships between map-graph instruction, reading comprehension, abstract reasoning, and spatial relation scores of urban black and Iranian students. More specifically, the study attempted to ascertain the relationship between five dependent variables; namely, reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation, with the following independent variables; female vs. male, black vs. Iranian, and treatment vs. nontreatment.

Procedure

The data collected for this study encompassed the time period from the Fall of 1977 through the Spring of 1978, and were based on the performance of college students enrolled in courses at a two-year Midwestern community college.

From a total population of eight hundred minority students enrolled in over fifty different classes, one hundred thirteen black and Iranian students in six classes were randomly selected to participate in the study. The six classes participating were selected from a class list of fifty, including every other class from the inner city site in one of two different types of reading programs: map-graph and remedial reading.

The Stanford Diagnostic Reading Test and the Differential Aptitude Test were utilized to preassess students' cognitive level, and subsequently, to determine the extent to which the instructional approach impacted students' reading comprehension, decoding, vocabulary, spatial relation, and abstract reasoning scores.

Utilizing a pre-post experimental design with comparable comparison groups, the data were analyzed by using an analysis of covariance to determine whether the intervention resulted in a statistically significant difference between the two groups. The three hypotheses, stated in the null form, were tested at the 0.05 level of confidence for statistical significance.

Results

Utilizing step down F tests, the data revealed that when viewing all five measures collectively, there were significant differences in the scores of students receiving map-graph vs. remedial reading instruction with the exception of abstract reasoning. This study also revealed that black students did not experience greater gains than Iranian students on the following dependent measures; comprehension, vocabulary, decoding, and

spatial relation. And finally, this study determined that sex was not a significant factor impacting students' reading comprehension, decoding, vocabulary, spatial relation, and abstract reasoning scores.

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CHAPTER I: THE PROBLEM

INTRODUCTION

Purpose of the Study

The purpose of this study is to investigate relationships between reading comprehension, abstract reasoning, and spatial relation scores of urban black and Iranian students assigned to groups receiving map-graph instruction or remedial reading instruction.

Statement of the Problem

The college population in the United States has gradually changed over the years. More students from the traditionally non-college segment of society are entering college. Open admissions programs are attracting students who lack the skills which have customarily been held to be necessary for college-level work. Colleges have assumed partial responsibility for bringing up to college level, students who may not have even secondary level reading skills. Colleges are also being asked to provide educational opportunities for adults who have been away from school for many years and who may not have been very successful in their previous schooling.

Traditional methods of teaching reading to adults are being questioned as to their effectiveness. According to Raisner[1], adults are different from children in many ways and most probably require a different instructional program: Methods

specifically designed for them are lacking. Kavale and Lindsey[2] and Nacke and Culbertson[3] focused specifically on the need for more information regarding adult reading strategies. A theoretically-based approach to teaching reading to the new population of college students and to those of the old population who did not learn to read well from traditional reading instruction appears to be needed. This study is designed to investigate the untraditional approach (defined by Crano and Johnson as map-graph instruction) to teaching reading which may enhance students' reading comprehension scores.

Need for the Study

During the past forty years, American higher education has witnessed the growth of several non-traditional subcultures within undergraduate education. One of the most recent subcultures to gain both public and collegiate awareness has been the older student. By 1980, these older adults (25 years of age and older) should represent, in conservative figures, one-third of the National undergraduate enrollment[4].

In addition to this segment of the student population are categories of student segments that may or may not be included in the older population. These segments are the "new students" and the "non-traditional" students. Cross[5] describes the new students as those who are educationally disadvantaged in the sense that they need help with basic skills, motivation, and guidance on how to make it in the educational system. He writes:

> New students may be white or black, rich or poor; but they share the common experience of

> poor past performance in school. Without "open admissions" and "special" admissions they would not be considered "college material"[6].

Cross further states:

> The term "non-traditional students" is generally used to describe adult, parttime learners who carry full-time adult responsibilities in addition to their study. Higher education needs to respond quite differently to these two groups. By and large, new students have basic skills deficiencies and are academically dependent...[7]

According to Friedlander[8], Morrison, Watson, and Goldstein[9], higher education has attempted to respond to these students' needs. Goldstein and Watson notes:

> Since the 1960s, increasing number of community colleges have initiated special educational programs to attract and retain students previously denied access to higher education for such reasons as poor academic performance, unsatisfactory elementary and/or secondary school experiences and financial limitations. The kinds of programs introduced have expanded from recruitment of non-traditional students to development of their academic, social, and career-related areas through specially staffed comprehensive support programs. These have typically included remedial reading courses, tutoring special instructional services (e.g., reading-writing laboratories...Astin, Bisconti, and Frankle, 1972; Cross, 1976; Tinto and Sherman, 1974)[10].

Many of these academic support programs in reading have been helpful to numerous of students in certain aspects of reading, but not all of them have been successful in impacting some of the students' overall comprehension scores. Artley,

Burton and Cook[11] reviewed studies relating to college students' reading gain from 1968 through 1972 and found that students taking reading courses experienced rate gains, occasional vocabulary gains, and at best, no loss of comprehension.

Also, Heilman[12], Goodwin[13], and Freer[14], Smith[15], Miller[16], and Chaplin[17] indicated the need to further investigate methods of teaching reading to college students.

Considering the facts that by early 1960, more than 500 colleges were providing instruction in the improvement of reading (see Cole[18]); that today, almost every college or university has either a reading clinic or one or more reading classes (see Miller[19]); that numerous students enrolled in these courses have not experienced gains in reading comprehension scores (see Artley et. al.[20]) and that students may benefit from an alternative instructional reading method (see Crano[21]), there is a need to investigate the use of an alternative untraditional approach to teaching reading to college students that may enhance their reading comprehension scores.

This study addresses the need in that it investigates relationships between spatial relation, abstract reasoning, decoding, vocabulary and reading comprehension skills of college students. More specifically, this study attempts to answer the following questions:

Q_1: Will a randomly selected group of urban black and Iranian students receiving mapgraph instruction in addition to their regular course instruction evidence greater gains on the measures of reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation,

than a group receiving remedial reading instruction, in addition to their regular course instruction?

Q_2: Will a randomly selected group of urban black students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction, evidence greater gains on reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation measures than Iranian students in experimental and control groups receiving map-graph and remedial reading instruction, in additon to their regular course instruc tion.

Q_3: Will a randomly selected group of female students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction, evidence greater gains on reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation measures than male students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction?

Purpose of the Study

The purpose of this study is as follows: to investigate relationships between reading comprehension, abstract reasoning, spatial relation, decoding, and vocabulary scores of urban black and Iranian students assigned to one of two groups; map-graph instruction or remedial reading instruction. More specifically, the purpose of the study is to determine whether students receiving thirty (30) minutes of consistent programatic map-graph instructions once per week during a fifteen week term will experience greater gains on the Stanford Diagnostic Reading

Test and the Differential Aptitude Test; space relations and abstract reasoning subscales, than students receiving remedial reading instruction.

Hypothesis

The study attempts to verify the hypothesis that map-graph instruction has a more profound effect on college students' reading comprehension, spatial relation and abstract reasoning scores than a remedial reading instructional approach, regardless of students' sexual makeup.

Theoretrical Justification

Crano and Johnson[22] cites a theory for enhancing students' reading comprehension scores that has been acknowledged in the field of education since the early 1900's by such well respected researchers as Binet and Simon[23], Thurstone[24], and Piaget[25]. The theory is that reading comprehension is a sophisticated skill that is based upon the acquisition of prerequisite lower level skills that may be acquired through self-instructional map-graph materials. Crano and Johnson states:

> Converging evidence from unrelated realms of scientific investigation suggests that cognitive skills follow predictable developmental sequences, which originate in infancy. Basic to all of these perspectives is the assumption that spatial cognitive skills, broadly defined, underlie the development of more abstract skills (e.g., reading)[26].

Crano's theory was based on the hypothesis that map-graph instruction increases students' reading comprehension scores,

which suggests that spatial skills are percursors to formal operational thinking and/or skills necessary for reading comprehension.

There are some individuals in education as well as other disciplines who have documented that lower level skills such as spatial skills are percursors to more complex cognitive functions. Renner[27] and Hunt[28] are two such individuals. A review of their studies, as well as other literature in the field provided a frame work for the development of this study.

Assumptions

In the research design for this study, the following assumptions were made:

Assumption 1: Instructors and students involved in the study opted to include the instruction for the study as part of the regular course requirement; therefore, it can be assumed that those who participated did their best; and

Assumption 2: Coupling map-graph instruction with regular course represents a cross validation of the Crano and Johnson studies, which also included map-graph instruction with other course requirements.

Definition of Terms

Map-graph Instruction - is the teaching of map-graph reading skills through the use of a series of self-instructional exercises, consisting of a map or graph, followed by a series of self-scored questions which could be answered from an accurate interpretation of the materials.

Remedial Reading Instruction - is for the purpose of this research, the Reading Attainment System which was developed under the auspices of the U.S. Department of Labor and focused on the reading problems of underachieving adults. The instructional program consisted of 240 graded and high interest reading lessons. Each lesson provided the learner with a short story or essay and was accompanied by a glossary of possibly unfamiliar terms which appeared in the lesson, simple instructions on various language skills and, a ten item self-administered and self-scored test of reading comprehension. The materials were graded into twelve levels of difficulty, with twenty exercises available at each level.

Abstract Reasoning - is a nonverbal reasoning ability needed to view a series of changing diagrams that was presented to students requiring them to discover the principle or principles governing the change of the figures and give evidence of their understanding by designating the diagram which should logically follow.

Spatial Relation - consists of the ability of students to deal with concrete materials through visualizations by requiring that they mentally manipulate objects in three-dimensional space and create a structure in their minds, then give evidence of their understanding by selecting the correct structure from a series of incorrect ones.

Regular Course Work - is the requirements described by the course instructor that was used to determine the students' grade.

Overview

The first chapter has introduced the study, purpose, need, significance and general questions to be examined, as well as the assumptions of the study and key definition of terms. A review of related literature is found in Chapter II. The design of the study is presented in Chapter III. The analysis of data and findings are presented in Chapter IV. Conclusions, implications, and recommendations for further study are included in the fifth and final chapter.

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CHAPTER II: REVIEW OF RELATED LITERATURE

INTRODUCTION

The purposes of this chapter are two fold: To briefly review literature that indirectly relates to this study; and to thoroughly review recent studies that have a direct bearing on this study, namely, the investigation of spatial relation and abstract reasoning skills in relation to reading comprehension.

Literature that has an indirect bearing on this study is presented first, in order to provide a basis for understanding why college and university personnel, in spite of their academic support programs for the changing population of students, still need to identify an alternative method of teaching reading. Secondly, literature which has a direct relationship with this study, covering the period from the early 1900's to the present, is reviewed.

Literature Indirectly Relating to the Study

Academic support programs in higher education relating to reading appear to be a relatively new concept. Prior to the 1960's only a few were in existence. Miller[1] described the following historical development of college reading programs as follows:

> Until 1960, few programs were available in college reading and study skills (Cuasey,

> 1960). A few notable ones include those directed by Samuel Bonshaw at Ohio State University using tachistoscopic controls, Guy T. Buswell at the University of Chicago using the reading record, a forerunner of reading pacers, and William S. Gray who spearheaded an innovative curriculum at the University of Chicago. In 1952, it was predicted (Kingston and Nelson in Cole, 1971, Anderson, 1975), that a reading clinic would be a fundamental part of a college or university in the 1960's... Today, evidence of this predicted expansion is apparent on almost every college campus. A college or university may have a reading clinic/or one or more reading courses designed to enhance reading ability, improve reading rate or develop study skill efficiency. Counselors advise students to seek help based on high school records, low SAT scores, or reading screening test scores.

Chaplin[2] also described how reading courses became a part of the college and/or university program. She found:

> Reading courses in higher education have proliferated as colleges and universities opened their doors to the so-called non-traditional student - students who in the past would not have gone beyond high school. It was believed that programs of remediation were necessary to ease these students in. They were coming to college less well prepared and with lower admission scores than in the past. And the answer to all these problems was reading centers and laboratories.
>
> Because of the rapidity with which these events occurred there was little foresight and planning.

Although many institutions of high education either developed diagnostic reading programs or programs with a major thrust on teaching study skills, Artley et. al.[3] indicated that these types of programs were not, to a great extent, positively impacting the reading comprehension problems of college students.

Educators such as Heilman[4] suggested that one of the reasons that students' comprehension scores weren't significantly affected by the existing instructional strategies was due to inadequate diagnosis of students' reading problems. Goodwin[5] went a step farther and conducted a survey of junior college reading problems to explore the extent of diagnostic testing. Out of three hundred responses, sixty percent of the reading instructors reported that they considered the standardized reading tests administered in the beginning of the program to be diagnostic. The four frequently named tests were survey tests. The teachers explained the inadequacy of the survey tests named by Goodwin in the following manner:

> They yield only grade level or percentile scores in general comprehension and vocabulary, and tell little more than whether a particular student can or cannot read at a certain level, or that his vocabulary is inadequate. They tell nothing, without at least some item analysis, about why the student reads poorly or what his specific deficiencies are.[6]

Freer[7] cited an inadequacy in college reading programs stating that in the more advanced skills of drawing conclusions, making inferences, reading critically, and reacting to reading, diagnosis is needed. Smith[8] supported Goodwin, Freer, and others. He conducted a study in the diagnostic area using the developmental reading program at Kennesaw Junior College. His investigation was on the effects of additional diagnosis in comprehension and in phonics. The results of his study suggested that college reading instructors cannot increase student achievement by using current techniques to diagnose

comprehension and phonics skills. He suggested that instructional strategies need to focus in a new direction.

This new direction could possibly be that of study skills courses for college students. But, Miller[9] cautioned that the effectiveness of study skills courses appears to be too inconclusive. She contended that one of the most important measures of successful reading courses is the effect such courses have on the quality point average of students taking these courses. In a summary of the results of eighty-seven college reading/study skills courses from 1930 to 1974, using overall grade point averages as a criterion for program evaluation, it was reported that only thirty-nine percent of the courses offered could conclusively be regarded as successful.

Chaplin[10] suggested that remedial reading courses are not as relevant to students' academic experiences as they should be and they do not reflect an understanding of the demands that are made on students in the wider academic community. Breen[11] concurred with Chaplin and further suggested that one way of making reading instruction relevant to students' academic experiences is by teaching them to think. He felt that traditional reading courses do not develop students' ability to think. Biggs[12] stated that not only should reading courses link reading to thinking, but reading teachers should be concerned more, if not most, with helping students learn to think through learning to read carefully and critically.

Another supportive view linking reading to thinking is that of Bauman[13], who indicated that the traditional classroom

starves the tender roots of better thinking. Basing his conclusions on several studies, Bauman reported that only forty percent of our high school graduates have developed the capacity for what Piaget calls formal operational thinking, a prerequisite for college work. Moreover, standard college courses have little effect on this skill.

According to Renner[14], every program from reading the Bible to space age education, has been based upon the assumption that there are certain pieces of information, facts, skills, and attitudes that must be presented to the learner. He states:

> The general assumption was that presenting the learner the material and involving him with it would also teach him to think. Because of that assumption, such subjects as Greek, Latin, Euclidean Geometry and many others have been kept in the curricula for years, particularly in the secondary schools. Intellectual development, therefore, was considered to be a concomitant outcome.[15]

On the other hand, Piaget, Crano and others, contended that the exact reverse is probably true. If educational programs, especially reading, are overtly designed to foster intellectual development, the understanding of the material from the discipline that "must" be taught will be the concomitant outcome. In keeping with the Piagetian model, the purpose of schools is then to be concerned with intellectual development of students, with the central unifying purpose being the development of the ability to think. This concern is also stated by the Educational Policies Commission in its essay "The Central Purpose of American Education" which states:

> The ability to lead children toward intellectual development, or the development of the ability to think is one of the main purposes of American education.[16]

Resulting from both the needs of many students and the realization that the one subject that serves as a basic foundation for all others is reading, teachers of reading have accepted the responsibility of relating thinking to intellectual development. For those students in higher education, college reading instruction may be the last chance for them to develop thinking skills that may enhance their intellectual development and enable them to survive in the college academic environment.

Literature Directly Relating to the Study

Literature that relates the process of reading to intellectual development dates back to the early 1900's. During the early days of intelligence assessment, Binet and Simon[17], focusing their attention on the origin and nature of verbal ability, found an intriguing and non-obvious relationship between spatial reasoning and reading. Several years later, studies conducted by Thurstone[18] surfaced similar findings, that spatial skills and symbolic reasoning appear to have strong predictive implications for complex cognitive operations. While these findings indicate definite relationships between spatial skills and reading comprehension, educators regarded them as inconsequential, giving credit to the development of a more general ability ("g")[19]. Crano[20] described this general ability as being spurious and indicated that there is a third variable

which operates to render the observed relationship between spatial skills and reading.

Contrary to this belief is supportive evidence from a physiological perspective which suggests that cognitive skills follow predictable developmental sequences that begin in infancy and continue throughout adolescence. Hebb[21], states that both innate developmental patterns and the influence of early experiences are important in the theory of cerebral functions. The underlying thought is that an important commonality, namely, primitive spatial-cognitive acquisitions, appear to preceed the development of more abstract cognitive skills (e.g., reading). He explained that the necessary process through which cell assemblies and phase sequences are formed is called primary learning. Since most primary learning depends on early preceptual acquisitions, Hebb saw cognitive functioning as strongly influencing preverbal experiences (e.g. spatial skills).

This theory coincides with a typical Piagetian theory of instruction which first surfaced in 1936[22]. After he conducted a study of development, Piaget found that:

> ...intellective functions pass through stages in a sequence which are fixed by maturational processes and universal sensory experiences. The sequential stages are during the first eighteen months, from two to four years, from seven to eleven years, and from eleven to fifteen years.[23]

Evidence of this theoretrical concept was documented by Renner et. al.[24]. Basic to their theory was the concept that physical

development of the human organism begins at conception and cognitive development probably begins sometime before birth. They contend that the human animal has the ability to pass through four distinct intellectual development phases from birth to death. Renner states:

> When an individual is in each of these stages, his "mental functioning" has certain characteristics, or properties, and as he begins to leave one stage and enters another, those properties begin to change. Eventually his intellectual functioning undergoes a gradual but complete change and what was earlier impossible for him to do (that is, think about) he can now accomplish.[25]

Renner further writes that Piaget's model of intellectual development comes from direct association with learners of all ages. He describes the first level as follows:

> The first stage of intellectual development in Piaget's model begins at birth and continues until the child is approximately two and one-half years old... He has called this period the sensory motor phase. During this phase the child learns that objects are permanent, that just because objects disappear from sight does not mean that it no longer exists... During the sensory-motor period, language begins to develop...the child learns to attach sounds to the objects, symbols and experiences he has had... It is during the sensory motor period that the first signs begin to emerge that intellect is developed and does not just occur.[26]

He adds that a description of the second level does not happen at an exact or precise age, for there is not a chronological line that as the child passes it, he moves from one stage to another. He further states:

> A two and one half year old child will begin to enter the preoperational stage at around eleven years of age... Perhaps the best description of the preoperational child is that he is preception-bound - he sees, he decides, and he reports. In short, he thinks, but he cannot think about his own thinking... Basically, there are five characteristics of the preoperational child; egocentrism, irreversibility, centering, states and transformation and transductive reasoning.[27]

Thirdly, Renner and Stafford collaborated and offered a description of Piaget's third level of development.

> The research of Piaget has led us to conclude that the ability to use conservation reasoning appears at about seven years of age. He has also developed tasks that allow a child to demonstrate his ability to utilize conservation reasoning; conservation of number, liquid amount, solid amount, weight, length, and area.[28]

The fourth and last level of development is described by Renner as thus:

> Somewhere around eleven years of age, according to Piaget, there begins to emerge from concrete-operational thought minds that can be described as "concerned with reality" but reality is only a subset within a much larger set of possibilities. The formal-operational thinker stretches his thinking far beyond reality and into the possible.[29]

Consistent with the Piagetian theorists is the theory cited by Crano[30] in his study investigating prerequisite skills for reading comprehension. He suggested that unless a child attains the critical "images" consisting of primitive, pre-logical perceptions, high order conceptual tasks such as reading are impossible.

Crano's study involved an investigation of test scores of fourth and sixth grade students in the Milwaukee Public Schools. The results of this study indicated that the map reading and graph interpretation subscales of the Iowa Test of Basic Skills were good predictors of determining students' level of reading comprehension in subsequent school years.

Crano and Johnson[31] also conducted an experimental study to determine whether spatial skills were precursors of reading comprehension. Therefore, the major focus of their investigation was an inspection of the relationship responsible for the significant interactions of the map-graph training measures. The results of the study indicated that a positive relationship exists between spatial skills and reading comprehension.

Additionally, the findings of Crano and Johnson[32] were later supported in a study they conducted the following year. Again, the results indicated that map-graph training had a substantial impact on reading comprehension scores.

The theory of prerequisite skills for reading comprehension is further supported by Corcia and Jacques[33]. Their study emphasized the significance of the relationship between developmental stages and cognitive functions. Although the relationship is spurious, other researchers such as Calfee, Chapman and Venezky[34], Almy[35], and Cohen[36] supported the findings of Crano, that generally speaking, children who are able to conserve at an early age do better on reading tests.

On the other hand, to view the spatial skills relationship with reading comprehension as being highly correlated, rather

than coincidental, produces a different kind of conceptualization. That is, more specifically, if the relationship is causal between spatial skills and reading comprehension, then an intervention can be applied to reverse reading deficits. This was the framework from which Coleman[37] used to reverse educational deficits of low socioeconomic status students by providing them with an enrichment program similar to those of middle class children.

Hunt[38] also suggested that the treatment of educational deficits of students should consist of an enrichment program designed to provide low achieving students with experiences similar to those of middle class students. It was this mode of thinking that brought about the advent of early remediation programs. However, after a comprehensive evaluation of enrichment programs, especially the Headstart Program, it was noted that positive effects from these programs were ephemeral.

There is ample evidence to suggest that enrichment programs involving spatial skills instruction could yield positive achievement results. In a study conducted by Smith[39] there was an investigation to determine the skills against a criteria of success in grammer schools and secondary technical schools. The results of his study found that students who performed well on verbal (English) tests tended to do well in subjects for which the criterion of success depended on the execution of an actual job; whether in technical drawing or other courses. Further, Smith's findings as a whole suggested that spatial skills positively influenced cognitive functions to the extent of using

spatial tests as valid predictors of success in woodwork, metalwork and other subjects involving the use of hands.

The review of other pertinent literature from researchers in other disciplines such as physiology and education provided even greater support for causal relations between spatial skills and later reading attainment (e.g., Bennett[40], Bandura[41], Gormly and Nittoli[42], Crano and Brewer[43]).

Summary

In this chapter a review of literature relating both directly and indirectly to the study has been presented. Included in the review of literature were studies from various disciplines that related the concept of causal relationships between spatial skills and reading comprehension.

While the studies presented covered at least three disciplines, there was a limited amount of information available in the spatial skills and reading comprehension areas.

Based on the review of literature, it is quite evident that there is sufficient evidence to support the notion that there is a causal relationship between spatial skills and reading comprehension. What is apparently lacking, however, is needed research on the relationship between spatial skill and reading comprehension of nontraditional or new students in postsecondary schools.

The evidence presented in the review of literature suggests the need for a study identifying an effective instructional method of teaching reading to the new population of college students and to those who have not learned to read sufficiently

from traditional methods. The present study is unique in that it investigates spatial skill relationships with the reading comprehension scores of low socioeconomic status black students and Iranian students.

In the next chapter the analysis of data is presented.

FOOTNOTES: CHAPTER II

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CHAPTER III: DESIGN

INTRODUCTION

In the preceding two chapters, the background of the study and the review of literature in related fields were presented. In Chapter III, the source of data, the manner in which the sample group for the study was selected. The instrumentation, statistical hypothesis, instructional material and the procedures used to analyze the data will be discussed.

Source of Data

The data collected for this study covered the period from the Fall of 1977 to the Spring of 1978, and is based on the responses of students in selected academic classes at a Mid-western Community College located in Central Michigan. The college is located in a highly industrial urban area, and it has twelve satellite centers located in the Greater Metropolitan Area. The college is located in a county which has a total population of 219,743 individuals[1]. Blacks represent approximately 12.0 percent of the population (or 26,853 individuals), and the majority of black students attending the college reside within the county[2]. Black residents are primarily employed in the automotive industry as unskilled laborers and operators. As was the case with many northern and industrial cities, there was a large migration of blacks from southern cities to the area after World War II.

During the Fall of 1977, the total enrollment of students in this college was 10,000; with a minority student enrollment of approximatley eight hundred. Of the minority students enrolled, many matriculated in courses at one of the twelve satellite centers to acquire sufficient skills for academic survival before taking courses at the main two-year college campus.

Most black students in the county attended neighborhood inner city schools. A recent study conducted by Bowman[3] indicated that the majority of these students leave their respective high schools either functionally illiterate outputs or ill-prepared for higher education.

Sample

The total population in this study consisted of six classes of students randomly selected from a list of academic classes offered at this Midwestern College satellite center. More specifically, the sample consisted of one hundred and thirteen black and Iranian students. The mean age ($\bar{x}$) of these students was twenty-three years. Of the total number of students who participated in the study initially, 111 of them remained in the population throughout the completion of this study. All black students resided in the county and all Iranian students lived in the college's campus housing facility. On an average, the subjects of the study were two to four grade levels below the national average, as measured by the Stanford Diagnostic Reading Test.

Procedure

Of the total population of minority students enrolled in over fifty classes, six classes were randomly selected by including every other one in the study until there were at least 100 students participating. Every other class was assigned to the control group; 45 students were included in the experimental group and 66 in the control group respectively. In order to determine students' cognitive level, both groups were administered a pretest at the beginning of the study. The experimental group received map-graph instruction while the control group received remedial reading instruction. In the experimental and control groups, instructors for the study relieved regular course instructors for the first thirty minutes of the class hour. All subjects were enrolled in no less than three credit hour courses, which required their attendance at least one and one-half hours per week for fifteen weeks. Of the total fifteen class sessions, three were used for pre-post, and interim testing, and two were used for semester examinations. In the event that students were unable to attend class, arrangements were made for makeup sessions through the course instructor. Participating classes considered involvement in the study as part of the requirements for the course. All instructors for the study received training in map-graph instruction from Crano and Johnson, professors of psychology at Michigan State University. All instructors provided students with occasional positive reinforcement, and they were instructed not to tutor or coach students or admonish them for lack of achievement.

Instrumentation

This study attempted to ascertain the relationship between five dependent variables, namely, reading comprehension, decoding, vocabulary, abstract reasoning and spatial relation, with three independent variables; sex, race or nationality, and treatment. An analysis of covariance was employed to determine whether differences observed in the two groups were attributed to sampling error, chance fluctuation or type of instructional approach. The instruments used in the study consisted of: The Stanford Diagnostic Reading Test - Level III and The Differential Aptitude Tests; abstract reasoning and spatial relation subscales.

Stanford Diagnostic Reading Test - Level III. The Stanford Diagnostic Reading Test was used in the study because it was designed to assess the major aspects of reading process. Reading for the purpose of this test, is viewed as consisting of; comprehension, vocabulary, decoding and rate[4]. This study was concerned with the following three measures: comprehension, decoding and vocabulary. The Stanford Diagnostic Reading Test has a reliability coefficient of .94 and a validity coefficient range from .30 to .70.

Differential Aptitude Test. The Differential Aptitude Test was used in the study because it was designed to measure a composite of abilities that have been useful in educational and vocational guidance. The test batteries included eight tests, each measuring a separate set of abilities[5]. In this study, spatial relation and abstract reasoning subscales were used. The Differential Aptitude Test has a reliability coefficient of .93 and a validity coefficient range from .37 to .80.

Hypotheses

The hypotheses of this study attempted to investigate causal relationships between spatial skills and reading comprehension. The hypotheses, stated in the null form, are listed as follows:

H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning, and spatial relation scores of students in control and experimental groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning, and spatial relation scores of black and Iranian students in experimental and control groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation scores of male and female students in experimental and control groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

Experimental Design

In order to determine whether students receiving map-graph instruction performed better than students receiving remedial reading instruction, a pre-post experimental design with a comparable comparison group was utilized. The three hypotheses were stated in the null form and test of statistical significance were applied to determine whether each hypothesis was either accepted or not accepted. This is illustrated by

the process schematized as follows: H_o: $M_1 = M_2$. In all test applications, the 0.05 level of confidence was used to determine statistical significance.

Analysis

In order to test the hypotheses, data were entered into a analysis of covariance which assessed the effects of the map-graph interpretation training over the course of the study. This statistical model is generally utilized in the study of human behavior because of its ability to look at many dependent measures of subjects at the same time. It produces tests of significance that are quantitatively correct but do not conform to assumed probability statements. Because of these factors, the analysis of covariance model frequently has high appeal[6].

Summary

The study's design utilized a pre-post experimental design with a comparable comparison group. Students in the study were randomly assigned by classes, every other one to one of two types of instructional approaches; map-graph or remedial reading. The Stanford Diagnostic Reading Test and the Differential Aptitude Test were utilized to assess students' cognitive level and the degree to which the instructional approach impacted students' reading comprehension, spatial relation, abstract reasoning, decoding and vocabulary scores. Utilizing a multivariate analysis, the three hypotheses were tested at the 0.05 confidence level of significance.

FOOTNOTES: CHAPTER III

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CHAPTER IV: ANALYSIS OF RESULTS

INTRODUCTION

In the preceding three chapters, the problem, the review of related literature, and the design were presented. In this chapter, the test of hypotheses and an analysis of the data is addressed.

Test of Hypotheses

Presented in this section is the analysis of the data for each of the three hypotheses of the study. In each case, the hypothesis is restated, and an appropriate statistical analysis is conducted to either accept or not accept the null hypothesis. In all test applications, the 0.05 level of confidence was used to determine statistical significance.

> H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation scores of students in experimental and control groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

In order to test the first hypothesis, data from the post-test results of the five dependent variables were entered into an analysis of covariance. This determined whether, as a group, there was a significant difference in the scores of students receiving map-graph instruction in comparison to students

receiving remedial reading instruction. (The reader is referred to Table 1.)

TABLE 1

ANALYSIS OF COVARIANCE OF STUDENTS' ACHIEVEMENT IN MAP GRAPH INSTRUCTED GROUPS VS. REMEDIAL READING INSTRUCTED GROUPS

Independent Variable	Multivariate	P of Multivariate F	Dependent Variable	Step Down F	P of Step Down F	Significance P
Experimental vs. Control	37.0791	.0001	Comprehension	7.1851	.0087	.0001
			Vocabulary	4.5363	.0358	.0001
			Decoding	8.2366	.0051	.0001

The data in the above table indicated that, when viewed collectively, there was a significant difference in the overall achievement of students in the experimental and control groups. In conducting a further investigation utilizing the step down F tests, there were significant differences in the achievement of students in the experimental group vs. the control group in all measures except abstract reasoning. Therefore, this hypothesis is not rejected only with respect to abstract reasoning and rejected with respect to comprehension, vocabulary, decoding and spatial relations.

H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning, and spatial relation scores of black and Iranian students in experimental and control

groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

Table 2 contains the data necessary to test this hypothesis.

TABLE 2

ANALYSIS OF COVARIANCE OF BLACK AND IRANIAN STUDENT'S ACHIEVEMENT IN MAP-GRAPH INSTRUCTED GROUPS VS. REMEDIAL READING INSTRUCTED GROUPS

Independent Variable	Multivariate	P of Multivariate F	Dependent Variable	Step Down F	P of Step Down F	Significance
Black vs Iranian	3.3217	.0084	Comprehension	.7122	.4009	n.s.
			Vocabulary	.1854	.6678	n.s.
			Decoding	.2781	.5992	n.s.
			Abstract	10.9690	.0014	.01
			Spatial	.0000	.9969	n.s.

The results of these measures indicated that, when viewed collectively, there were no significant differences in the scores of black and Iranian students. Further investigation of these measures utilizing the step down F test indicated, that while there was no overall significant difference in the test scores of black and Iranian students in the area of reading comprehension, vocabulary, decoding and spatial relation, there was a significant difference in the abstract reasoning score of black and Iranian students in the experimental and control groups. Considering the overall result of the data, the null hypothesis was not rejected on the following dependent measures:

comprehension, vocabulary, decoding and spatial. This hypothesis was rejected with respect to abstract reasoning, as there was a significant difference in the abstract reasoning scores of black students and Iranian students.

H_o: There will be no significant difference in the reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation scores of male and female students in experimental and control groups receiving map-graph instruction in comparison to corresponding students receiving remedial reading instruction.

In Table 3, the data needed to test the third hypothesis is presented.

TABLE 3

ANALYSIS OF COVARIANCE OF MALE AND FEMALE STUDENTS' ACHIEVEMENT IN MAP-GRAPH INSTRUCTED GROUPS VS. REMEDIAL READING INSTRUCTED GROUPS

Independent Variable	Multivariate	P of Multivariate F	Dependent Variable	Step Down F	P of Step Down F	Significance P
Female vs. Male	1.4696	.2072	Comprehension			n.s.
			Vocabulary			n.s.
			Decoding			n.s.
			Abstract			n.s.
			Spatial			n.s.

The data in Table 3 indicated that, when reviewed collectively, there were no significant differences in the reading comprehension,

spatial relation, vocabulary, decoding and abstract reasoning scores of both male and female students either in the experimental or control group on all five measures. Therefore, on the basis of this data, the null hypothesis is not rejected, as sex was not a significant factor in increasing students' scores in the following five areas assessed; comprehension, vocabulary, decoding, abstract reasoning and spatial relation.

In order to verify the hypothesis that map-graph instruction had a more profound effect on college students' test scores in the following areas; reading comprehension, spatial relation, abstract reasoning, decoding, and vocabulary, pretest and post-test combined means were compared considering three independent variables; experimental vs. control, male vs. female, and black vs. Iranian.

Table 4 contains the data necessary to compare observed combined means of the experimental and the control groups.

TABLE 4

PRE-POST COMBINED MEANS SCORES OF STUDENTS IN EXPERIMENTAL AND CONTROL GROUPS IN THE STANFORD DIAGNOSTIC AND THE DIFFERENTIAL APTITUDE TESTS

	Experimental Group (N=45)			Control Group (N=66)		
	Pre-test	Post test	Diff.	Pre-test	Post-test	Diff.
Comprehension*	3.400	4.600	+1.200	3.640	3.880	+ .240
Vocabulary*	3.733	5.000	+1.267	3.803	4.273	+ .470
Decoding*	3.889	4.689	+ .800	4.288	4.561	+ .273
Abstract Reasoning**	23.470	27.310	+3.840	21.070	23.370	+2.300
Spatial Relation**	22.240	30.400	+8.160	21.890	23.550	+1.660

*Scores are reported in terms of grade equivalent units.

**Scores are reported in terms of raw scores with a total of 50 tests items related to abstract reasoning and 60 items related to spatial relation respectively.

The data in the above table indicated that there was a appreciable difference in the test scores of students in the experimental group in comparison to that of the control group on each of the five measures. Students' scores in the experimental group exceeded those of the control group.

In Table 5 the data is presented comparing combined means of female and male students.

TABLE 5

PRE-POST COMBINED MEANS SCORES OF FEMALE AND MALE STUDENTS ON THE STANFORD DIAGNOSTIC READING AND THE DIFFERENTIAL APTITUDE TESTS

	Female Group (N=57)			Male Group (N=54)		
	Pre-test	Post-test	Diff.	Pre-test	Post-test	Diff.
Comprehension*	3.842	4.491	+ .649	3.222	3.833	+ .611
Vocabulary*	4.140	4.933	+ .790	3.389	4.185	+ .796
Decoding*	4.351	4.702	+ .351	3.889	4.519	+ .630
Abstract Reasoning**	22.910	24.980	+2.070	21.070	23.370	+2.300
Spatial Relation**	21.840	26.000	+4.160	22.240	26.670	+4.430

*Scores are reported in terms of grade equivalent units.

**Scores are reported in terms of raw scores with a total of 50 tests items related to abstract reasoning and 60 items related to spatial relation respectively.

The results of these measures indicated that when comparing pre-post combined group means of female and male students, there was no appreciable difference in students' scores on any of the five measures.

Table 6 contains data necessary to compare combined means of black American and Iranian students.

TABLE 6

PRE-POST COMBINED MEANS SCORES OF BLACK AND IRANIAN STUDENTS ON THE STANFORD DIAGNOSTIC READING AND THE DIFFERENTIAL APTITUDE TESTS

	Black Group (N=96)			Iranian Group (N=15)		
	Pre-test	Post-test	Diff.	Pre-test	Post-test	Diff.
Comprehension*	3.354	3.937	+ .583	4.733	5.667	+ .934
Vocabulary*	3.583	4.417	+ .834	5.000	5.533	+ .533
Decoding*	3.906	4.406	+ .500	5.533	5.933	+ .400
Abstract Reasoning**	20.790	22.600	+1.810	29.870	34.400	+5.070
Spatial Relation**	20.900	24.960	+4.060	29.330	35.070	+5.740

*Scores are reported in terms of grade equivalent units.

**Scores are reported in terms of raw scores with a total of 50 tests items related to abstract reasoning and 60 items related to spatial relation respectively.

Data in Table 6 indicate that when comparing test scores of black and Iranian students there was an appreciable difference in the abstract reasoning measure. However, there was no appreciable difference in the scores of the two groups on the comprehension, vocabulary, decoding, and spatial relation measures.

Discussion

In order to give the reader plausible explanations as to why select hypotheses were either rejected or not rejected, this section presents additional information relating the effects of

spatial skills on reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation measures.

Considering the data reported in Table 1, there were significant differences in the comprehension, vocabulary, decoding, and spatial relation scores of students in the map-graph instructed group in comparison to students in the remedial instructed groups. The data supported the theory that direct teaching of spatial-perceptual skills of the type utilized in map-graph instruction may provide an instructional strategy which may be appropriately utilized with the new population of college students. The data also indicated that there was no significant difference in the abstract reasoning scores of the students in the experimental group in comparison to students in the control group. Similar results were found in studies conducted by Crano and Johnson in 1976 and 1977. There appeared to be no reasonable explanation for this discrepancy neither then nor now. Further research investigating this discrepancy is needed.

A review of data presented in Table 2 also revealed a discrepancy in the area of abstract reasoning. There was a significant difference in the abstract reasoning scores of black and Iranian students. The same recommendation is offered.

Data presented in Table 3 indicated no significant difference in female and male students scores in reading comprehension, vocabulary, decoding, spatial relation, and abstract reasoning. Since the difference was not significant, the corresponding hypothesis for this table was rejected.

The data presented in Table 4 indicated that map-graph instruction had a more profound effect on college students scores on all five dependent measures. Students in the experimental group out paced their peers in the control group by the following margins; reading comprehension +.960 GEUs, vocabulary +.797 GEUs, decoding .247 GEUs, abstract reasoning 3.540 raw scores, and spatial relation 6.500 raw scores.

These results further support previous studies that relationships exist between spatial relation skills and reading comprehension, even though the extent of the relationships has not been clearly defined.

Data in Tables 5 and 6 presented comparisons of pre-post combined means scores of students by sex and nationality. There were no appreciable differences in the scores of students on either of the five measures when controlling for nationality and sex.

Summary

The six tables presented in this chapter indicated an analysis of covariance of three independent variables; experimental vs. control, black vs. Iranian, and male vs. female on five dependent measures: comprehension, vocabulary, decoding, abstract and spatial. Tables 1, 2 and 3 contained specific data to test a corresponding hypothesis for the study and Tables 4, 5 and 6 contained comparisons of pre-post combined mean scores of the independent variables.

CHAPTER V: SUMMARY AND CONCLUSIONS

INTRODUCTION

In this final chapter, a brief review of the answers to the three major questions in this study concerning the investigation of causal relationships between spatial relation, abstract reasoning, decoding, vocabulary, and reading comprehension are presented. Finally, conclusions of the study are presented along with recommendations for areas which might warrant further study.

Review of the Problem

The overall problem addressed in this study was whether causal relationships existed between reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation scores of urban black and Iranian students in experimental and control groups. More specifically, this study attempted to determine whether students receiving thirty minutes of consistent programmatic map-graph instruction once per week during a fifteen week term experienced greater gains on the Stanford Diagnostic Reading Test and The Differential Aptitude Test; space relation and abstract reasoning subscales, than students receiving remedial reading instruction.

In order to achieve this purpose, an analysis of covariance was employed to determine whether differences observed in the

groups were attributed to sampling error, chance fluctuation or type of instructional approach.

Need for the study was based on the concern that numerous students in higher education do not have skills necessary for academic survival and instructors have assumed the responsibility of assisting students in reversing their reading deficits. In addition, more information is needed on prerequisite skills for reading comprehension, in order to provide the most appropriate intervention technique to significantly impact the reading deficit problem of students in higher education.

Question 1

The first question of the study was as follows: Will a randomly selected group of urban black and Iranian students receiving map-graph instruction in addition to their regular course instruction evidence greater gains on the measures of reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation, than a group receiving remedial reading instruction, in addition to their regular course instruction?

Findings---Of the total population of eight hundred minority students, 113 students participated in the study initially, and 111 remained in the study through its completion. The findings of the study indicated that there were significant differences in the academic achievement scores of students in the experimental group vs. the control group on the following measures; reading comprehension, vocabulary, decoding, and spatial relation. The abstract reasoning measure was the only one that indicated

findings that negated the acceptance of the first two null hypotheses of the study.

Considering the results of the data, map-graph instruction did make a difference in students' reading comprehension scores.

Question 2

Secondly, the next question of the study asked: Will a randomly selected group of urban black students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction, evidence greater gains on reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation measures than Iranian students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction?

Findings---The results of the data on the dependent measures included in the second question revealed that, when viewed collectively, there were no significant differences in the scores of black and Iranian students. However, further investigation of the dependent measures utilizing step down F test, indicated that there was a significant difference on the abstract reasoning measure. The discrepancy in the results of this measure in comparison to the results of the other four measures was not explained, but recommendations were made for further research in this area.

Question 3

The last question was stated as follows: Will a randomly selected group of female students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction, evidence greater gains on reading comprehension, vocabulary, decoding, abstract reasoning and spatial relation measures than male students in experimental and control groups receiving map-graph and remedial reading instruction, in addition to their regular course instruction?

Findings---Data relative to the results of these findings revealed that there were no significant differences in the academic achievement of both male and female students either in experimental or control groups on all five measures. On the basis of data presented, sex was not a significant factor impacting students' academic achievement.

Discussion

Data from this study have illustrated that the concept of causal relationships between spatial relations and reading comprehension is a reality. The data clearly indicated that map-graph instruction has a significant effect on reading comprehension scores of students.

This theory coincides with studies conducted by such well known researchers as; Piaget[1], in a discussion of levels of cognitive functions; Thurstone[2], in a discussion of primary mental abilities; and Crano and Johnson[3], in their studies of map-graph instruction and reading performance.

Implication of Future Research

The present study has implications for future research of map-graph instruction on the academic achievement of all students. Although this study was limited to inner city black youngsters and Iranian students, the findings in this study clearly revealed that black and Iranian students enrolled in the map-graph instructed group evidenced higher test scores in reading comprehension, vocabulary, decoding, spatial relation and abstract reasoning than black and Iranian students assigned to the remedial reading instructed group.

It is recommended that this study be replicated. The sample size as well as the length of intervention should be expanded, and students at the middle/junior high and high school levels should be included. Since this study has implications that students from low-ses are significantly affected by map-graph instruction, there is a need to include students from diverse backgrounds, different age groups and different geographical regions.

Considering the fact that reading level for both the black and Iranian students was considerably low, a study needs to be conducted to compare test results of map-graph instructed students reading four to six years behind grade level to map-graph instructed students reading one to two years behind grade level.

Further, reviewing the overall results of the tests of hypotheses for this study, the map-graph relationship with reading comprehension appears to be the most significant finding.

The implications of this finding may mean that educators' remedial instructional approaches for teaching reading can be expanded to include a map-graph instructional approach.

FOOTNOTES: CHAPTER V

[1]Piaget, J., The Origins of Intelligence in Children, New York: International University Press, (1952) as quoted by Case, Robbie, "Piaget's Theory of Child Development and Its Implications," Phi Delta Kappan, (September 1972).

[2]Thurstone, L.L., Primary Mental Abilities, Chicago: University of Chicago Press, (1938).

[3]Crano, W.D., Johnson, C.J., "Facilitative Effects of Map Interpretation on Reading Skills," A paper presented at the annual convention of American Psychological Association (Division 15), Washington, D.C., (September 1976).

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