THE RELATIONSHIP OF FIFTH-GRADE STUDENTS' SELF-CONCEPTS AND ATTITUDES TOWARD MATHEMATICS TO ACADEMIC ACHIEVEMENT IN ARITHMETICAL COMPUTATION, CONCEPTS, AND APPLICATION

Dissertation

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF EDUCATION

By

Bobbie Dean Moore, B. S., M. Ed.
Denton, Texas
August, 1971

The purpose of this study was to determine the inter-relationship of self-concept and attitude toward mathematics to academic achievement in the areas of arithmetical computation, concepts, and application.

The design of this study provided for both the Self-Concept Inventory and Likert-Type Attitude Scale to be administered in March, 1971. The Stanford Achievement Tests were administered in November, 1970, and the results were made available for the purpose of this study in March, 1971.

The subjects of this study (551 boys and 559 girls) were all members of self-contained classes and were a part of the elementary school organization. Statistical analyses were completed for the total group and for four subgroups comprised according to scores on the SEI and LTAS.

Chapter I is an introduction to this study, and Chapter II, a review of the related literature. Chapter III contains a description of the subjects and research site, the procedures used in collecting data, a description of the data-gathering instruments, and the statistical treatment of the
data. Chapter IV presents an analysis of the data, whereas, Chapter V is a summary of the significant findings, conclusions, and recommendations for further investigation.

An analysis of the data resulted in the following major findings:

1. The independent variables, self-concept and attitude toward mathematics, were significantly related to the dependent variables, achievement in arithmetical computation, concepts, and achievement. When subjected to the criterion of Garrett's descriptive labels, however, these relationships were not found to be substantially significant.

2. The relationships between each dependent variable and a combination of the two independent variables considered simultaneously were found to be statistically significant.

3. Through a procedure of analysis of variance it was revealed that there were significant differences among the mean achievement scores of the four groups. It was concluded that high achievement in mathematics was more likely to occur if a student scored high on both the ESI and ETAS.

From the findings of this study it was concluded that self-concepts and attitudes toward mathematics do influence achievement in mathematics. However, the reasonable position is to infer a reciprocal cause-effect relationship between these variables. Although not considered the main determinants of academic success, this study reveals that self-concept and attitude toward mathematics have a significant
influence on arithmetical achievement. Finally, it was concluded that high self-concepts and positive attitudes toward mathematics are important but certainly not sufficient factors in determining academic achievement in mathematics. Based upon the results and conclusions of this study, the following recommendations are projected:

1. Measurement of self-concept and attitude toward mathematics should become a part of the school's testing and evaluation program and results be made an intricate part of the students' cumulative records.

2. There is a need to continue efforts to develop reliable instruments with which to assess affective variables such as the ones in this study.

3. There should be continuing efforts in pre- and in-service training programs for teachers to assist them in developing a better understanding of the theories of self-concept and various attitudes and their important roles in learning.

4. Replications of this study should be conducted in other geographical areas.

5. A similar study should be made comparing and contrasting more integrated populations as well as various ability level groups.
THE RELATIONSHIP OF FIFTH-GRADE STUDENTS’ SELF-CONCEPTS AND ATTITUDES TOWARD MATHEMATICS TO ACADEMIC ACHIEVEMENT IN ARITHMETICAL COMPUTATION, CONCEPTS, AND APPLICATION

DISSERTATION

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF EDUCATION

By

Bobbie Dean Moore, B. S., M. Ed.

Denton, Texas

August, 1971
**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>v</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td></td>
</tr>
<tr>
<td>Purposes of the Study</td>
<td></td>
</tr>
<tr>
<td>Hypotheses</td>
<td></td>
</tr>
<tr>
<td>Significance of the Study</td>
<td></td>
</tr>
<tr>
<td>Definition of Terms</td>
<td></td>
</tr>
<tr>
<td>Limitations</td>
<td></td>
</tr>
<tr>
<td>Assumptions</td>
<td></td>
</tr>
<tr>
<td>II. SURVEY OF RELATED LITERATURE</td>
<td>11</td>
</tr>
<tr>
<td>Self-Concept</td>
<td></td>
</tr>
<tr>
<td>Measuring the Self-Concept</td>
<td></td>
</tr>
<tr>
<td>Relationship between Self-Concept and Academic Achievement</td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td></td>
</tr>
<tr>
<td>Measuring Attitudes</td>
<td></td>
</tr>
<tr>
<td>Relationship between Attitudes toward Mathematics and Academic Achievement</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>III. PROCEDURES FOR COLLECTING AND TREATING DATA</td>
<td>50</td>
</tr>
<tr>
<td>Description of Subjects and Research Site</td>
<td></td>
</tr>
<tr>
<td>Procedures for Collecting Data</td>
<td></td>
</tr>
<tr>
<td>Description of the Data Gathering Instruments</td>
<td></td>
</tr>
<tr>
<td>Statistical Treatment of the Data</td>
<td></td>
</tr>
<tr>
<td>IV. PRESENTATION AND ANALYSIS OF DATA</td>
<td>60</td>
</tr>
<tr>
<td>Hypotheses Involving Simple Correlation ($r$)</td>
<td></td>
</tr>
<tr>
<td>Hypotheses Involving Multiple Correlation ($R$)</td>
<td></td>
</tr>
<tr>
<td>Hypothesis Involving Simple Analysis of Variance</td>
<td></td>
</tr>
<tr>
<td>Discussion of Non-Hypothesized Data</td>
<td></td>
</tr>
<tr>
<td>Summary of Results</td>
<td></td>
</tr>
</tbody>
</table>
Chapter                  Page

V. SUMMARY, FINDINGS, CONCLUSIONS, AND CONCLUSIONS .......................... 93

Summary
Findings
Conclusions
Recommendations

APPENDIX .......................... 101

BIBLIOGRAPHY .......................... 107
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Intercorrelations among the Six Variables of the Study of Fifth-Grade Students</td>
<td>61</td>
</tr>
<tr>
<td>II. A Comparison between the Total Self-Concept Scores and the Total Achievement Scores in the Area of Arithmetical Computation</td>
<td>62</td>
</tr>
<tr>
<td>III. A Comparison between the Total Self-Concept Scores and the Total Achievement Scores in the Area of Arithmetical Concepts</td>
<td>63</td>
</tr>
<tr>
<td>IV. A Comparison between the Total Self-Concept Scores and the Total Achievement Scores in the Area of Arithmetical Application</td>
<td>64</td>
</tr>
<tr>
<td>V. A Comparison between the Total Attitude toward Mathematics Scores and the Total Achievement Scores in the Area of Arithmetical Computation</td>
<td>65</td>
</tr>
<tr>
<td>VI. A Comparison between the Total Attitude toward Mathematics Scores and the Total Achievement Scores in the Area of Arithmetical Concepts</td>
<td>67</td>
</tr>
<tr>
<td>VII. A Comparison between the Total Attitude toward Mathematics Scores and the Total Achievement Scores in the Area of Arithmetical Application</td>
<td>68</td>
</tr>
<tr>
<td>VIII. A Comparison between the Total Attitude toward Mathematics Scores and the Total Arithmetical Achievement Scores</td>
<td>69</td>
</tr>
<tr>
<td>IX. A Comparison between the Total Self-Concept Scores and the Total Arithmetical Achievement Scores</td>
<td>70</td>
</tr>
<tr>
<td>X. A Comparison between the Total Self-Concept Scores and Attitude toward Mathematics Scores</td>
<td>72</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>XI. A Comparison of the Simple and Multiple Correlations among Three Variables of Fifth-Grade Students</td>
<td>73</td>
</tr>
<tr>
<td>XII. A Comparison of the Simple and Multiple Correlations among Three Variables of Fifth-Grade Students</td>
<td>75</td>
</tr>
<tr>
<td>XIII. A Comparison of the Simple and Multiple Correlations among Three Variables of Fifth-Grade Students</td>
<td>76</td>
</tr>
<tr>
<td>XIV. A Comparison of the Simple and Multiple Correlations among Three Variables of Fifth-Grade Students</td>
<td>77</td>
</tr>
<tr>
<td>XV. A Simple Analysis of Variance of Total Arithmetic Achievement of Four Groups Based on SEI and LTAS Scores</td>
<td>79</td>
</tr>
<tr>
<td>XVI. Fisher's t Tests on the Differences between Means of Four Groups Based on SEI and LTAS Scores</td>
<td>81</td>
</tr>
<tr>
<td>XVII. The Comparison of the Mean, Standard Deviation, and Simple r's of Six Variables According to Sex of Subjects</td>
<td>83</td>
</tr>
<tr>
<td>XVIII. A Comparison of the Simple r's, Multiple R's, and F-Ratios According to Sex of Subjects</td>
<td>85</td>
</tr>
<tr>
<td>XIX. A Comparison of Parents' Attitude toward Mathematics As Reported by Students of Various Levels of Attitude</td>
<td>87</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Educators in elementary schools are concerned with the affective as well as the cognitive development of the student. There are, however, still too many teachers who give lip service to this concept but, in reality, are concerned solely with the students' intellectual development. Most educators would agree that the intellectual development of the child is a time-honored and appropriate goal for education; however, curriculum makers must also become sensitive to the existence of complementary affective goals that enable intellectual development to occur with more personal relevance for the child (1). Evidence suggests that a child's cognitive learning is proportionately related to the degree to which he is affectively inclined to learn (3, 5).

Presumably, the way one feels toward a subject--his acceptance or rejection, enthusiastic exploration or reluctant subjection to it--is most important in achieving results in it (2). Although teachers are rather generally aware that interest in a particular school subject is a major factor in success in that subject, they are less aware of the personality factors and generalized attitudes that are associated with patterns of success or failure in classroom learning. The constant association of negative attitudes with poor
achievement and positive attitudes with high achievement should convince teachers that consideration of attitude is an important factor in their daily planning.

Teachers cannot escape concern with the attitudes that children develop both in and out of school. The child's attitudes toward his playmates, teachers, parents, and school work and toward social customs and institutions are all related to his mental health. Behavior does not result from the intellect alone; it results from the individual's background of attitude patterns and experiences (7, p. 10). The child's attitudes affect what he learns, what he remembers, what he thinks, and what he does. Hence, evaluation of the child's attitudes or feelings for or against things assumes a fundamental role in guiding his development.

A crucial problem facing educators is the determination of reasons why some students are positively oriented toward academic pursuits while others of ostensibly comparable ability and background are negatively inclined (9). These differences in academic motivation may partially be attributed to differences in the self-concepts of individuals.

Of all the perceptions existing for an individual, none is so important as those he has about himself. The individual's self is the center of his world, the point of origin for all behavior (3). What one believes about himself affects every aspect of his life. Many people, unfortunately, are victims of the beliefs they hold about themselves.
Seeing themselves as inadequate, they tend to perform inadequately.

Inasmuch as the emphasis of education is primarily upon academic achievement, the study of factors which are thought to affect achievement should be a primary concern of educators. This concern is reflected in the amount of educational research which has centered around academic achievement with the hope of identifying those variables that enhance the individual's chances of achieving. It was the attempt in this study to ascertain the various relationships of self-concept and attitude toward mathematics to achievement in mathematics.

Statement of the Problem

The problem of this study was to ascertain the relationship of fifth-grade students' self-concepts and attitudes toward mathematics to academic achievement in the areas of arithmetical computation, concepts, and application.

Purposes of the Study

The purposes of this study were (a) to determine the relationship between self-concept and academic achievement in the areas of arithmetical computation, concepts, and application; (b) to determine the relationship between attitude toward mathematics and academic achievement in the areas of computation, concepts, and application; (c) to determine the combined relationship of self-concept and attitude toward mathematics to total arithmetical achievement and also to
achievement in the areas of arithmetical computation, concepts, and application; (d) to determine the relationship between attitude toward mathematics and total arithmetical achievement; and (e) to determine the relationship between self-concept and total arithmetical achievement.

Hypotheses

The scores of all subjects were used to test all hypotheses with the exception of Hypothesis X. To test this hypothesis only combinations of the upper-third and lower-third scores from the self-concept and attitude scales were used to form these four groups. There was a minimum of forty in each of these groups.

The following hypotheses were tested in this study:

I. There will be a substantially significant relationship between self-concept, as measured by the Self-Esteem Inventory (SEI), and the arithmetical achievement scores in the following areas, as measured by the Stanford Achievement Tests (SAT):
   A. Computation
   B. Concepts
   C. Application

II. There will be a substantially significant relationship between attitude toward mathematics, as measured by the Likert-Type Attitude Scale (LTAS), and the following areas of arithmetical achievement:
A. Computation
B. Concepts
C. Application

III. There will be a substantially significant relationship between attitude toward mathematics and total arithmetical achievement.

IV. There will be a substantially significant relationship between self-concept and total arithmetical achievement.

V. There will be a substantially significant relationship between self-concept and attitude toward mathematics.

VI. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical computation.

VII. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical concepts.

VIII. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical application.

IX. There will be a significant relationship of self-concept and attitude toward mathematics to total arithmetical achievement.

X. There will be no significant differences among the mean arithmetical achievement score of the following groups of students:
A. Those with scores on both the SEI and the LTAS within the upper-third of the total group.

B. Those with scores on both the SEI and the LTAS within the lower-third of the total group.

C. Those with SEI scores within the lower-third and LTAS scores within the upper-third of the total group.

D. Those with SEI scores within the upper-third and LTAS scores within the lower-third of the total group.

Significance of the Study

The importance of non-intellectual factors in academic achievement has long been discussed in educational circles. Two of these affective variables of academic achievement, the self-concept and attitude toward mathematics, were the subject of this study. Although these variables are generally assumed to be major factors in determining behavior, there has been relatively little research clarifying their significance at the elementary school level. This is certainly true of the three specific areas of mathematics achievement with which this study was concerned.

The measurement of self-concepts and attitudes has played a vital role in educational research. Educators tend to agree that these affective variables are important factors in the determination of how children respond, act, learn, and perform in school (3, 5, 7).

Originally, the inference was drawn that, if self-concept and attitude were found in this study to be substantially
related and significant as determinants of achievement in mathematics, then there would appear to be a need to develop and fully utilize instruments that measure these affective characteristics of students. Measurement of these variables should become a part of the school's testing and evaluation program and be made an intricate part of the students' cumulative records. There would also be a need for greater efforts in pre- and in-service training programs for teachers to assist them in developing a better understanding of the theories of the self-concept and various attitudes and their important role in learning.

Further significance was accorded this study since it represented basic research dealing with the relationship of one's self-concept and attitude toward mathematics to achievement. Insofar as could be ascertained, no other research study has been conducted to determine this relationship.

Definition of Terms

For the purposes of this study, the following terms were clarified:

1. **Attitude**—Although there is no standard definition, the term was used in this study as a learned, emotionally-toned predisposition, to react in a consistent way, favorable or unfavorable, toward a person, object, or idea. It was also a reference to the individual's own report of his feelings toward mathematics as measured by the *Likert-Type Attitude Scale* (L/TAS).
2. **Self-Concept**—Self-concept is a composite of self-percepts—a hypothetical construct, encompassing all of the values, attitudes, and beliefs toward one's self in relation to the environment (6). Sarbin (8) says the self is what the person is, while Combs (3) says the self-concept is what the individual thinks he is. These writers do agree that the self-concept should reflect the individual's feelings about himself. It was also a reference to the individual's own report of his feelings about himself as measured by the **Self-Esteem Inventory** (SEI).

3. **Academic Achievement**—For the purpose of this study the term was a reference to the results obtained from the **Stanford Achievement Tests** (SAT). Both total and partial scores from the arithmetic section were utilized. The partial scores were from the areas of arithmetical computation, concepts, and application.

4. **Arithmetical Application**—The use of this term was a reference to the area of verbal problem-solving.

5. **Substantially Significant**—Correlation coefficients as low as .19 are considered significant. In determining the significance of \( r \) coefficients in this study, Garrett's descriptive labels (4, p. 176) were used. These descriptive labels indicate that coefficients of correlation ranging from .00 to \( \pm .20 \) denote "indifferent or negligible" relationships; from \( \pm .20 \) to \( \pm .40 \) denote "low" relationships; from \( \pm .40 \) to
...denote "substantial or marked" relationships; and from 
\( \pm 0.70 \) to \( \pm 1.00 \) denote "high to very high" relationships. 

In this study, for an \( r \) to be substantially significant, the coefficient must be a minimum of \( \pm 0.40 \).

Limitations

This study was limited to the achievement area of mathematics. The study was limited to fifth-grade students in self-contained classrooms from a suburban school district located in the heart of a north central Texas metropolitan area. The school system is a typical district with the possible exception of its Negro population. Due to the geographical layout, the Negro population is restricted, resulting in a total of only twenty Negro students in a total district population of approximately 15,000 students. In an effort to generalize the results of this study to other schools, one would have to consider the type of program from which these findings come.

Assumptions

The basic assumptions of this study were (a) that the instruments employed for this study accurately assessed their respective variables, and (b) that each subject cooperated by responding to each item with candor.
CHAPTER BIBLIOGRAPHY


CHAPTER II

SURVEY OF RELATED LITERATURE

The primary purpose of this study was to determine the interrelationships of self-concept, attitudes toward mathematics, and academic achievement. The purpose of this chapter is to present the findings of the related literature in six sections. They are (a) self-concept, (b) measuring self-concepts, (c) self-concept and achievement, (d) attitudes, (e) measuring attitudes, and (f) attitudes and achievement.

Self-Concept

There have been an increasing number of studies relating to the broader area of self-concept in the past few years. Most of these studies have focused on secondary school students, and only recently has there been a concerted effort in respect to this subject at the elementary school level. Most of these investigations have centered on the disadvantaged youngster (21).

Many authors have shown concern about the effects of self-concept upon individuals. As one example, Combs (24) feels that thousands of people in society are victims of their own self-concepts. Seeing themselves as inadequate they perform inadequately. A positive view of self is
necessary for the individual in dealing with life and in bringing about his own successful living. Others agree with Combs on the importance of the self-concept to individuals (10, 62, 80, 87).

The implications of self-concept and the effect the self-image has upon a youngster have been disseminated to teachers in educational psychology courses for many years. With mental health statistics indicating increasing numbers of mental problems among youth, it seems imperative that emphasis be placed on the preventative rather than the curative components in the psychological field (31). The elementary school is fertile ground for action programs that enhance positive self-concepts. Individual teachers can play an important role in enabling the child to gain a more positive and realistic view of himself. Teachers should consider self-concept and attitude as important aspects of learning and development which the school, through its educational process, should seek to promote and foster in every child.

Gill (54), from his paper read at the annual meeting of the American Educational Research Association Convention, concluded by stating the following: "The results of this study support the conclusion with such convincing uniformity that the importance of the self-concept in the educational process seems to need more emphasis than is presently given to it."
Measuring the Self-Concept

During the last several years professional attention has been increasingly focused upon assessing the validity of non-intellectual traits (e.g., measures of interests, self-concept, achievement motivation, personal adjustment, etc.) as predictors of school success (22).

Numerous studies on the self-concept have been based on the assumption that evaluative statements made by the individual about himself are valid and reliable data (77). A statement by Strong and Feder summarizes this assumption: "Every evaluative statement that a person makes concerning himself can be considered a sample of his self-concept, from which inference may then be made about the various properties of that self-concept" (90, p. 170).

In a survey of the related literature, the self-concept is shown to be studied in various ways. The most popular technique of inferring this variable appears to be by means of a self-report of the individual (i.e., rating scales, Q-sorts, Semantic Differentials, etc.). Other techniques used include observations of the subjects' behavior and projective techniques. Although there have been varied approaches in attempting to assess the self-concept, all measurements of this construct include the ideas of desirability and undesirability (66).

An instrument to measure attitude toward self and
statements from clients at The University of Chicago Counseling Center, he developed a 101-item rating scale. More recently, however, there have been numerous other researchers who either constructed new instruments or utilized existing ones to infer their subjects' self-concepts.

Coopersmith (28) compared self-concepts, as measured by the Self-Esteem Inventory, with that estimated by observers, as measured by the Behavior Rating Form. Using children as subjects, he concluded that there are actually the following four types of self-concept: (a) what a person purports to have, (b) what he really has, (c) what he displays, and (d) what others believe he has.

Both Campbell (23) and Bledsoe (11) used self-report inventories to determine the influence of sex on the relationship between the self-concept and achievement. In the latter study Bledsoe used the Bledsoe Self-Concept Scale to infer the self-concepts of 271 fourth- and sixth-grade students. This scale consists of a check-list of thirty trait-descriptive objectives which the student checked as characteristic of himself "nearly always," "about half the time," or "just now and then." With similar objectives, Baum et al. (9) used the Self-Concept as Learner Scale to ascertain the influence of sex on this relationship.

Brownfain (20), in an adaptation of the rating scale, devised a means by which to determine the stability of the self-concept. On twenty-five words and phrases that describe
different areas of personality adjustment, the subject is instructed to rate himself, first with an optimistic outlook and second with a pessimistic one. The stability of the self-concept depends on the degree of congruence between the two ratings.

The **Self-Concept of Ability Scale**, a multiple-choice questionnaire to measure one's self-concept of ability as a learner, was devised by Brookover et al. (17). It is intended to tap facets of an individual's concept of his ability to achieve well academically.

Paschal (71) used the **Spivack Response Form** to appraise the self-esteem and self-rejection of 152 seventh-grade students. Using these scores, the students were classified as having adequate self-concept or inadequate self-concept.

In an attempt to study self-estimates of ability as a concomitant of academic performance, Bowen (14) developed the **Self-Estimate of Ability to Do School Work Scale**. The scale was based on self-concept theory and previous research on the use of self-estimates of ability, tried out, and used in the study to measure self-attitudes related to ability.

In an effort to determine differences between achievers' and underachievers' concept of themselves, Shaw et al. (84) used the **Sarbin Adjective Checklist**. By this method, the subject checks the appropriate adjectives or statements that describe himself or other persons being evaluated. This method is limited in that each item is treated in an all-or-
none fashion by the use of a check mark. There is no way of determining the degree of involvement that the items have for the individual (90).

The Piers and Harris study (75) was a systematic effort to develop and standardize a general self-concept instrument that could be used with children over a wide age range and to determine correlates of self-concept in children. Internal consistency and test-retest reliability coefficients were judged satisfactory, but continued refinement of the instrument was pledged.

The Q-sort is a different approach towards measuring the self-concept. The Q-sort is not so much an instrument as it is a technique. Cummins (30) and Strong and Fader (90) give a more extensive description of this method. Other investigators who have successfully used Q-sorts to measure self-concepts include Rogers and Dymond (80), Stephenson (88), Smith (86), and Perkins (73).

Using the Q-sort method and a pictorial test of self-esteem, Kish (60) investigated underachievement in a self-concept personality framework of forty boys from grades five through eight.

Generally speaking, self-concept measures have been found moderately stable over a period of time. This conclusion was supported by Engle’s study (45). In this study Engle administered a Q-sort to a group of sixth- and eighth-grade students in an attempt to determine their self-concept.
After two years, the same test was repeated to these students and a correlation of .78 was found between the first and second assessments.

Using the Semantic Differential to reveal self-insight, Fiedler et al. (49) found no significant relationship between the self-concept of young adults and their grade-point averages.

Perkins (73) inferred the self-concepts of his fourth-and fifth-grade students from their scores on the Jersild Q-Sort. Achievement scores in arithmetic, reading, language, and total achievement were obtained from the California Achievement Test.

Anecdotal observations were used in another investigation (67) in an attempt to identify those aspects of school life that lead to dissatisfaction, low achievement, and school dropout in students and faculty. Data gathered included questionnaires, observations, remarks made during group discussions, and diaries completed by subjects after each group session. From the data, these subjects were found to have very low self-esteem and readily found contempt and disrespect in their dealing with others, especially adults.

A less frequently used method of assessing the self-concept consists of having the subject respond to some projective technique such as the Rorschach Method or the Thematic Apperception Test. The latter test consists of a series of pictures. In response to seeing the pictures,
the subject is asked to tell (a) who the characters are, (b) what has happened to them before, (c) what is happening at the time the picture was taken, and (d) what the outcome will be.

Bolea et al. (13) developed an instrument, the Pictorial Self-Concept Scale, to measure self-concepts of children in kindergarten through grade four. The instrument was constructed from the children's statements about themselves. The scale has been successfully used in at least five other research projects.

Every evaluative statement that a person makes concerning himself can be considered a sample of his self-concept, from which inferences may then be made about the various properties of that self-concept (90). The major critics of self-reporting, however, believe that while the self-concept is what an individual believes about himself the self-report is only what he is willing and able to disclose to someone else (77). It is argued by Combs et al. (24) that what an individual believes and what he is willing to reveal are seldom, if ever, identical. In a related study (25) it was contended that the degree to which self-reports can be relied upon as an accurate assessment of the self-concept depends upon such factors as (a) the clarity of the subject's awareness, (b) his command of adequate symbols for expression, (c) the cooperation of the subject, (d) social expectancy, and (e) the individual's freedom from threat.
It is true that self-reports contain a host of contaminating variables, and educators should use these reports with great caution. However, in spite of their weaknesses and limitations, self-reports do reveal characteristics of the self and are important to teachers. Used sensitively in conjunction with other evidence, self-reports can give rich insights into how a child sees himself and his environment (77).

Relationship between Self-Concept and Academic Achievement

In surveying the related literature, an overwhelming majority of the research indicates a persistent and significant relationship between self-concept and academic achievement. A few studies, however, report no significant relationship between these two variables (73, 93, 49). The survey of research in this study, as well as research by Paussaint and Atkinson (72), bears out this contradiction.

Perkins (73) studied a group of fourth- and sixth-grade students over a six-month period to determine the relationship of self-concept and achievement. The California Achievement Tests were used to obtain achievement scores in language, reading, and arithmetic. The self-concepts were determined from the scores obtained from the Jersild Q-Sort. Although a significant increase in the self-concept was found, the increases in the three areas of achievement did not differ significantly from zero. The results of research
by Fiedler (49) and Turner and Vandelippe (93) parallel these findings.

In a thorough study completed recently, Purkey (77) found a strong and persistent relationship between the self-concept and academic achievement. Throughout the study there were overtones of deepening discontent with the notion that human ability is the overwhelming factor in academic success.

One of the most extensive research projects which points to the significant relationship between self-concept and academic achievement was conducted by Brookover et al. (16, 17, 18). The project was a six-year investigation to determine the relationship of self-concept of academic ability to school achievement. The study began when the subjects were in grade seven and continued as they progressed through grade twelve. Some of the important findings were as follows: (a) the reported self-concept of ability was significantly related to school achievement for boys and girls ($r = .57$ for both sexes); (b) self-concept of ability was significantly related to achievement even when measured I.Q. was controlled—this correlation, with I.Q. held constant, was $.42$ for boys and $.39$ for girls; (c) achievement in school is greatly influenced by the student's perception of his ability; and (d) the self-concept of ability is a better predictor of success in school than the general self-concept.

Fisher (52) investigated the effect of how one views himself as a student on problem-solving performance and how
performance on problem-solving tasks may be improved through an appropriate method of problem presentation. The study revealed that there is a difference in problem-solving performance between groups differing in academic self-concepts. Students with high academic self-concepts performed at significantly higher levels than those with low academic self-concepts, even when matched on I. Q. These results support the hypothesis that the functional limits of one's ability may be determined by one's academic self-concept.

Walsh (94) investigated the differences in self-concept between boys of above 120 I. Q. who were ranked in the lowest quarter of their class in academic achievement and a group of carefully matched normal achievers who ranked in the top half of their class. She ascertained their self-concepts from the data obtained by the Driskoll Playkit, which consisted of a facsimile of a six-room house, toy furniture, and a doll family (father, mother, boy, girl, and baby). Also, in determining their self-concepts, she used the stories concocted by the children from the incomplete stories given them to complete.

The findings of Walsh's study suggest that children who have come to feel that their freedom is restricted, that they cannot pursue their interests or express their feelings, and who do not feel close to their families may express these feelings by achieving far less than they are capable of accomplishing. In other words, Walsh found that underachievers
manifested inadequate and crippling self-concepts. Positive and negative self-concepts were found existing within the same groups.

In studying the self-reports of over 1,000 seventh-grade, white students in an urban school system, Brokover et al. (16) revealed the three following findings: (a) the student's concept of his ability in school is significantly and positively related to his academic performance; (b) there are specific concepts of ability which correspond to specific subject-matter areas and which differ from self-concept of general ability; and (c) the self-concept is significantly and positively correlated with the student's perception of how other significant people view his ability.

Bowen (14) found that scores on the Self-Estimate of Ability Scale were significantly and substantially correlated with grade-point average. This conclusion was supported by the findings of Paschal's study of 152 seventh-grade students (71).

In a population of fifth- and sixth-grade students, Coopersmith (28) found a definite correlation ($r = .36$) between self-concept and academic achievement. Children characterized by a low self-concept are usually more anxious and less well-adjusted and are less effective in groups and in the tasks of life as compared with a child possessing high self-esteem. The findings of Klausmeir and Check (61) and Ringness (79) tend to support the hypothesis that there is
a significant relationship between self-concept and achievement.

Parls (46), in a study involving intermediate-grade students, claimed that high-achieving boys and girls reported significantly higher self-concepts than low-achieving boys and girls.

In a similar study, Piers and Harris (75) found there was a significant relationship between self-concept and I. Q. as well as academic success. The relationship was found to be greater at the sixth-grade level than at the third grade.

Certain studies indicate that girls tend to rate themselves higher on self-esteem than do boys (7, 4, 11, 9). These and other investigators were interested in determining whether sex had any influence on the relationship of self-concept and achievement.

Bledsoe's study (11) was concerned with the self-concepts of 271 fourth- and sixth-grade students in relation to their intelligence, academic achievement, interests, and manifest anxiety. It was interesting to note there was a significant positive correlation between self-concept and academic achievement for boys but a non-significant correlation for girls.

In analyzing their studies, both Campbell (23) and Bledsoe (11) found that the correlation between self-concept and academic achievement appears quite significant for boys but less so for girls. The sex influence in this relationship
was noted primarily in the area of underachievement. Similar findings were noted in Baum's study (9).

The results of another study (51) appear to confirm the hypothesis that an adequate self-concept is related to high academic achievement and an inadequate self-concept is related to underachievement. Two groups of ninth-grade students were paired on the basis of achievement and underachievement. Three separate psychologists, using a miscellany of test data (California Psychological Inventory, Bender Visual-Motor Gestalt Test, Gough Adjective Checklist, Draw-a-Person Test, a brief student essay describing what they would be like in twenty years, and a personal data sheet), judged each student as adequate or inadequate. The combined ratings then revealed significant differences between achievers and underachievers, with the achievers being rated as far more adequate in their self-concepts. This hypothesis was accepted at the .001 level for boys and at the .01 level for girls.

A more recent study (50) was concerned with the prediction of academic success among high school students from junior high assessments of convergent and divergent thinking abilities along with selected personality and self-concept measures. It was concluded that the convergent variables, represented by the Sequential Test of Educational Progress and the School and College Ability Test, the self-ratings,
and the divergent measures of originality and flexibility are valuable predictor variables of senior high performance.

The findings of Kish (60), who investigated underachievement in a self-concept personality framework of forty boys from grades five through eight, supported the hypothesis that there is a significant relationship between how one perceives himself and academic success.

An interesting finding in a related study of Brookover et al. (18) was that while students who report inadequate self-concepts seldom achieve at above average levels some who esteem themselves highly do not show commensurate achievement in school. Other researchers (34, 74, 82) have not found the relationship between self-concept and academic achievement to be inevitable. This leads to the conclusion that a positive self-image of one’s academic ability is a necessary, but not sufficient, factor in determining academic success.

Judging by the results of research as revealed in this summary, there seems to be little doubt about the significance of the relationship between self-concept and academic achievement. However, as Purkey (77) points out, a great deal of caution is a must before assuming that self-concept determines academic performance or that academic performance shapes the self-concept. This relationship may well be determined by a yet undetermined variable. The best evidence research provides suggests that it is a two-way street, that there is
a continuous interaction between the self-concept and academic performance, and that each variable directly influences the other.

Attitudes

Logically speaking, successful people ought to appear to be satisfied and unsuccessful people dissatisfied, when queried about the conditions surrounding their achievements (57). Students who are achieving well in school may be expected to express dissatisfaction. Surprisingly, however, a survey of educational research did not provide a solid confirmation of this compelling expectation. Actually, an impressive amount of conflicting evidence has accumulated over the past several years regarding the relationship of scholastic success to attitudes toward schools (57).

During the past two decades, particularly, an impressive amount of professional literature has borne on attitudinal factors in the educative process. It has been asserted that such concern is pragmatically justified in the light of a logical relationship to such school phenomena as underachievement, failure, conduct problems, and drop-outs (15).

Educators are very much aware that attitude or an "emotionally-toned predisposition" is involved in the instruction process. Nonetheless, few educators have obtained research data on pupil attitudes toward mathematics (6).
Mager (64) says favorable attitudes toward school subjects maximize the possibility that a student will willingly learn more about the subject, remember what he has learned, and use what he has learned. Assuming that attitudes are crucial to learning, more emphasis on the development of favorable attitudes toward mathematics is needed since research reveals that there is a somewhat positive correlation between a student's attitude and his achievement in mathematics (56).

One of the major obstacles to the effective learning of mathematics is the negative attitude toward this subject which many students have acquired (56). In conjunction with this deplorable fact, the longitudinal study by Anttonen (5) produces convincing evidence that attitudes toward learning mathematics become increasingly negative as children ascend the academic ladder. The results of other studies verify Anttonen's findings (78, 35, 38). However, it was interesting to note that Stright (89) found evidence for a decline from the third- through the sixth-grade in the percentage of pupils expressing negative attitudes toward arithmetic.

The fact that an alarmingly large number of students possess negative attitudes toward mathematics must be acknowledged. Such students have a history of failure in mathematics; they usually feel threatened by this subject and, frequently, they are not even expected by their parents
or teachers to succeed in the subject. It has been shown, however, that attitudes of underachieving students can be improved and that such improvement will lead to improved performance (56).

It is generally recognized that attitudes toward mathematics in adults can be traced to childhood (69). Along these same lines, Fedon (48) found that some students have definite and relatively strong positive attitudes toward elementary school mathematics, while others will have definite and relatively strong negative attitudes about the subject as early as the third-grade. However, these attitudes tend to be more positive than negative in elementary school (89).

In a parallel study, Dutton (37) found that in attitude development the intermediate grades—fourth through sixth—were more influential. This seems reasonable since these are typically the elementary grades in which arithmetic is stressed most.

Faust (47), in studying more than 2,500 elementary school children, found that of the "skill subjects" they preferred arithmetic first. Another study with comparable findings was conducted by Brown and Abel (19).

Poffenberger and Norton (76) found in their study that the development of attitudes toward mathematics is a summatory with each conditioning experience building on the one that preceded it. They also found that initial attitudes
are developed in the home with the child's first contact with numerals as symbols. In a similar study conducted by Aiken and Dreger (3), these findings were verified.

Measuring Attitudes

Because attitudes are thought to be so important in influencing children's work in mathematics, considerable attention should be given to collecting data about children's attitudes so that teachers can provide for the development of positive feelings toward each aspect of mathematics (36). A survey of the educational literature bears out the significant role attitudes play in the teaching and learning of arithmetic.

In spite of the claim that there are actually no valid measures of attitudes toward mathematics (69), a number of techniques are available to the researcher. The techniques employed by Dutton (39, 40, 41) and others (48, 29) are representative methods used to measure and collect data on attitudes toward mathematics.

While there is no direct way to measure a student's attitude about anything, inferences may be made about an underlying attitude by observing what a person says and does in applicable situations. In their study, Corcoran and Gibb (29) describe several of these techniques. They are (a) observational methods, (b) interviews, and (c) self-report methods such as questionnaires, attitude scales, sentence completion, projective techniques, and content
analysis of essays. Attitudes toward specific courses or types of mathematics problems can be assessed, although the majority of investigations have dealt with attitudes toward mathematics in general.

The observed behavior of an individual would seem to be quite indicative of his attitudes, but research reveals that this assumption does not always hold true. Ellington (43) found a significant positive correlation between inventoried attitudes of 775 junior and senior high school students' and teachers' ratings of the students' attitudes toward mathematics. Contrary to this conclusion, Brown and Abel (19) found teachers' observations to be inadequate for appraising their students' attitudes toward mathematics.

Through observation, much of the students' development in the affective domain (e.g., his attitude toward mathematics) can be assessed. Methods for assessing attitudes other than teacher observation have been used in California. One of the simpler instruments is a mathematics ability check list (59). Another tool for assessing student attitudes, biases, and concerns is the attitude inventory (59). The construction and results of such an inventory will stimulate teachers to analyze themselves, the program, and the method.

Shapiro (33) used a semi-structured interview to ask a group of sixth-grade students how they felt about
mathematics. This would appear to be a fairly obvious approach to determine how one feels toward mathematics.

In surveying the educational research, the attitude scale seems to be the instrument most often used in assessing students' attitude. Of the various attitude scales, the Thurstone, Likert, and Guttman scales seem to be utilized most often.

On the Thurstone scale, each of a series of statements reflecting various degrees of positive and negative feelings toward something is given a scale value. The sum of the scale values of the statements which the respondent confirms would indicate his attitude. This scale and others are described in greater detail by Edwards (42).

Dutton's scale (39, 37) has probably been used more than any other scale to assess attitudes of prospective teachers and students toward mathematics. This scale consists of a variety of statements expressing negative and positive feelings toward arithmetic. Different statements of Dutton's scale assess attitudes toward various aspects of arithmetic. Although the scale was originally constructed to measure the attitudes of prospective teachers in the elementary school, it has been revised and effectively administered to children (35, 41). Fedon (48) points out in his study that at the level of grade three, children already have rather firm attitudes toward mathematics.
Guttman's scalogram analysis is another method for scaling attitudes but is utilized less frequently for measuring attitudes toward mathematics than are the more popular Thurstone and Likert techniques. This is probably because the Guttman scale procedure requires that the items to be scaled be on a single dimension, so that if the respondent endorses one item he will endorse all items having a lower scale value (2). Such a restriction would be more appropriate for cognitive items than for affective items such as attitude statements. In one longitudinal study, Anttonen (5) arranged ninety-four attitude scale items into fifteen Guttman-type scales. Using this scale, Anttonen examined the stability of mathematics attitude and its relationship to achievement from grades five and six to grades eleven and twelve.

Since Likert scales are usually easier to construct than the Guttman or Thurstone scales, they are utilized by many researchers interested in obtaining student attitudes toward mathematics. In Likert's method of summated ratings, the respondent indicates whether he strongly agrees, agrees, is undecided, disagrees, or strongly disagrees with each statement expressing positive or negative feelings toward something. Ratings are then assigned to each of the five responses. The subject's score is the total of the weights assigned to the particular response of each statement. High scores indicate a more favorable attitude toward the
particular topic, whereas a low score indicates a more negative feeling.

In an effort to assess attitudes toward mathematics on the part of prospective elementary teachers, Adams and Von Brock (1) devised a 35-item mathematics attitude scale based on the attitudinal levels of the Taxonomy of Educational Objectives: Affective Domain (12).

In their Likert-type scale, Dutton and Blum (41) used the strongest items from the earlier Dutton-Thurstone-type scale (39) and reworded them to make third-person statements. This scale will be described more extensively later in this study.

A type of questionnaire to measure attitudes toward mathematics and other school subjects was constructed by Kane (58). From English, mathematics, science, and social studies, college students were instructed to indicate which subject they (a) most enjoyed and found worthwhile in high school, (b) most enjoyed in college, (c) learned the most about in college courses, (d) would probably enjoy teaching, and (e) were probably most competent to teach. The extent to which mathematics was preferred over the other subjects indicated how they felt toward mathematics.

In an attempt to determine the attitudes of a group of college students toward mathematics, Dreger and Aiken (33) asked the students to respond to three questionnaire items with true or false.
The importance of attitudes as one aspect of the teaching and learning of arithmetic has been well established in educational literature. The findings of this survey of research also revealed that no instrument or technique designed to measure one's attitude was infallible. However, in spite of the weaknesses and limitations of the instruments, these reported approaches do reveal certain feelings students have toward mathematics that are important to teachers. Measures of attitude should be used sensitively and in conjunction with additional evidence.

Relationship between Attitudes toward Mathematics and Academic Achievement

Research tells that, for the most part, there is a positive correlation between a student's attitude and achievement in mathematics (56, pp. 55-56). With this in mind, Miller (68) claimed that a person's attitude can significantly affect the score he earns and certainly should be considered when interpreting results of achievement.

Despite substantial differences in populations and instruments, results from various studies (5, 81, 55) are generally consistent in obtaining positive correlations between attitudes toward mathematics and achievement in the .20 to .40 range. Aiken (2) reviewed more than ninety journal articles, doctoral dissertations, and reports of studies concerned with attitudes toward mathematics. Of these, however, only five were specifically concerned with
the relationship of attitude and achievement in elementary school mathematics.

In testing the hypothesis that mathematics attitudes are unrelated to specified "general personality" variables, Aiken and Dreger (3) administered the Math Attitude Scale to 310 college students. From the study it was found that attitudes toward mathematics were apparently related to intellectual factors and achievement but not to temperament variables.

It was clearly demonstrated in one study (19) that the relationship of attitudes, which are integrally related to expectations, to achievement appears to be especially important in mathematics learning. However, in most studies the correlations between attitudes and achievement in elementary school, although statistically significant in most cases, are usually not very high.

Anttonen (5) gathered data on 607 fifth- and sixth-graders in a longitudinal study extending from the spring of 1960 to the spring of 1966 when these same students were eleventh- and twelfth-graders. A main part of the study was to investigate the relationship of mathematics attitude scores to mathematics achievement over this six-year period. The study revealed consistently low positive correlations between elementary attitude scores and achievement in mathematics. Somewhat higher correlations were observed between the attitude and achievement of the students when they
reached the secondary grades. Achievement was also greater for those students whose attitudes had remained positive or had become more positive since the testing in elementary school.

Degnan (32) measured attitudes toward mathematics and anxiety in a group of twenty-two eighth-grade students who were classified as low and high achievers in mathematics. Even though it was found that high achievers had more positive attitudes toward mathematics than the low achievers, they were also characterized as generally more anxious than the underachievers.

Using a group of college students, Dutton (37) found indirect evidence of a relationship between their attitudes toward mathematics and the reported mathematics grades they received in elementary school.

In contrast to a later study by Jackson and Lahaderne (57), Baraheni (8) found significant positive relationships of success in mathematics to the attitudinal variables of satisfaction of reciprocated need for affection, popularity within the classroom, and intimacy of friendship. The later study suggests teachers tend to expect more satisfaction in accordance to achievement than actually exists.

Several studies were summarized in Trail's investigation (92). These dealt with the relationship of attitudes toward school or a specific subject matter and achievement and have found significant, although small, relationships.
It would appear as though attitude is an important variable in learning, but few instruments have been developed which adequately measure it in relation to a specific learning experience.

Educational studies that point to an empirical linkage between school failure and school dropouts, lead one to suspect that reduced effectiveness in school would be a natural concomitant of dissatisfaction among low-achieving students. These students might be unable, for one reason or another, to deal adequately with the scholastic material with which they might be confronted in a mathematics class (53).

In a related study, Brodie (15) presents evidence in support of the prediction that one would expect to find dissatisfaction among students who are unable to deal successfully with the subject matter students might encounter in a mathematics class. In his study, satisfied students generally out-performed dissatisfied students at a statistically significant level. From this study, it also appears that a negative attitude toward school would have a particularly inhibitory effect on those learnings which are emphasized in the classroom but would be less effective on learnings not as closely related with school and education in a formal sense.

The findings in Brodie's study contradict the conclusions of Getzels and Jackson (53). The latter investigation
examined the differences in psychological functioning and classroom effectiveness between two groups of adolescents—those who are satisfied with their school experiences and those who are dissatisfied. They found that indices of academic achievement failed to differentiate between satisfied and dissatisfied students.

In another study (19) it was revealed that the correlation between pupil attitude and achievement was higher for mathematics than it was for spelling, reading, or language. The student's general ability to learn seems to be associated with his liking for mathematics. The results of Faust's study (47) verified these findings.

It was interesting to note that Eilish (44) found a definite correlation between the attitude a student has toward the educational institution he attends and his academic performance at that institution.

The purpose of a study by Tenenbaum (91) was to determine to what extent attitudes expressed by children correlated with intelligence, achievement in school work, and proficiency marks in school. In this investigation it was found that intelligence, achievement in school subjects, and proficiency marks, both past and present, are not highly correlated with the child's attitude toward school, teachers, and classmates. These findings were supported by a similar study of 108 Brazilian fourth-grade students by Lindgren.
et al. (63). They found a positive but not significant correlation between attitudes and marks in mathematics.

A study by Malpass (65), which was exploratory in nature, set out to determine the relationships between students' perception of school and their achievement in school when mental ability was held constant. Results obtained were ambiguous. Little or no relationship existed between measures of perception and standardized achievement test scores, which are objective measurements of the cumulative effects of knowledge in particular subject matter. Significant relationships were found between measures of perception and end-of-semester grades, which are subjective evaluations of scholastic achievements predicated on the immediate effects of knowledge.

Finally, it was noted that Neale (70) found evidence that patience, compliance, and obedience are more important than attitudes as determinants of achievement in mathematics.

Summary

Several approaches to the measurement of self-concepts were discussed. In a survey of the research, the self-report technique was preferred by a great majority of the investigators. Rating scales, Q sorts, and the Semantic Differentials were the types of self-reports most often used.

In surveying the research concerning the correlation of the self-concept to academic achievement, the findings
were somewhat contradictory. Most investigators found a persistent and significant relationship while a few found no significant relationship between these two variables.

Although it was claimed that there were no valid instruments to measure attitudes toward mathematics, there was more counter-evidence that there are substantial techniques available to the interested researcher. It was acknowledged by most investigators that better instruments could and should be devised in order to assess more accurately one's true feelings toward mathematics. Although several instruments used in research are discussed, the survey of the literature revealed that none of the instruments or techniques was infallible. These measures should be used with caution and in conjunction with additional data.

If attitudes were not thought to affect achievement in some way, then, obviously, the assessment of attitudes toward mathematics would be of less concern. The relationship between attitudes and performance is certainly the consequence of a reciprocal influence, in that attitudes affect achievement and achievement in turn affects attitudes. In surveying the results of research on the relationship between attitudes and achievement in mathematics, these studies are not always consistent in their findings. They do, however, generally report low to moderate correlations between these variables.


46. Faris, R. J., "High and Low Achievement of Intellec-
tually Average Intermediate Grade Students Related to
the Self-Concept and Social Approval," unpublished
doctoral dissertation, School of Education, Indiana
University, Bloomington, Indiana, 1967.

47. Faust, Claire E., "A Study of the Relationship between
Attitude and Achievement in Selected Elementary
School Subjects," Dissertation Abstracts, State
University of Iowa, Ames, Iowa, 23 (1962), 2572-A.

48. Fedon, Peter, "The Role of Attitudes in Learning Arith-
metic," The Arithmetic Teacher, 5 (December, 1958),
304-310.

49. Fiedler, P. F. and others, "Interrelations among
Measures of Personality Adjustment in Nonclinical
Populations," Journal of Abnormal and Social Psy-
chology, 56 (August, 1958), 345-351.

50. Fieldhusen, John F., Donald J. Treffinger, and Robert
M. Elias, "Prediction of Academic Achievement with
Divergent and Convergent Thinking and Personality
Variables," Psychology in the Schools, 7 (January,

51. Fink, M. B., "Self-Concept As It Relates to Academic
Underachievement," California Journal of Educational

52. Fisher, Richard Irving, "The Effect of the Academic
Self-Concept and the Method Problem Solving Per-
formance," unpublished doctoral dissertation, School
of Education, University of Kansas, Lawrence, Kansas,
1969.

53. Getzels, J. W. and Philip W. Jackson, "A Study of Dis-
satisfaction with School among Adolescents," Journal
of Educational Psychology, 50 (March, 1959), 295-300.

54. Gill, M. P., "Pattern of Achievement as Related to the
Perceived Self," paper read at the annual meeting of
the American Educational Research Association Con-
vention, Los Angeles, 1969.

55. Husem, T. H., International Study of Achievement in


82. Schwarz, M. E., "The Effect of Teacher Approval on the Self-Concept and Achievement of Fourth, Fifth and Sixth-Grade Children: Case Studies of Seven Children and Seven Teachers," Dissertation Abstracts, University of Nebraska Teachers College, Lincoln, Nebraska, 28 (1967), 523-A.


CHAPTER III

PROCEDURES FOR COLLECTING AND TREATING DATA

This chapter contains a description of the subjects and research site, the procedures used for collecting data, a description of the data-gathering instruments, and the procedures for statistical treatment of the data.

Description of Subjects and Research Site

The subjects of this study comprised the entire fifth-grade population of students from a north central Texas public school district. This district, which encompasses four suburban communities, serves a forty square-mile area that is a predominantly white middle-class suburb and is adjacent to a city of over 400,000. Presently, the district is served by two senior high schools, five junior high schools, and thirteen elementary schools. The total student population for the 1970-71 academic year was just under 15,000.

In the final analysis, there were 1,110 fifth-grade students from whom data were obtained for this study. More specifically, there were 551 boys and 559 girls. There were forty-six classes located in thirteen schools. All classes were self-contained and a part of the elementary school organization.
The district might well be described as a composite one, since it includes persons from all levels of the economic ladder. The area is judged to be relatively stable, with the majority of its residents either engaged in professional work, local businesses, or industrial work in the surrounding metropolitan area. Since industry within the district is limited, the burden of financing the school's program falls largely upon the homeowners.

Procedures for Collecting Data

In the selection of subjects, the fifth-grade age group was chosen because it was felt that the personality presumably has been relatively well formed by this time, while the adolescent turmoil frequently noted in American society is not yet likely to have occurred.

The size of the sample is an extremely important determinant of the significance of the difference between means, for with increased sample size means tend to become a more stable representation of group performance (4). The larger the sample, the greater the confidence one can place in a relatively minor difference between the means. Whereas with an extremely small sample, one should be reluctant to place much confidence in even a large difference between two means. Therefore, it was determined to use the entire population of fifth-graders for this study.

The Stanford Achievement Tests (SAT) were administered in November, 1970. For the purpose of this study, the
results were made available upon request. All fifth-grade students who took the SAT in November were given the Likert-Type Attitude Scale (LTAS) (2) and the Self-Esteem Inventory (SEI) (1) at the same sitting. These tests were administered in early March of 1971. Both the SEI and the LTAS were administered to the fifth-graders of each school simultaneously in the cafeteria of the school.

One problem that has been underscored by users of self-report inventories at the elementary school level is the readability and interpretability of the instruments. By reading the directions and each item orally to the students, this problem was lessened. Other steps taken in an effort to make the results more reliable and valid were the following:

1. Sent a schedule of the planned testing time for each group to each fifth-grade teacher and requested that, if possible, no major quiz be given during the two or three days prior to the day the students were to be tested for self-concepts and attitudes.

2. Read uniform directions to each group.

3. Administered tests on Friday or late in the day.

Each teacher's participation in this study was on a voluntary basis. There was 100 per cent participation and the personnel of each school cooperated quite well.

Preliminary instructions were designed to minimize anxiety and to indicate that these tests were not related
to the students' academic work; that the tests were not
tests of achievement and would in no way affect the stu-
dents' grades and would certainly remain confidential. To
encourage honesty in the self-reports, the subjects were
assured that their responses would not be seen by their
teachers nor by anyone else connected with the schools
(including parents). Finally, the classroom teacher, or
any other school personnel, was not present during the ad-
ministration of either instrument.

The shorter LTAS was administered first, since the
longer SEI could possibly have had some influence on atti-
tudes if administered first. The subjects in each group
responded simultaneously to each orally read statement.
There was no time limit on either test.

Description of the Data Gathering Instruments

For the purpose of this study, three measures were ob-
tained. Dutton's Likert-Type Attitude Scale (LTAS) was
utilized to measure the students' attitudes toward mathe-
matics (2), while Coopersmith's Self-Esteem Inventory (SEI)
was used to infer their self-concept (1). The Stanford
Achievement Tests (SAT) were used to assess the students'
achievement in the areas of arithmetical computation, con-
cepts, and application.

The Likert-Type Attitude Scale (LTAS), one of the
first scales used to measure attitudes of students or
teachers toward mathematics was developed by Dutton and
was based on techniques of Thurstone (7). In addition to the Dutton-Thurstone-type scale, the Likert-type attitude scale had been used very sparingly in mathematics but quite extensively in psychology and the social sciences. The LTAS used in this study was developed by Dutton and Blum (2), in 1967.

The LTAS is composed of twenty-five third-person statements to which a subject may make five responses: strongly agree, agree, undecided, disagree, or strongly disagree. Ratings are then assigned to each of the five responses on the scale. For each positive statement five points are allowed for "strongly agree," four points for "agree," three points for "undecided," two points for "disagree," and one point for "strongly disagree." For the negative statements the scale values would be reversed. A neutral subject would have a total attitude index of 75; the strongest (positive) index would be 125; while the weakest (negative) index would be 25.

To prepare the LTAS, Dutton and Blum used the strongest items from the Dutton-Thurstone-type scale (1951) and reworded them to make third-person statements. Other items for the scale were secured by asking a variety of students from junior high school through college to take the Dutton scale and to list two things they disliked about new mathematics.
Items were then subjected to a series of tests devised by Thurstone (?). Each item on the scale was checked to see that it had only one main idea, that it had no ambiguities, that it was not too long, and that it would discriminate between positive and negative feelings. An equal number of positive and negative items were selected. After each item was typed on an index card, the cards were then shuffled, and the items were listed in random order. The scale was administered to a trial group and revised on the basis of the results. The reliability, as determined by the Spearman-Brown test-retest reliability coefficient formula, was 0.84.

The Self-Esteem Inventory (SEI). The SEI was developed by Coopersmith (1). It was constructed on the basis of items selected from the Rogers and Dyniond Scale (5) which were reworded for use with children. Several additional items were designed by Coopersmith. The entire battery was presented to five psychologists who sorted the items into two groups—those indicative of high self-esteem and those indicative of low self-esteem. Items that appeared to be ambiguous, repetitious, or about which there was disagreement were eliminated. The set of items was then tested for comprehensibility with a group of thirty children. The final inventory consisted of fifty items concerned with the students' perceptions in four areas: peers, parents, school, and self. Each item checked in the positive direction, such as an item designating high self-esteem checked in the "Like
Me" column or an item designating low self-esteem checked in the "Unlike Me" column, was worth two points. Only the total score was reported.

One of the problems of self-reporting is the question of whether a subject is distorting his responses, presenting an acceptable facade, or expressing a genuine statement of his views. A unique feature of the SSI is a built-in "Lie Scale." There are eight such items scattered throughout the SSI. The lie scale is to determine the validity of the results. Any paper with a score of less than eight on the lie scale items would be considered an unreliable one and the total paper would be questionable as to its worth. Therefore, such papers should be discarded.

The SSI was administered by Coopersmith, on a group basis, to two fifth- and sixth-grade classes. Five weeks later the SSI was readministered to one of the fifth-grade classes. The test-retest reliability, after a five-week interval with the sample of thirty fifth-grade children was 0.88. The test-retest reliability, after a three-year interval with a sample of fifty-six children from this same population, was 0.70.

The Stanford Achievement Tests (SAT). The SAT (1964 Revision) has three batteries which yield ten scores. They are word meanings, paragraph meanings, spelling, word-study skills, language, arithmetic computation, arithmetic concepts, arithmetic applications, social studies, and science.
Only the scores related to mathematics were used in this study.

The manual presents split-half reliability for each subtest and grade level. The coefficients are based on a random sampling of about 250 selected from as many as thirty-four school systems. Reliability coefficients range from 0.86 to 0.93. A reliability coefficient based on a comparison of the alternate form is not given.

The standardization sample school systems were selected from four geographic regions and five system types. The sample per grade ranged from a low of 3,352 students in grade nine to a high of 16,175 students in grade four. Grade nine was the only sample of less than 9,000 students. The tests may be interpreted in terms of modal-age grade norms, total-age grade norms, percentiles, and stanines. For the purposes of this study, raw scores were used.

Statistical Treatment of the Data

The data on all subjects were punched on IBM cards by the Data Processing Center of North Texas State University, Denton, Texas. The Center's computer then made the necessary computations. Standard statistical analysis of the collected data was used to determine the tenability of the hypotheses in the following manner:

1. The Pearson product-moment correlation coefficient formula (3, p. 143) was used to test Hypotheses I-(A, B, C); II-(A, B, C); III; IV; and V.
2. A Multiple Correlation (R) equation (6) was used to test Hypotheses VI, VII, VIII, and IX.

3. A Simple Analysis of Variance formula (6) was used to test Hypothesis X. When significant P values were found, the Fisher's t test (4) was used to determine the specific variance.

4. The tenability of each hypothesis was tested at the .05 level of significance.

5. In addition to being tested at the .05 level of significance, all r values were subjected to Garrett's descriptive labels. (See Definition of Terms.)
CHAPTER BIBLIOGRAPHY


The purpose of this study was to determine the interrelationships of self-concept, attitude toward mathematics, and arithmetical achievement in the areas of computation, concepts, and application. This chapter presents an analysis of the data which served as the basis for determining these various interrelationships. The concluding sections present discussions of non-hypothesized data along with the chapter summary.

The hypotheses were tested in the null form, but only Hypothesis X was stated initially in the null form. In addition to being tested at the .05 level of significance, all \( r \) values (Hypotheses I through V) were subjected to Garrett's descriptive labels. (See Definition of Terms.)

Hypotheses Involving Simple Correlation (\( r \))

The first four hypotheses deal with the simple correlations of the six variables mentioned earlier in this study and also noted in Table I. The intercorrelational data of these variables can be found by examining Table I. The data presented in this table give a comprehensive overview of the intercorrelations among these variables. More specific
information regarding these relationships is found in Tables II through IX.

### TABLE I

**INTERCORRELATIONS AMONG THE SIX VARIABLES OF THE STUDY OF FIFTH-GRADe STUDENTS**

<table>
<thead>
<tr>
<th>Variables**</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>0.31</td>
<td>0.25</td>
<td>0.29</td>
<td>0.28</td>
<td>0.31</td>
</tr>
<tr>
<td>2</td>
<td>0.31</td>
<td>1.00</td>
<td>0.28</td>
<td>0.30</td>
<td>0.29</td>
<td>0.33</td>
</tr>
<tr>
<td>3</td>
<td>0.25</td>
<td>0.28</td>
<td>1.00</td>
<td>0.60</td>
<td>0.62</td>
<td>0.83</td>
</tr>
<tr>
<td>4</td>
<td>0.29</td>
<td>0.30</td>
<td>0.60</td>
<td>1.00</td>
<td>0.79</td>
<td>0.89</td>
</tr>
<tr>
<td>5</td>
<td>0.28</td>
<td>0.29</td>
<td>0.62</td>
<td>0.78</td>
<td>1.00</td>
<td>0.91</td>
</tr>
<tr>
<td>6</td>
<td>0.31</td>
<td>0.33</td>
<td>0.83</td>
<td>0.89</td>
<td>0.91</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*All r's were significant at or beyond the .01 level.*

**1 - Self-concept  2 - Attitude  3 - Computation  4 - Concepts  5 - Application  6 - Total Achievement**

By examining Table I, it can be noted that all r values are significant at or beyond the .01 level of significance. However, the intercorrelations of the variables of arithmetical achievement are substantially significant. This is a very strong indication that when a student achieves well in one area he is likely to do so in the other areas. Conversely, if he performs poorly in one area, then he is likely to perform similarly in the other areas.

It was stated in Hypothesis I-A that there would be a substantially significant relationship between self-concept,
as measured by the Self-Esteem Inventory (SEI), and the achievement scores in the area of arithmetical computation, as measured by the Stanford Achievement Tests (SAT).

Table II contains the mean and standard deviation of each variable, as well as the correlation coefficient of these two variables ($r = .25$). The results showed that there was a positive relationship at both the .05 and .01 levels of significance.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>$r$</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-concept Arithmetical Computation</td>
<td>66.62</td>
<td>16.26</td>
<td>.25</td>
<td>.01</td>
</tr>
<tr>
<td>N = 1110</td>
<td>18.44</td>
<td>6.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After subjecting the $r$ value to the criterion of Garrett's descriptive labels, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis I-A was rejected.

Although the research Hypothesis I-A was rejected, there was a "low" relationship between self-concept and achievement in the area of arithmetical computation. This
indicates that knowing a student's self-concept might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical computation.

It was stated in Hypothesis I-B that there would be a substantially significant relationship between self-concept, as measured by the SSI, and the achievement scores in the area of arithmetical concepts, as measured by the SAT. Table III contains the mean and standard deviation of each variable, as well as the correlation coefficient of these two variables ($r = .29$). The results showed that there was a positive relationship at both the .05 and .01 levels of significance. After subjecting the $r$ value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis I-B was rejected.

**TABLE III**

A COMPARISON BETWEEN THE TOTAL SELF-CONCEPT SCORES AND THE TOTAL ACHIEVEMENT SCORES IN THE AREA OF ARITHMETICAL CONCEPTS

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>$r$</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-concept</td>
<td>60.62</td>
<td>16.26</td>
<td>.29</td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Concepts</td>
<td>16.52</td>
<td>6.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$N = 1110$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Although the research Hypothesis I-B was rejected, there was a "low" relationship between self-concept and achievement in the area of arithmetical concepts. This indicates that knowing a student's self-concept might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical concepts.

**TABLE IV**

A COMPARISON BETWEEN THE TOTAL SELF-CONCEPT SCORES AND THE TOTAL ACHIEVEMENT SCORES IN THE AREA OF ARITHMETICAL APPLICATION

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>( r )</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-concept</td>
<td>63.62</td>
<td>16.26</td>
<td>.28</td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Application</td>
<td>16.78</td>
<td>6.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 1110)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It was stated in Hypothesis I-C that there would be a highly significant relationship between self-concept, as measured by the SSI, and the achievement scores in the area of arithmetical application, as measured by the SAT. Table IV contains the mean and standard deviation of each variable, as well as the correlation coefficient of these two variables (\( r = .28 \)). The results showed that there was a positive relationship at both the .05 and .01 levels of significance. After subjecting the \( r \) value to the criterion
of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis I-C was rejected.

Although the research Hypothesis I-C was rejected, there was a "low" relationship between self-concept and achievement in the area of arithmetical application. This indicates that knowing a student's self-concept might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical application.

TABLE V
A COMPARISON BETWEEN THE TOTAL ATTITUDE TOWARD MATHEMATICS SCORES AND THE TOTAL ACHIEVEMENT SCORES IN THE AREA OF ARITHMETICAL COMPUTATION

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>F</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward Mathematics</td>
<td>93.11</td>
<td>15.41</td>
<td>.28</td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Computation</td>
<td>18.44</td>
<td>6.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 1110)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis II-A stated that there would be a substantially significant relationship between attitude toward mathematics, as measured by the LTAS, and the achievement scores in the area of arithmetical computation, as measured by the SAT. Table V contains the mean and standard deviation
of each variable, as well as the correlation coefficient of these variables ($r = .28$). The results showed that there was a positive relationship at both the .05 and .01 levels of significance. After subjecting the $r$ value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis II-A was rejected.

Although the research Hypothesis II-A was rejected, there was a "low" relationship between attitude toward mathematics and achievement in the area of arithmetical computation. This indicates that knowing a student's attitude toward mathematics might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical computation.

Hypothesis II-B predicted a substantially significant relationship between attitude toward mathematics, as measured by the LTAS, and the achievement scores in the area of arithmetical concepts, as measured by the SAT. Table VI contains the mean and standard deviation of both variables, as well as a correlation coefficient for the variables ($r = .30$). The results showed that there was a significant positive relationship at both the .05 and .01 levels of significance. After subjecting the $r$ value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially
significant. Thus, the research Hypothesis II-B was rejected.

**TABLE VI**

A COMPARISON BETWEEN THE TOTAL ATTITUDE TOWARD MATHEMATICS SCORES AND THE TOTAL ACHIEVEMENT SCORES IN THE AREA OF ARITHMETICAL CONCEPTS

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>$r$</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward Mathematics</td>
<td>93.11</td>
<td>15.41</td>
<td>.30</td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Concepts</td>
<td>16.59</td>
<td>6.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 1110)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Although the research Hypothesis II-B rejected, there was a "low" relationship between attitude toward mathematics and achievement in the area of arithmetical concepts. This indicates that knowing a student's attitude toward mathematics might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical concepts.

Hypothesis II-C predicted a substantially significant relationship between attitude toward mathematics, as measured by the LTAS, and the achievement scores in the area of arithmetical application, as measured by the SAT. Table VII contains the mean and standard deviation of both variables,
as well as the correlation coefficient for the two variables ($r = .29$). The results did show that there was a significant positive relationship at both the .05 and .01 levels of significance. After subjecting the $r$ value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis II-C was rejected.

### TABLE VII

A COMPARISON BETWEEN THE TOTAL ATTITUDE TOWARD MATHEMATICS SCORES AND THE TOTAL ACHIEVEMENT SCORES IN THE AREA OF ARITHMETICAL APPLICATION

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>$r$</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward Mathematics</td>
<td>93.11</td>
<td>15.41</td>
<td>.29</td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Application</td>
<td>16.78</td>
<td>6.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

($N = 1110$)

Although the research Hypothesis II-C was rejected, there was a "low" relationship between attitude toward mathematics and achievement in the area of arithmetical computation. This indicates that knowing a student's attitude toward mathematics might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of arithmetical application.
Hypothesis III stated that there would be a substantially significant relationship between attitudes toward mathematics, as measured by the LIAS, and total arithmetical achievement, as measured by the SAT. An examination of Table VIII will reveal the mean and standard deviation of both variables, as well as the correlation coefficient for the two variables ($r = .33$). The results showed that there was a positive relationship at both the .05 and .01 levels of significance. After subjecting the $r$ value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis III was rejected.

**TABLE VIII**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>$r$</th>
<th>Level Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward Mathematics</td>
<td>93.11</td>
<td>15.41</td>
<td>.33</td>
<td>.01</td>
</tr>
<tr>
<td>Total Arithmetical Achievement</td>
<td>51.78</td>
<td>17.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 1,110)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Although the research Hypothesis III was rejected, there was a "low" relationship between attitude toward
mathematics and total arithmetical achievement. This indicates that knowing a student's attitude toward mathematics might be somewhat useful, but not highly reliable, in predicting his academic performance in overall area of mathematics.

TABLE IX

A COMPARISON BETWEEN THE TOTAL SELF-CONCEPT SCORES AND THE TOTAL ARITHMETICAL ACHIEVEMENT SCORES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Scores</th>
<th>Standard Deviation</th>
<th>r</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-concept</td>
<td>60.62</td>
<td>16.25</td>
<td>.31</td>
<td>.01</td>
</tr>
<tr>
<td>Total Arithmetical</td>
<td>51.78</td>
<td>17.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement (N = 1110)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis IV stated that there would be a substantially significant relationship between self-concept, as measured by the SEI, and total arithmetical achievement, as measured by the SAT. Table IX contains the mean and standard deviation of both variables, as well as the correlation coefficient for the two variables (r = .31). The results revealed that there was a significant positive relationship at both the .05 and .01 levels of significance. After subjecting the r value to the criterion of Garrett's descriptive labels, however, the relationship of these two
variables is not interpreted as being substantially significant. Thus, the research Hypothesis IV was rejected.

Although the research Hypothesis IV was rejected, there was a "low" relationship between self-concept and total arithmetical achievement. This indicates that knowing a student's self-concept might be somewhat useful, but not highly reliable, in predicting his academic performance in the area of mathematics.

It is interesting to note that a comparison of the correlation coefficients (r's) in Tables VIII and IX reveals that the relationship of self-concept and achievement is slightly lower than that of attitude toward math and achievement in that subject.

In Hypothesis V it was stated that there was a substantially significant relationship between self-concept, as measured by the SEI, and attitude toward mathematics, as measured by the LTAS. Table X presents the correlational data which include the mean and standard deviation of both variables, as well as the correlation coefficient for the two variables (r = .31). The results showed that there was a positive relationship at both the .05 and .01 levels of significance. After subjecting the r value to the criterion of Garrett's descriptive labels, however, the relationship of these two variables is not interpreted as being substantially significant. Thus, the research Hypothesis V was rejected.
Although the research Hypothesis V was rejected, there was a "low" relationship between self-concept and attitude toward mathematics. This indicates that when one has a good concept of himself he would tend to display a favorable attitude toward mathematics. This relationship is certainly not inevitable. It is conceivable that one could have a very good self-image and, at the same time, possess a very negative attitude toward mathematics. This could also work in reverse. From the data in Table X, however, one's self-concept and attitude tend to be somewhat related.

Hypotheses Involving Multiple Correlation (R)

A means of further analyzing the data may be done by ascertaining the relationship between each dependent variable and a combination of two or more independent variables considered simultaneously. The extent of such a relationship may be determined through a procedure of multiple correlation.
Through this procedure a coefficient ($R$) was computed and its significance was determined by the $F$-ratio. As can be noted in Tables XII through XIV, the multiple correlation coefficient is not a sum of the relationship between one variable and several others. Often one can strengthen the relationship between a dependent variable and several independent (predictor) variables by computing an $R$.

**Table XI**

A Comparison of the Simple and Multiple Correlations Among Three Variables of Fifth-Grade Students

<table>
<thead>
<tr>
<th>Relationship of Variables</th>
<th>Coefficients</th>
<th>$F$</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetical Computation vs Self-concept</td>
<td>.25</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Computation vs Attitude toward Mathematics</td>
<td>.28</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Computation vs Self-concept and Attitude toward Mathematics</td>
<td>.32</td>
<td>48.73</td>
<td>.01</td>
</tr>
</tbody>
</table>

(Hypothesis VI predicted a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical computation. Table XI reveals that the simple coefficient of correlation between self-concept and arithmetical computation is .25, as compared to
.29 between attitudes toward mathematics and arithmetical computation. Also, Table XI contains a multiple R of .32, which is significant at or beyond both the .05 and .01 levels of significance. An F-ratio of 3.00 is necessary for an R to attain significance at the .05 level, whereas significance at the .01 level would require an F-ratio of 4.61. Thus, the research Hypothesis VI was retained and the null hypothesis was rejected.

The retention of research Hypothesis VI means that the relationship between the combined independent variables and the dependent variable resulted in a multiple R that was somewhat stronger than the simple r between the dependent variable (arithmetical computation) and either criterion variable (self-concept or attitude toward mathematics).

Hypothesis VII stated that there was a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical concepts. Table XII reveals that the simple coefficient of correlation between self-concept and arithmetical concepts is .29, as compared to .30 between attitude toward mathematics and arithmetical concepts. Table XII also contains a multiple R of .36 between arithmetical concepts and a combination of self-concept and attitude toward mathematics. This relationship is significant at or beyond the .001 level of significance. An F-ratio of 3.00 is necessary for an R to obtain significance at the .05 level, whereas significance
at the .01 level would require an F-ratio of 4.61. Thus, the research Hypothesis VII was retained and the null hypothesis was rejected.

**TABLE XII**

A COMPARISON OF THE SIMPLE AND MULTIPLE CORRELATIONS AMONG THREE VARIABLES OF FIFTH-GRADE STUDENTS

<table>
<thead>
<tr>
<th>Relationship of Variables</th>
<th>Coefficients</th>
<th>F</th>
<th>P</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetical Concepts vs Self-concept</td>
<td>.29</td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Concepts vs Attitude toward Mathematics</td>
<td>.30</td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Concepts vs Self-concept and Attitude toward Mathematics</td>
<td>.36</td>
<td>33.76</td>
<td>.001</td>
<td></td>
</tr>
</tbody>
</table>

(d.f. = 2, 1107)

The retention of research Hypothesis VII indicates that the relationship between the combined independent variables and the dependent variable resulted in a multiple R that was stronger than the simple r between the dependent variable (arithmetical concepts) and either criterion variable (self-concept or attitude toward mathematics).

It was predicted in Hypothesis VIII that there would be a significant relationship of self-concept and attitudes toward mathematics to achievement in the area of arithmetical
application. Table XIII reveals that the simple coefficient of correlation between self-concepts and arithmetical application is .28, as compared to .29 between attitude toward mathematics and arithmetical application. Table XIII also contains a multiple correlation (R) of .35 between arithmetical application and a combination of self-concept and attitude toward mathematics. This relationship is significant at the .001 level of significance. An F-ratio of 3.00 is necessary for an R to obtain significance at the .05 level, whereas significance at the .01 level would require an F-ratio of 4.61. Thus, the null hypothesis was rejected and the research hypothesis VIII was retained and considered true.

TABLE XIII

A COMPARISON OF THE SIMPLE AND MULTIPLE CORRELATIONS AMONG THREE VARIABLES OF FIFTH-GRADE STUDENTS

<table>
<thead>
<tr>
<th>Relationship of Variables</th>
<th>Coefficients</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arithmetical Application vs Self-concept</td>
<td>.28</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Application vs Attitude toward Mathematics</td>
<td>.29</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Arithmetical Application vs Self-concept and Attitude toward Mathematics</td>
<td>.35</td>
<td>76.27</td>
<td>.001</td>
</tr>
<tr>
<td>(d.f. = 2, 107)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The acceptance of research Hypothesis VIII means that the relationship between the combined independent variables and the dependent variable resulted in a multiple $R$ that was quite stronger than the simple $r$ between the dependent variable (arithmetical application) and either criterion variable (self-concept or attitude toward mathematics).

TABLE XIV

A COMPARISON OF THE SIMPLE AND MULTIPLE CORRELATIONS AMONG THREE VARIABLES OF FIFTH-GRADE STUDENTS

<table>
<thead>
<tr>
<th>Relationship of Variables</th>
<th>Coefficients</th>
<th>$F$</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Arithmetical Achieve-ment vs Self-concept</td>
<td>.31</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Total Arithmetical Achieve-ment vs Attitude toward Mathematics</td>
<td>.33</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>Total Arithmetical Achieve-ment vs Self-concept and Attitude toward Mathematics (d.f. = 2, 1107)</td>
<td>.39</td>
<td>99.23</td>
<td>.001</td>
</tr>
</tbody>
</table>

It was stated in Hypothesis IX that there would be a significant relationship of self-concept and attitude toward mathematics to total arithmetical achievement. An examination of Table XIV reveals that the simple coefficient of correlation between self-concept and total arithmetical
achievement is .31, as compared to .33 between attitude toward mathematics and total arithmetical achievement. This implies that attitude is somewhat higher related to total arithmetical achievement than is self-concept.

Table XIV also contains a multiple R of .39 between total arithmetical achievement and a combination of self-concept and attitude toward mathematics. This relationship is significant at and beyond the .001 level of significance. An F-ratio of 3.00 is necessary for an R to obtain significance at the .05 level, whereas significance at the .01 level would require an F-ratio of 6.61. Accordingly, the research Hypothesis IX was retained, whereas the null hypothesis was rejected.

The retention of the research Hypothesis IX means that the relationship between the combined independent variables and the dependent variable resulted in a multiple R that was much stronger than the simple r between the dependent variable (total arithmetical achievement) and either criterion variable (self-concept or attitude toward mathematics).

Hypothesis Involving Simple Analysis of Variance

Research Hypothesis X predicted no significant differences among the mean arithmetical achievement scores of four groups of students. Students were selected for the various groups on the basis of their scores on the SEI and WEAS. These grouping criteria were as follows:
1. Group One—those with scores on both the SEI and LTAS within the upper third of the total group.

2. Group Two—those with SEI scores within the upper third and LTAS scores within the lower third of the total group.

3. Group Three—those with SEI scores within the lower third and LTAS within the upper third of the total group.

4. Group Four—those with scores on both the SEI and the LTAS within the lower third of the total group.

An examination of Table XV reveals the analysis of variance summary for mean achievement scores among these four groups. The magnitude of $F$ tends to increase as the differences among the group means increase; therefore, the large $F$-ratio of 55.82 certainly indicates there are significant differences among the mean achievement scores of the four groups.

TABLE XV

A SIMPLE ANALYSIS OF VARIANCE OF TOTAL ARITHMETICAL ACHIEVEMENT OF FOUR GROUPS BASED ON SEI AND LTAS SCORES

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sums of Squares</th>
<th>d.f.</th>
<th>Mean Square</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>43034.82</td>
<td>3</td>
<td>14351.61</td>
<td>55.82*</td>
</tr>
<tr>
<td>Within groups</td>
<td>12751.38</td>
<td>496</td>
<td>257.09</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>170571.20</td>
<td>499</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at or beyond the .01 level.
Contrary to the prediction of research Hypothesis X, the F test refutes the null hypothesis and demonstrates the existence of significant mean differences between two or more of the four groups which cannot be explained by chance.

Although the over-all hypothesis of equal means was rejected by the analysis of variance, this is not to say that every group mean differs significantly from every other group mean. Rather, this rejection of Hypothesis X indicates that at least one group mean differs significantly from one other group mean.

An examination of the data recorded in Table XVI reveals that there were significant differences among the mean achievement scores of the four groups of students. These data were subjected to the Fisher's t test for testing the significance of the difference between pairs of means. Table XVI also contains the mean, standard deviation, Fisher's t, and the level of significance of all possible comparisons between pairs of means.

In utilizing the mean and standard deviation of all possible comparisons between pairs of group means, a Fisher's t test reveals that there were significant differences among the mean achievement scores of all possible combinations of pairs of means, with the exception of Group Two and Group Three. Table XVI shows that the means of Group Two (53.32) and Group Three (51.94) do not differ significantly. All other group means differ at the .001 level of significance.
As presented in Table XVI, the greatest difference in group means was between Group One (62.93) and Group Four (40.84). Group One consisted of students with scores on both the SEI and LTAS within the upper third of the total group, whereas Group Four was comprised of students with scores on both the SEI and LTAS within the lower third of the total group.

**TABLE XVI**

**FISHER'S t TESTS ON THE DIFFERENCES BETWEEN MEANS OF FOUR GROUPS BASED ON SEI AND LTAS SCORES**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.D.</th>
<th>t</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>62.93</td>
<td>53.32</td>
<td>15.58</td>
<td>17.77</td>
<td>4.13</td>
<td>.001</td>
</tr>
<tr>
<td>1 - 3</td>
<td>62.93</td>
<td>51.94</td>
<td>15.58</td>
<td>14.99</td>
<td>5.10</td>
<td>.001</td>
</tr>
<tr>
<td>1 - 4</td>
<td>62.93</td>
<td>40.84</td>
<td>15.53</td>
<td>16.25</td>
<td>12.92</td>
<td>.001</td>
</tr>
<tr>
<td>2 - 3</td>
<td>53.32</td>
<td>51.94</td>
<td>17.77</td>
<td>14.99</td>
<td>0.52</td>
<td>N.S.</td>
</tr>
<tr>
<td>2 - 4</td>
<td>53.32</td>
<td>40.84</td>
<td>17.77</td>
<td>16.25</td>
<td>5.20</td>
<td>.001</td>
</tr>
<tr>
<td>3 - 4</td>
<td>51.94</td>
<td>40.84</td>
<td>14.99</td>
<td>16.25</td>
<td>5.20</td>
<td>.001</td>
</tr>
</tbody>
</table>

As shown in a study of Table XVI, the least desirable combination of scores on the SEI and LTAS, as achievement in mathematics is concerned, would be a low score on both instruments (Group Four). On the other hand, the most desirable combination would be a high score on both assessments (Group One). Students with high scores on the SEI and low
scores on the LTAS (Group Two) tended to achieve higher than did those scoring high on the LTAS but low on the SET. These findings certainly concur with the hypothesis that there is a positive relationship between attitude toward mathematics and self-concept to arithmetical achievement.

Discussion of Non-Hypothesized Data

Although it was not hypothesized, the data gathered in this study were subjected to the product-moment correlation formula and analyzed to determine what influence, if any, sex had upon mean scores on self-concept, attitudes, and areas of arithmetical achievement. Table XVII presents a comparison of the mean, standard deviation, and simple r's of the six variables of this study according to subjects' sex.

A thorough study of Table XVII reveals some interesting findings. For example, the correlation coefficients for boys were all higher than for the girls, with the exception of self-concepts vs attitudes (boys' $r = .30$, whereas girls' $r = .37$). Three correlation coefficients were notably higher for boys than girls. They were (a) self-concepts vs arithmetical application, (b) attitudes vs arithmetical application, and (c) attitudes vs total achievement.

Contrary to findings reported earlier in the survey of related literature, boys tended to rate themselves slightly higher on self-concept than did the girls (61.51 to 59.75).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Sex</th>
<th>Mean</th>
<th>Mean</th>
<th>S.D.</th>
<th>S.D.</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-concepts vs Arithmetical Computation</td>
<td>M</td>
<td>61.31</td>
<td>17.43</td>
<td>15.62</td>
<td>6.81</td>
<td>.27</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>59.75</td>
<td>19.44</td>
<td>16.83</td>
<td>6.31</td>
<td>.22</td>
</tr>
<tr>
<td>Self-concepts vs Arithmetical Concepts</td>
<td>M</td>
<td>61.51</td>
<td>16.72</td>
<td>15.62</td>
<td>6.44</td>
<td>.30</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>59.75</td>
<td>16.47</td>
<td>16.83</td>
<td>6.30</td>
<td>.28</td>
</tr>
<tr>
<td>Self-concepts vs Arithmetical Application</td>
<td>M</td>
<td>61.71</td>
<td>16.80</td>
<td>15.62</td>
<td>7.24</td>
<td>.33</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>59.75</td>
<td>16.72</td>
<td>16.54</td>
<td>6.67</td>
<td>.23</td>
</tr>
<tr>
<td>Attitudes vs Arithmetical Computation</td>
<td>M</td>
<td>92.76</td>
<td>17.43</td>
<td>15.66</td>
<td>6.81</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>93.45</td>
<td>19.44</td>
<td>14.72</td>
<td>6.31</td>
<td>.24</td>
</tr>
<tr>
<td>Attitudes vs Arithmetical Concepts</td>
<td>M</td>
<td>92.76</td>
<td>16.72</td>
<td>16.04</td>
<td>7.24</td>
<td>.34</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>93.45</td>
<td>16.47</td>
<td>14.72</td>
<td>6.30</td>
<td>.28</td>
</tr>
<tr>
<td>Attitudes vs Arithmetical Application</td>
<td>M</td>
<td>92.76</td>
<td>16.77</td>
<td>15.86</td>
<td>7.24</td>
<td>.34</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>93.45</td>
<td>16.80</td>
<td>14.72</td>
<td>6.67</td>
<td>.23</td>
</tr>
<tr>
<td>Attitudes vs Total Achievement</td>
<td>M</td>
<td>92.76</td>
<td>50.35</td>
<td>16.83</td>
<td>13.64</td>
<td>.37</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>93.45</td>
<td>52.70</td>
<td>14.72</td>
<td>17.57</td>
<td>.29</td>
</tr>
<tr>
<td>Self-concepts vs Total Achievement</td>
<td>M</td>
<td>61.51</td>
<td>50.45</td>
<td>15.62</td>
<td>18.04</td>
<td>.33</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>59.75</td>
<td>52.70</td>
<td>18.89</td>
<td>17.27</td>
<td>.28</td>
</tr>
<tr>
<td>Self-concepts vs Attitudes</td>
<td>M</td>
<td>61.51</td>
<td>92.76</td>
<td>15.84</td>
<td>14.74</td>
<td>.28</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>59.75</td>
<td>93.45</td>
<td>16.68</td>
<td>14.72</td>
<td>.24</td>
</tr>
</tbody>
</table>
However, the girls rated themselves higher on attitudes toward mathematics than did the boys (93.45 to 92.76). A cursory examination of the mean scores in Table XVII reveals that girls scored higher in all areas of arithmetical achievement, with the exception of arithmetical concepts, and this was very slight (16.47 to 16.72). Since the girls scored higher on attitude and achievement, this indicates that attitude toward mathematics might be more useful than self-concept in forecasting arithmetical achievement.

For the boys in this study, the strength of the relationship between each criterion and predictor variables was increased by computing a multiple R. Table XVIII shows that by computing a multiple R for the boys, a substantially significant relationship was revealed in three of the four R's. Only the relationship between attitude toward mathematics self-concept to achievement in arithmetical computation was not substantially significant. As was true for the simple r's, without exception, the R's computed for boys were much higher than those for the girls.

The most significant difference in R's by sex occurred in the relationship of attitude and self-concept to arithmetical application. For this relationship, an R of .42 was computed for the boys while an R of only .28 was revealed for the girls. This means that having knowledge of a boy's measured self-concept and attitude toward mathematics would be more useful than having the same knowledge of a girl's
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>Males (551)</th>
<th></th>
<th></th>
<th>Females (559)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coefficients</td>
<td>F</td>
<td>Significance</td>
<td>Coefficients</td>
<td>F</td>
<td>Significance</td>
</tr>
<tr>
<td>Arith. Computation</td>
<td>Self-concept</td>
<td>.27</td>
<td>.36</td>
<td>4.055</td>
<td>.01</td>
<td>.25</td>
<td>30</td>
</tr>
<tr>
<td>and Attitude</td>
<td></td>
<td>.31</td>
<td>.01</td>
<td>.24</td>
<td>.01</td>
<td>.30</td>
<td>27.69</td>
</tr>
<tr>
<td>Arith. Concepts</td>
<td>Self-concept</td>
<td>.30</td>
<td>.40</td>
<td>51.31</td>
<td>.001*</td>
<td>.28</td>
<td>.33</td>
</tr>
<tr>
<td>and Attitude</td>
<td></td>
<td>.34</td>
<td>.01</td>
<td>.26</td>
<td>.001*</td>
<td>.33</td>
<td>33.53</td>
</tr>
<tr>
<td>Arith. Application</td>
<td>Self-concept</td>
<td>.33</td>
<td>.42</td>
<td>57.50</td>
<td>.001*</td>
<td>.22</td>
<td>.26</td>
</tr>
<tr>
<td>and Attitude</td>
<td></td>
<td>.34</td>
<td>.01</td>
<td>.23</td>
<td>.001*</td>
<td>.26</td>
<td>23.00</td>
</tr>
<tr>
<td>Total Arithmetical Achievement</td>
<td>Self-concept</td>
<td>.34</td>
<td>.44</td>
<td>66.92</td>
<td>.001*</td>
<td>.28</td>
<td>.34</td>
</tr>
<tr>
<td>and Attitude</td>
<td></td>
<td>.37</td>
<td>.01</td>
<td>.27</td>
<td>.001*</td>
<td>.34</td>
<td>36.19</td>
</tr>
</tbody>
</table>

*Substantially significant relationships.
measured feelings toward self and mathematics in predicting performance of both sexes in the area of arithmetical application.

An attempt was made to determine whether there was any evidence of parents' attitudes toward mathematics affecting their children's attitudes toward mathematics. Table XIX contains four statements about parents' attitude toward mathematics as reported by the students. As each statement was read, the subjects decided whether the statement was true about (a) both parents, (b) neither parent, (c) only the father, or (d) only the mother. The students then responded by circling the one about which the statement was true.

In order to be able to draw inferences from the results of this study, a fairly representative sample of fifth-grade students' responses was selected. This sample was comprised of students with "high," "average," and "low" scores on the LTAS. Those with "high" attitudes represented those students who scored 115 or better on the LTAS. Those with "average" attitudes represented students whose scores on the LTAS ranged from 88 to 98. Those with "low" attitudes scored below 66 on the LTAS. This sample contained 232 subjects, or approximately 20 per cent of the total number of fifth-grade students involved in this study. A complete report of the findings is presented in Table XIX.
### Table XIX

**A COMPARISON OF PARENTS' ATTITUDE TOWARD MATHEMATICS AS REPORTED BY STUDENTS OF VARIOUS LEVELS OF ATTITUDE**

<table>
<thead>
<tr>
<th>No.</th>
<th>Statements</th>
<th>Attitude</th>
<th>Both</th>
<th>Neither</th>
<th>Father</th>
<th>Mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>59.</td>
<td>My parents enjoy helping me with my math homework.</td>
<td>(high)</td>
<td>34</td>
<td>2</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(avg.)</td>
<td>52</td>
<td>8</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(low)</td>
<td>12</td>
<td>26</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>60.</td>
<td>My parents sometimes express their dislike of math.</td>
<td>(high)</td>
<td>2</td>
<td>44</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(avg.)</td>
<td>12</td>
<td>66</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(low)</td>
<td>14</td>
<td>26</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>61.</td>
<td>My parents expect us to do better in math than in other subjects.</td>
<td>(high)</td>
<td>20</td>
<td>36</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(avg.)</td>
<td>38</td>
<td>54</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(low)</td>
<td>16</td>
<td>22</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>62.</td>
<td>My parents talk about how they use math in their everyday lives.</td>
<td>(high)</td>
<td>40</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(avg.)</td>
<td>52</td>
<td>26</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(low)</td>
<td>20</td>
<td>26</td>
<td>16</td>
<td>4</td>
</tr>
</tbody>
</table>

(N = 232)

In order that the students' response reflect a positive attitude on statement number 59, both parents should have been circled. If either parent was circled, this could also indicate a positive attitude. However, if neither parent was circled, this could mean the parents were disinterested.
and, at best, tended to display a neutral attitude toward mathematics. An examination of Table XIX shows that students who have a "high" or positive attitude toward mathematics report that their parents also have positive attitudes toward mathematics. On the other hand, very few students who have a "low" or negative attitude report that both parents enjoy helping with their homework. More than twice as many report that neither parent enjoys helping them with their homework.

To reflect a positive attitude on the part of the parents, the students should have indicated that neither parent sometimes expresses their dislike for mathematics. If the student had circled both parents, this would have indicated the parents had negative feelings toward mathematics. Table XIX also reveals that students with "low" or negative attitudes responded in a manner that indicates their parents also have negative attitudes toward mathematics.

In regard to parents expecting their child to do better in mathematics than in other subjects, it was interesting to note the report of students with negative attitudes. In a further examination of Table XIX, it shows that, in most cases, one or both parents expected their children to perform better in mathematics than in other subject areas.

There was no great difference in the number of students reporting that either or both parents talk about how they use mathematics in their everyday lives. The difference was
as is shown in Table XIX, in the statement of both parents talking about how they use mathematics in their everyday lives. Students with "high" or positive attitudes reported twice the number of parents talking about how they use mathematics every day than did students with "low" or negative attitudes.

Summary of Results

Using Pearson's product-moment approach, a comparison was made of the interrelationships of self-concept, attitude toward mathematics, and achievement in the areas of arithmetical computation, concepts, and application. Another comparison using the multiple correlation technique was made by ascertaining the relationship between each dependent variable and a combination of the two independent variables considered simultaneously. Finally, a simple analysis of variance approach was used to determine if there were any significant differences among the mean arithmetical achievement scores of four groups comprised of students with various combinations of scores on the SEI and ITAS.

In testing the hypotheses considered in this study, the results can be summarized concisely in the following manner:

1. There was a significant correlation between self-concept and arithmetical computation. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially
significant. Therefore, the research Hypothesis I-A was rejected.

2. There was a significant correlation between self-concept and arithmetical concepts. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis I-B was rejected.

3. There was a significant correlation between self-concept and arithmetical application. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis I-C was rejected.

4. There was a significant correlation between attitude toward mathematics and arithmetical computation. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis II-A was rejected.

5. There was a significant correlation between attitude toward mathematics and arithmetical concepts. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis II-B was rejected.
6. There was a significant correlation between attitude toward mathematics and arithmetical application. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis II-C was rejected.

7. There was a significant correlation between attitude toward mathematics and total arithmetical achievement. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis III was rejected.

8. There was a significant correlation between self-concept and total arithmetical achievement. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis IV was rejected.

9. There was a significant correlation between self-concept and attitude toward mathematics. When subjected to the criterion of Garrett's descriptive labels, however, this relationship was not interpreted as being substantially significant. Therefore, the research Hypothesis V was rejected.

10. There was a significant correlation of self-concept and attitude toward mathematics to achievement in the area
of arithmetical compilation. Hypothesis VII was retained and considered tenable.

11. There was a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical concepts. Hypothesis VII was retained and considered tenable.

12. There was a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical application. Hypothesis VIII was retained and considered tenable.

13. There was a significant correlation of self-concept and attitude toward mathematics to total arithmetical achievement. Hypothesis IX was retained and considered tenable.

14. When a comparison was made among the mean arithmetical achievement scores of the four groups (comprised on basis of the SSI and LTAS scores), significant differences were found among all group means, with the exception of Group Two and Group Three. Hypothesis X, as stated in the null form, was rejected.
CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS,
AND RECOMMENDATIONS

The purpose of this research study was to determine the interrelationship of fifth-grade students' self-concept and attitude toward mathematics to academic achievement in arithmetical computation, concepts, and application. This chapter presents a summary of the study, findings, conclusions, and recommendations for future research possibilities.

Summary

The entire fifth-grade population (551 boys and 559 girls) of a public school district in north central Texas was chosen for this study. These subjects were given the Stanford Achievement Tests in November, 1970, by their classroom teacher. In early March of 1971, the SII and LTAS were administered to the subjects.

The SII and LTAS were hand-scored and these data, along with the SAT results, were punched on IBM cards by the Data Processing Center of North Texas State University, Denton, Texas. The statistical techniques used to treat the data were the product-moment correlation, multiple correlation, and simple analysis of variance. In the latter technique, when a significant F-ratio resulted, the data were further
treated with the Fisher's $t$ test to determine the specific variance.

The following hypotheses were formulated and tested by statistical analysis in this investigation.

1. There will be a substantially significant relationship between self-concept and arithmetical achievement scores in the following areas:
   a. Computation
   b. Concepts
   c. Application

When subjected to the criterion of Garrett's descriptive labels, none of these relationships was found to be substantially significant. Hypothesis I was rejected.

2. There will be a substantially significant relationship between attitude toward mathematics and arithmetical achievement in the following areas:
   a. Computation
   b. Concepts
   c. Application

When subjected to the criterion of Garrett's descriptive labels, none of these relationships was found to be substantially significant. Hypothesis II was rejected.

3. There will be a substantially significant relationship between attitudes toward mathematics and total arithmetical achievement. Hypothesis III was rejected.
4. There will be a substantially significant relationship between self-concept and total arithmetical achievement. Hypothesis IV was rejected.

5. There will be a substantially significant relationship between self-concept and attitude toward mathematics. Hypothesis V was rejected.

6. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical computation. Hypothesis VI was considered tenable.

7. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical concepts. Hypothesis VII was considered tenable.

8. There will be a significant relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical application. Hypothesis VIII was considered tenable.

9. There will be a significant relationship of self-concept and attitude toward mathematics to total arithmetical achievement. Hypothesis IX was considered tenable.

10. There will be no significant differences among the mean arithmetical achievement scores of the four groups selected on the basis of their scores on the SEI and LTAS. Hypothesis X was rejected.
Findings

Chapter IV presents the statistical treatment of the data, the results of which were used to determine the acceptance or rejection of each hypothesis. The simple \( r \)'s and multiple \( R \)'s of each correlation were interpreted. Also, the \( F \) value of the analysis of variance was interpreted. If a significant \( F \) value was revealed, the Fisher's \( z \) test was used to determine the specific variance. An analysis of the data resulted in the following findings:

1. The relationships between self-concept and arithmetical achievement in the areas of computation, concepts, and application were found to be significant, but not substantially significant.

2. The relationships between attitude toward mathematics and arithmetical achievement in the areas of computation, concepts, and application were found to be significant, but not substantially significant.

3. The relationship between attitude toward mathematics and total arithmetical achievement was found to be significant, but not substantially significant.

4. The relationship between self-concept and total arithmetical achievement was found to be significant, but not substantially significant.

5. The relationship between self-concept and attitude toward mathematics was found to be significant, but not substantially significant.
6. The relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical computation was found to be statistically significant.

7. The relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical concepts was found to be statistically significant.

8. The relationship of self-concept and attitude toward mathematics to achievement in the area of arithmetical application was found to be statistically significant.

9. The relationship of self-concept and attitude toward mathematics to total arithmetical achievement was found to be statistically significant.

10. In comparing the mean arithmetical achievement scores of the four groups (selected on the basis of SEI and LTAS scores), significant differences were found among all group means, with the exception of Group Two and Group Three.

Summarily speaking, the major findings of this study were the following:

a. The independent variables, self-concept and attitude toward mathematics, were significantly related to the dependent variables, achievement in the areas of arithmetical computation, concepts, and application. When subjected to the criterion of Garrett's descriptive labels, however, these relationships were not found to be substantially significant.
b. The relationships between each dependent variable (achievement in areas of arithmetical computation, concepts, and application, as well as total achievement) and a combination of the two independent variables (self-concept and attitude toward math) considered simultaneously were found to be statistically significant.

c. Through a procedure of analysis of variance it was revealed that there were significant differences among the mean achievement scores of the four groups. It was concluded that high achievement in mathematics was more likely to occur if a student scored high on both the SEI and LTAS.

Conclusions

The following conclusions were formulated from an analysis of the findings of this investigation:

1. Self-concepts and attitudes toward mathematics do influence students' achievements in the areas of arithmetical computation, concepts, and application. The most reasonable position is to infer a reciprocal cause-effect relationship of self-concept, attitude toward mathematics, and arithmetical achievement.

2. A student's academic achievement in mathematics is certainly not determined by any one variable. Although intellectual ability has long been considered the main determinant of academic success, this study reveals that
self-concept and attitude toward mathematics have a significant influence on arithmetical achievement.

3. High self-concepts and positive attitudes toward mathematics are important but certainly not sufficient factors in determining academic achievement in mathematics.

Recommendations

Based upon the results and the conclusions of this study, the following recommendations for future investigations are projected:

1. Measurement of self-concept and attitude toward mathematics should become a part of the school's testing and evaluation program and results be made an intricate part of the students' cumulative records.

2. There is a need to continue efforts to develop reliable instruments with which to assess affective variables such as the ones in this study.

3. There should be continuing efforts in pre- and in-service training programs for teachers to assist them in developing a better understanding of the theories of self-concept and various attitudes and their important roles in learning.

4. In order to determine whether the findings of this study are regional in character, replications of this study should be conducted in other geographical areas.

5. A similar study should be made using a more int
6. A large percentage of the subjects in this study achieved below their grade level in mathematics. A similar study should be made comparing and contrasting various ability-level groups.
SELF-ESTEEM INVENTORY

Name ___________________________  School ___________________________

Class ___________________________  Date ___________________________

Please mark each statement in the following way:
If the statement describes how you usually feel, put a check ( ) in the column "LIKE ME."
If the statement does not describe how you usually feel, put a check ( ) in the column "UNLIKE ME."
There are no right or wrong answers.

Example: I'm a hard worker.

<table>
<thead>
<tr>
<th>Like Me</th>
<th>Unlike Me</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. I spend a lot of time day-dreaming. |         |
2. I'm pretty sure of myself. |         |
3. I often wish I were someone else. |         |
4. I'm easy to like. |         |
5. My parents and I have a lot of fun together. |         |
6. I never worry about anything. |         |
7. I find it very hard to talk in front of the class. |         |
8. I wish I were younger. |         |
9. There are lots of things about myself I'd change if I could. |         |
10. I can make up my mind without too much trouble. |         |
11. I'm a lot of fun to be with. |         |
12. I get upset easily at home. |         |
13. I always do the right thing. |         |
<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Someone always has to tell me what to do.</td>
</tr>
<tr>
<td>16</td>
<td>It takes me a long time to get used to anything new.</td>
</tr>
<tr>
<td>17</td>
<td>I'm often sorry for the things I do.</td>
</tr>
<tr>
<td>18</td>
<td>I'm popular with kids my own age.</td>
</tr>
<tr>
<td>19</td>
<td>My parents usually consider my feelings.</td>
</tr>
<tr>
<td>20</td>
<td>I'm never unhappy.</td>
</tr>
<tr>
<td>21</td>
<td>I'm doing the best work that I can.</td>
</tr>
<tr>
<td>22</td>
<td>I give in very easily.</td>
</tr>
<tr>
<td>23</td>
<td>I can usually take care of myself.</td>
</tr>
<tr>
<td>24</td>
<td>I'm pretty happy.</td>
</tr>
<tr>
<td>25</td>
<td>I would rather play with children younger than me.</td>
</tr>
<tr>
<td>26</td>
<td>My parents expect too much of me.</td>
</tr>
<tr>
<td>27</td>
<td>I like everyone I know.</td>
</tr>
<tr>
<td>28</td>
<td>I like to be called on in class.</td>
</tr>
<tr>
<td>29</td>
<td>I understand myself.</td>
</tr>
<tr>
<td>30</td>
<td>It's pretty tough to be me.</td>
</tr>
<tr>
<td>31</td>
<td>Things are all mixed up in my life.</td>
</tr>
<tr>
<td>32</td>
<td>Kids usually follow my ideas.</td>
</tr>
<tr>
<td>33</td>
<td>No one pays much attention to me at home.</td>
</tr>
<tr>
<td>34</td>
<td>I never get scolded.</td>
</tr>
<tr>
<td>35</td>
<td>I'm not doing as well in school as I'd like to.</td>
</tr>
<tr>
<td>36</td>
<td>I can make up my mind and stick to it.</td>
</tr>
<tr>
<td>37</td>
<td>I really don't like being a boy - girl.</td>
</tr>
<tr>
<td></td>
<td>Like Me</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
</tr>
<tr>
<td>38. I have a low opinion of myself.</td>
<td></td>
</tr>
<tr>
<td>39. I don't like to be with other people.</td>
<td></td>
</tr>
<tr>
<td>40. There are many times when I'd like to leave home.</td>
<td></td>
</tr>
<tr>
<td>41. I'm never shy.</td>
<td></td>
</tr>
<tr>
<td>42. I often feel upset in school.</td>
<td></td>
</tr>
<tr>
<td>43. I often feel ashamed of myself.</td>
<td></td>
</tr>
<tr>
<td>44. I'm not as nice looking as most people.</td>
<td></td>
</tr>
<tr>
<td>45. If I have something to say, I usually say it.</td>
<td></td>
</tr>
<tr>
<td>46. Kids pick on me very often.</td>
<td></td>
</tr>
<tr>
<td>47. My parents understand me.</td>
<td></td>
</tr>
<tr>
<td>48. I always tell the truth.</td>
<td></td>
</tr>
<tr>
<td>49. My teacher makes me feel I'm not good enough.</td>
<td></td>
</tr>
<tr>
<td>50. I don't care what happens to me.</td>
<td></td>
</tr>
<tr>
<td>51. I'm a failure.</td>
<td></td>
</tr>
<tr>
<td>52. I get upset easily when I'm scolded.</td>
<td></td>
</tr>
<tr>
<td>53. Most people are better liked than I am.</td>
<td></td>
</tr>
<tr>
<td>54. I usually feel as if my parents are pushing me.</td>
<td></td>
</tr>
<tr>
<td>55. I always know what to say to people.</td>
<td></td>
</tr>
<tr>
<td>56. I often get discouraged in school.</td>
<td></td>
</tr>
<tr>
<td>57. Things usually don't bother me.</td>
<td></td>
</tr>
<tr>
<td>58. I can't be depended on.</td>
<td></td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY

Books


**Articles**


Baum, M. J. and others, "Unified Effort of a Junior High School Faculty to Encourage Success for Seventh-Graders," Reporting Research, 3 (October, 1963), 7-15.


---


---


---


---


Kane, R. B., "Attitudes of Prospective Elementary School Teachers toward Mathematics and Three Other Subject Areas," The Arithmetic Teacher, 13 (October, 1968), 169-175.

Klausmeir, H. H., and John Check, "Relationships among Physical, Mental Achievement, and Personality Measures in Children of Low, Average, and High Intelligence at 113 Months of Age," American Journal of Mental Deficiency, 63 (May, 1959), 1057-1068.


Miller, Harold R., "WISC Performance under Incentive Conditions (Case Report)," Psychological Reports, 24 (June, 1969), 825-829.


Publications of Learned Organizations


Unpublished Materials


Butcher, Donald G., "A Study of the Relationship of Student Self-Concept to Academic Achievement in Six High-Achieving Elementary Schools," Dissertation Abstracts, Michigan State University, East Lansing, Michigan, 28 (1967), 4844-A


Schwarz, M. E., "The Effect of Teacher Approval on the Self-Concept and Achievement of Fourth, Fifth and Sixth-Grade Children: Case Studies of Seven Children and Seven Teachers," Dissertation Abstracts, University of Nebraska Teachers College, Lincoln, Nebraska, 28 (1967), 523-A.