June 1979

The Interrelationships of Parent, Teacher, and Student Attitudes Toward Mathematics and Student Achievement in Mathematics

Sandra L. Blevins

East Tennessee State University

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THE INTERRELATIONSHIPS OF PARENT, TEACHER, AND STUDENT ATTITUDES
TOWARD MATHEMATICS AND STUDENT ACHIEVEMENT IN MATHEMATICS

A Dissertation
Presented to
the Faculty of the Department
of Supervision and Administration
East Tennessee State University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

by
Sandra Cowan Blevins
June 1979
APPROVAL

This is to certify that the Graduate Committee of

SANDRA LEE COWAN BLEVINS

met on the

Twenty-fourth day of May, 1979.

The committee read and examined her dissertation, supervised her defense of it in an oral examination, and decided to recommend that her study be submitted to the Graduate Council and the Dean of the School of Graduate Studies in partial fulfillment of the requirements for the degree Doctor of Education.

Charles J. Beseda
Chairman, Advanced Graduate Committee

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Robert H. Shepard

Rita C. Hartwell

Clyde L. Orr

Signed on behalf of the Graduate Council

Elizabeth L. McMahon
Abstract

THE INTERRELATIONSHIPS OF PARENT, TEACHER, AND STUDENT ATTITUDES TOWARD MATHEMATICS AND STUDENT ACHIEVEMENT IN MATHEMATICS

by

Sandra Cowan Blevins

Purpose. The purpose of this study was to measure and analyze the relationships between the expressed attitudes toward mathematics of selected seventh grade students, their parents, and their former elementary school teachers and to relate these attitudes to student achievement in mathematics in elementary school.

Methods. One hundred and forty-nine students, comprising three groups, were selected from a population of 500 seventh graders, along with 212 parents and 86 former elementary teachers of these students. Attitude toward mathematics was measured utilizing: (a) Dutton's Attitude Toward Arithmetic, Form C (for students), (b) University of California Attitude Scale Three (for teachers), and (c) University of California Attitude Scale Three (modified for parents). Yearly mathematics grades were obtained, and the elementary school grade-point-average in mathematics for each student was calculated. The Sample Student Group consisted of 31 students whose parents and teachers responded to the attitudinal scales. Group A consisted of 75 students for whom parent attitude scores and not teacher attitude scores were available, and Group B consisted of 43 students for whom teacher attitude scores and not parent attitude scores were available. The following relationships were examined: (a) student and parent attitudes, (b) student and teacher attitudes, (c) student attitudes and student grades in mathematics, (d) teacher attitudes and student grades in mathematics, (e) teacher and parent attitudes, and (f) student attitudes and the attitudes of teachers and parents toward mathematics considered simultaneously.

Findings. The findings of the study revealed that:

1. There was a significant relationship between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics.

2. There was no significant relationship between the attitudes of students toward mathematics upon completing elementary school and the attitudes of the students' former elementary teachers toward mathematics.

3. There was a significant relationship between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.
4. There was no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

5. There was no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the attitudes of the students' parents toward mathematics.

6. There was a significant relationship between the attitudes of students toward mathematics and the attitudes of former elementary teachers and the parents of the students toward mathematics when considered simultaneously.

Student attitudes toward mathematics were found to be significantly related to: (a) parent attitudes toward mathematics, (b) student grades in mathematics, and (c) the attitudes of teachers and parents toward mathematics considered simultaneously. Teacher attitudes toward mathematics were not significantly related to either: (a) parent attitudes toward mathematics, (b) student attitudes toward mathematics, or (c) student grades in mathematics.

Conclusions. The attitudes of students and their mothers toward mathematics were significantly related; whereas, the attitudes of students and their fathers were not. The correlation between the attitudes of students and their mothers toward mathematics was higher than the correlation between the attitudes of students and the mean attitudes of both parents toward mathematics. The correlation between student and father attitudes toward mathematics was less than the correlation between student attitudes and the mean attitudes of both parents toward mathematics. Although there was not a significant correlation between student and father attitudes, when student attitudes were correlated with the mean attitudes of both parents toward mathematics, the correlation was significant. Even though the relationship between student and teacher attitudes was not significant, an inverse correlation suggested that higher teacher attitudes toward mathematics resulted in lower student grades. All other correlations were positive. Although teacher attitudes were not significantly related to either parent or student attitudes toward mathematics, student attitudes when correlated with the combined effect of teacher and parent attitudes resulted in a significant relationship.

Dissertation prepared under the guidance of Dr. Charles G. Beseda, Dr. Gem Kate Greninger, Dr. Lester C. Hartsell, Dr. Clyde L. Orr, Dr. Robert G. Shepard, and Dr. A. Keith Turkett.
INSTITUTIONAL REVIEW BOARD

This is to certify that the following study has been filed and approved by the Institutional Review Board of East Tennessee State University.

Title of Grant or Project The Interrelationships of Parent, Teacher, and Student Attitudes Toward Mathematics and Student Achievement in Mathematics

Principal Investigator Sandra Cowan Blevins

Department Educational Supervision and Administration

Date Submitted January 23, 1979

Principal Investigator Sandra Blevins

Institutional Review Board Approval, Chairman

[Signature]

v
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TABLE OF CONTENTS

Page

APPROVAL......................................................... ii
ABSTRACT......................................................... iii
INSTITUTIONAL REVIEW BOARD.............................. v
COPYRIGHT......................................................... vi
ACKNOWLEDGMENTS............................................... vii
LIST OF TABLES.................................................... xi

Chapter

I. THE INTRODUCTION........................................... 1
The Problem....................................................... 2
Statement of the Problem........................................ 2
Hypotheses......................................................... 2
Assumptions....................................................... 3
Limitations......................................................... 3
Significance of the Research..................................... 4
Definitions of Terms............................................ 5
Procedures......................................................... 7
Organization of the Study......................................... 8

II. THE LITERATURE............................................ 10
Historical Background.......................................... 14
Attitudes Toward Mathematics............................... 17
Liking Mathematics............................................. 17
Disliking Mathematics.......................................... 18
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level for Developing Attitudes</td>
<td>20</td>
</tr>
<tr>
<td>Attitudes and Personal Characteristics</td>
<td>22</td>
</tr>
<tr>
<td>Student Attitudes—Student Achievement</td>
<td>25</td>
</tr>
<tr>
<td>Parent Attitudes—Student Attitudes</td>
<td>28</td>
</tr>
<tr>
<td>Teacher Attitudes—Student Attitudes</td>
<td>32</td>
</tr>
<tr>
<td>Teacher Attitudes—Student Achievement</td>
<td>38</td>
</tr>
<tr>
<td>Factors Affecting Attitudes and Achievement</td>
<td>38</td>
</tr>
<tr>
<td>Sex Differences</td>
<td>38</td>
</tr>
<tr>
<td>Type of School or System</td>
<td>41</td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td>41</td>
</tr>
<tr>
<td>Attitude Change</td>
<td>42</td>
</tr>
<tr>
<td>Summary</td>
<td>48</td>
</tr>
<tr>
<td>III. THE METHOD.</td>
<td>50</td>
</tr>
<tr>
<td>The Sample</td>
<td>50</td>
</tr>
<tr>
<td>Available Methods for Appraising Attitudes</td>
<td>52</td>
</tr>
<tr>
<td>The Instruments</td>
<td>53</td>
</tr>
<tr>
<td>Reliability and Validity of the Parent Scale</td>
<td>55</td>
</tr>
<tr>
<td>Collection of the Data</td>
<td>56</td>
</tr>
<tr>
<td>Administration of the Instruments</td>
<td>57</td>
</tr>
<tr>
<td>Scoring the Instruments</td>
<td>58</td>
</tr>
<tr>
<td>Data Compilation</td>
<td>59</td>
</tr>
<tr>
<td>IV. THE ANALYSIS.</td>
<td>60</td>
</tr>
<tr>
<td>Statistical Treatment</td>
<td>60</td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td>61</td>
</tr>
<tr>
<td>Null Hypotheses</td>
<td>61</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Correlation of Attitude Self-Ratings</td>
<td>70</td>
</tr>
<tr>
<td>Reasons Given for Specific Attitudes</td>
<td>72</td>
</tr>
<tr>
<td>Liking Mathematics</td>
<td>72</td>
</tr>
<tr>
<td>Disliking Mathematics</td>
<td>72</td>
</tr>
<tr>
<td>V. THE SUMMARY</td>
<td>74</td>
</tr>
<tr>
<td>Findings</td>
<td>75</td>
</tr>
<tr>
<td>Conclusions</td>
<td>76</td>
</tr>
<tr>
<td>Recommendations</td>
<td>77</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>79</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>95</td>
</tr>
<tr>
<td>A. PARENTAL CONSENT</td>
<td>96</td>
</tr>
<tr>
<td>B. STUDENT INFORMATION</td>
<td>98</td>
</tr>
<tr>
<td>C. ATTITUDINAL SCALES</td>
<td>100</td>
</tr>
<tr>
<td>D. CORRESPONDENCE</td>
<td>107</td>
</tr>
<tr>
<td>E. FIELD TEST</td>
<td>114</td>
</tr>
<tr>
<td>F. MULTIPLE CORRELATION</td>
<td>119</td>
</tr>
<tr>
<td>G. DATA ON ALL SUBJECTS</td>
<td>121</td>
</tr>
<tr>
<td>VITA</td>
<td>127</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Correlation of Student Attitudes Toward Mathematics with Parent and Teacher Attitudes Toward Mathematics</td>
<td>62</td>
</tr>
<tr>
<td>2</td>
<td>Correlation of Student Attitudes Toward Mathematics with Student Grades in Mathematics</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>Correlation of Teacher Attitudes Toward Mathematics with Student Grades in Mathematics and with Parent Attitudes Toward Mathematics</td>
<td>68</td>
</tr>
<tr>
<td>4</td>
<td>Correlation of Self-Ratings with Actual Scores on the Mathematics Attitude Scales</td>
<td>71</td>
</tr>
</tbody>
</table>

**Field Test**

<table>
<thead>
<tr>
<th>Field Test</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Split-Halves Reliability of the Parent Scale Utilizing the First Parent Group</td>
<td>116</td>
</tr>
<tr>
<td>B</td>
<td>Split-Halves Reliability of the Student Scale Utilizing the Students of the First Parent Group</td>
<td>117</td>
</tr>
<tr>
<td>C</td>
<td>Scores from Two Administrations of the Parent Scale Utilizing the t Test for Independent Means</td>
<td>118</td>
</tr>
<tr>
<td>D</td>
<td>Attitude Scores and Student Grades</td>
<td>122</td>
</tr>
</tbody>
</table>
Chapter 1

THE INTRODUCTION

The secondary teacher of mathematics will probably encounter students who have been taught mathematics for several years by persons whose main area of interest and expertise is not mathematics. The students, before reaching secondary level, may have been influenced by attitudes from many sources concerning mathematics. The particular student attitudes developed may be attributable to parents, teachers, fellow students, or specific incidents occurring in the students' exposure to mathematics. The attitudes may be attributable to the ability and performance in mathematics of the students themselves.

When comparing student attitudes with parent and teacher attitudes toward mathematics, a significant relationship may indicate that the students have developed attitudes toward mathematics which are the same or similar to those of parents or teachers. A significant relationship when comparing student attitudes and student grades may indicate that student attitudes have influenced student grades or that student grades have influenced student attitudes.

This study examined the influences of parent and teacher attitudes upon student attitudes toward mathematics and the influence of student and teacher attitudes toward mathematics upon student achievement in mathematics. The attitudes toward mathematics developed in elementary school cannot be ignored by the conscientious secondary mathematics teacher.
The Problem

Statement of the Problem

The problem was to measure and analyze the relationships between the expressed attitudes toward mathematics of selected seventh grade students, their parents, and their former elementary school teachers and to relate these attitudes to student achievement in mathematics in elementary school.

Hypotheses

Hypothesis I. There will be a significant relationship between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics.

Hypothesis II. There will be a significant relationship between the attitudes of students toward mathematics upon completing elementary school and the attitudes of the students' former elementary teachers toward mathematics.

Hypothesis III. There will be a significant relationship between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

Hypothesis IV. There will be a significant relationship between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

Hypothesis V. There will be a significant relationship between the attitudes of students' former elementary teachers toward mathematics and the attitudes of the students' parents toward mathematics.
Hypothesis VI. There will be a significant relationship between the attitudes of students toward mathematics and the attitudes of former elementary teachers and the parents of the students toward mathematics when considered simultaneously.

Assumptions

1. The formation of student attitude toward mathematics is a cumulative process involving input from the experiences of the student.

2. The parent and teacher groups responding were representative of the parents and teachers of the seventh grade population from which the Sample Student Group was chosen.

3. A student's attitude toward mathematics when tested at seventh grade level was the same or very similar to that student's attitude toward mathematics at the time of completing elementary school.

4. A teacher's present attitude toward mathematics is the same or very similar to that teacher's attitude toward mathematics at the time the teacher was teaching the students in the Sample Student Group.

5. The relationship of the data was linear, homoscendasticity existed, and each of the groups was normally distributed.

Limitations

1. The scope of this study was limited to the seventh grade students in the participating school system whose teachers and parents responded to the attitude measure.

2. Only the current attitudes toward mathematics of the students,
teachers, and parents were examined; whereas, mathematics achievement for the past six years was analyzed.

**Significance of the Research**

Charles E. Osgood, George J. Suci, and Percy H. Tannenbaum (1957) have maintained that attitudes are learned. There is some evidence that undesirable attitudes can be modified. Therefore, research related to the existence, occurrence, and development of attitudes toward mathematics is needed.

Most research attempting to link attitudes toward mathematics with achievement in mathematics has involved the use of student score on a single mathematics test to represent achievement. Few studies have been done using student grade in mathematics as the achievement criterion, and no studies of attitude at seventh grade level were located by a computer search in which the achievement criterion was the grade-point-average of the student in mathematics upon completing elementary school. According to Marshall Bruce Gordon (1975), previous research attempting to relate attitudes toward mathematics to achievement in mathematics has indicated no strong agreement among researchers concerning the degree to which student attitudes and achievement in arithmetic are related.

Lewis R. Aiken, Jr. (1976) emphasized that proving teachers affect student attitudes toward mathematics is difficult. Studies comparing teacher attitudes toward mathematics with student attitudes have usually been performed by testing only the attitude of the current teacher. Robert Bass Phillips, Jr. (1969) conducted a study at seventh grade level in which the attitudes of former teachers for the last three years of elementary school were examined.
A computer search of the literature located few studies involving parent attitudes. Irving Kimball Burbank (1968), George Ivan Levine (1972), Thomas Poffenberger and Donald A. Norton (1956, 1959), and Leslie Donald Weston (1968) are among the few researchers who have analyzed parent attitudes toward mathematics.

Most studies have examined either parent attitudes or teacher attitudes in relationship to student attitudes toward mathematics. No studies were located that attempted to examine parent attitudes, teacher attitudes, and student attitudes simultaneously.

Aiken (1969) and other researchers have called for longitudinal studies. D. T. Campbell (1963) maintained that regardless of the numerous, complex problems in attitude research, studies should be conducted to clarify and supplement present knowledge in this area. Therefore, this study analyzed cumulative student attitudes over an extended period of time. Student attitudes toward mathematics were analyzed in relationship to parental influence, the influence of elementary teachers in grades 1 through 6, and achievement in mathematics in grades 1 through 6. These factors were analyzed simultaneously.

Definitions of Terms

Achievement. The criterion for achievement in mathematics is the overall grade-point-average in mathematics of the student upon completing elementary school.

Arithmetic or Mathematics. The terms arithmetic and mathematics are used interchangeably. In actual practice, the term arithmetic is probably used more frequently in elementary school (grades 1-6); and the term mathematics is probably used more frequently in secondary school.
Attitude Toward Mathematics. L. L. Thurstone and E. J. Chave (1929) defined attitude as:

the sum total of a man's inclinations and feelings, prejudices or bias, preconceived notions, ideas, fears, threats and convictions about any specific topic. (p. 604)

Paraphrasing this definition, attitude toward mathematics is the sum total of an individual's inclinations and feelings, preconceived notions, ideas, fears, and convictions about mathematics.

Parent. For a given student, the term parent is used to refer to the biological mother, father, or legal guardian of that student.

Parent Attitude (PA). For a particular student, the mean of the attitude scores of that student's parents represents parent attitude.

Student. The term student is used to refer to any seventh grader participating in the study.

Student Attitude (SA). For a particular student, the attitude score of the student represents the attitude of that student toward mathematics.

Student Grade (SG). For a particular student, the mean of that student's yearly grades in mathematics for the six years of elementary school represents student grade or grade-point-average in mathematics.

Teacher. For a given student, the term teacher is used to refer to any individual who has taught that student in a full-time teaching capacity while the student was in grades 1 through 6 of elementary school.

Teacher Attitude (TA). For a particular student, the term teacher attitude is used to refer to the mean value of the attitude scores of that student's former elementary teachers toward mathematics.
Procedures

1. The related literature was reviewed.
   
   A. A DATRIX Computer Search provided a list of recently written dissertations, and an ERIC Computer Search provided additional references.
   
   B. The libraries of East Tennessee State University and the University of Tennessee were searched for pertinent journal articles, books, and other materials.
   
   C. Content and relevancy of dissertations to this particular study were determined through Dissertation Abstracts International at East Tennessee State University.

2. An attitudinal instrument was selected for each of the following groups: (a) students, (b) teachers, and (c) parents.
   
   A. Dutton's Attitude Toward Arithmetic, Form C, was used for students.
   
   B. University of California Arithmetic Attitude Scale Three was used for teachers.
   
   C. University of California Arithmetic Attitude Scale Three (for teachers) was modified to provide a scale for parents.
   
   D. The modified instrument was administered as a field test to a selected group of parents similar to the parents in the Sample Parent Group. Attitude statements on the modified instrument were analyzed and a reliability coefficient calculated.
   
   E. The modified instrument was administered to a second group of parents to examine the validity.
   
   F. As an additional index of validity, items in the parent scale
were compared to specific attitudes toward mathematics listed by
a third group of parents.

3. Permission to use the Dutton scales was obtained from
Wilbur H. Dutton, University of California.

4. Permission to conduct the study was obtained from the school
superintendent of the participating school system.

5. Instructions were given to the seventh grade teachers and other
personnel concerning the administration procedures for the
attitudinal instruments.

6. Parental permission was obtained in accordance with current
guidelines and legal procedures for conducting research.

7. Yearly mathematics grades of participating students for
grades 1 through 6 were obtained from the permanent record file,
and mathematics grade-point-averages were calculated.

8. The attitudinal instruments were given to the selected seventh
grade students, their parents, and their former elementary teachers
during a chosen week.

9. Data were analyzed by means of the IBM 370/135 computer at East
Tennessee State University utilizing the SPSS Statistical Package
for the Social Sciences, which involves the Pearson product-moment
and multiple correlation coefficients.

10. A summary of the findings was prepared, conclusions drawn, and
recommendations made.

**Organization of the Study**

Chapter I contains an introduction, a statement of the problem,
hypotheses, assumptions, limitations, significance of the research,
definitions of terms, procedures, and organization of the study.
Chapter II contains a discussion of the related literature.

Chapter III contains an explanation of the methods and procedures used in the selection of the sample and the selection and administration of the attitude scales.

Chapter IV contains an explanation of the treatment of the data and the statistical procedures.

Chapter V contains the summary, conclusions, and recommendations which resulted from the analysis of the data.
Chapter 2
THE LITERATURE

According to Thurstone (1959), any symbol, person, phrase, slogan, or idea toward which an individual can maintain an attitude is referred to as a psychological object. An attitude is seldom thought to exist in a complete state of isolation; instead, each attitude is thought to be a part of a cluster of attitudes (Krech, Crutchfield, and Ballachey, 1962).

Daniel E. Katz and E. Stotland (1959) stated that attitudes have cognitive, affective, and behavioral components. An individual has a belief about an object—the cognitive component; a feeling, a like or dislike, toward the object—the affective component; and a way of behaving in terms of the object—the behavior or action component.

D. Cartwright (1959) stated that most research has been on the affective and cognitive elements. Martin Fishbein (1967) maintained that the affective component is usually measured, because it is considered central to an individual's attitude.

Proving that a particular affective and cognitive attitude corresponds with a definite behavior is not easy. Leonard Doob (1947) maintained that two individuals might have the same attitude and yet differ in behavior as a result of a learned pattern of response. William Deighan (1970) stressed that:

Although the measurement of attitudes by a particular instrument provides a score for comparison with others taking the same inventory, it is the relationship of attitudes to behavior which is most important. (p. 15)
Katz (1960) classified the four major functions which attitude performs as the: (a) instrumental, adjustive, or utilitarian function; (b) ego-defensive function; (c) values-expressive function; and (d) knowledge function. In the ego-defensive function, the attitude serves to protect the person from accepting basic truths about himself or the harsh realities of the external world. All individuals employ defense mechanisms, but differ in the extent to which they use them. They are ordinarily unaware of the mechanisms at the time, but later may realize they are using defenses. In the knowledge function, the attitude contributes to the search for meaning, the need to understand, and the trend toward organizing perceptions to provide clarity and consistency.

In the adjustment function, the individual develops favorable attitudes toward those objects which are associated with the satisfaction of his needs and unfavorable attitudes toward objects which thwart him or punish him. The closer the objects are to actual need satisfaction and the more they are perceived as relevant to need satisfaction, the greater are the probabilities of positive attitude formation. Melton Rokeach (1969) indicated that an individual is predisposed to perceive, recognize, judge, interpret, learn, forget, recall, and think in ways that are congruent with his attitude.

Lee J. Cronbach (1954) maintained that lack of success in mathematics contributed to negative attitudes toward mathematics and discouraged students from taking additional mathematics courses:

No man has succeeded through constant failure. Pupils who constantly fail mathematics have deflated egos and tend to develop attitudes of dislike and hostility toward mathematics. They do not willingly enroll in algebra class.
because they are afraid—it represents a threat. People prefer success to failure.

They cannot fail—if they choose not to run. Many sacrifice a doubtful victory to prevent deflating defeat. (p. 245-246)

Some individuals are taught to persist after failure; others are satisfied with being content.

Mary Tulock (1957) maintained that some students were so tense after traumatic experiences involving mathematics that they seemed to be paralyzed, "so rigid was the set against mathematics that some were convinced they just could not learn mathematics" (p. 573). Tulock advocated the interview technique, which involves building self-confidence in the student by expecting success and initially asking the student questions which the teacher is reasonably sure the student can answer. Only after the student has experienced success and a feeling of self-confidence from answering these simple questions, should the teacher proceed to more difficult questions or problems. Tulock recommended the following as steps to follow in removing emotional blocks from the mathematics classroom:

1. Set individual goals so that it is reasonable to expect that more mathematical experiences will culminate in feelings of success than culminate in feelings of failure.

2. Frequently judge the performance ability of each pupil and gear individual expectancy so as to make possible numerous initial rewards for successful accomplishment in the form of verbal confirmation of attained goals, good grades on exercises, successful class performance, etc.

3. Strive for interest by using puzzles, games, anecdotal materials, mathematical contests, audio-visual aids, resource materials from the environment, etc., that have a mathematical content or implication.
4. Praise, instantly and sincerely, accomplishments that are reasonably deserving of praise.

5. Discover as much as possible about how the child performs mathematical exercises.

Such an analysis might reveal troublesome areas of misunderstanding.

6. Teach for real understanding of mathematical manipulations and evaluate understanding.

a. By having the student explain why and how he performed as he did on a particular exercise.

b. By challenging him with problem situations requiring him to analyze what the problem is, the probable solution, different methods that may possibly lead to the solution, the use of the particular method, and the testing of the solution. At each stage the child should be able to give a lucid explanation of why, not just a rule of thumb.

7. Gradually draw the reticent child into the group activities by:

a. Oral answers in class—being reasonably sure that he knows the answer before you ask him:

1. If he raises his hand designating a willingness to answer.

2. If he has previously displayed a knowledge of the fact in question.

b. Volunteer board work.

c. Material voluntarily brought in for class use.

d. Special report on a challenging question.

8. Convey to the child in the best possible way your interest in him and your concern for his welfare.

9. Show your genuine pleasure at outstanding success and improvement.

10. Register disappointment, but cautiously, in situations where you are reasonably sure the child has not performed up to his ability.

11. Keep the work challenging so that the child feels a sense of accomplishment and satisfaction rather than humiliation.
12. Avoid criticizing the child either in public or in private.

13. Avoid being sarcastic.

14. Avoid being critical of the child's mathematical efforts except in a constructive way.

15. Avoid being patronizing. (p. 575)

According to Aiken (1969), research concerning attitude toward mathematics has greatly increased since 1960. Rosalind L. Fairabend (1960) has discussed the research performed during the decade of the 1950s. Aiken (1969) summarized much of the research performed during the decade of the 1960s. Nelida Rodriguez Feijoo (1974) analyzed research performed during the five year period from 1970 to 1976. This literature review will examine early mathematics attitude research as well as recent studies.

**Historical Background**

Three early periods in the development of arithmetic teaching in the United States have been referred to by Wilbur H. Dutton (1964) and William A. Brownell (1935):

1. **Drill Theory (Before 1900).** Arithmetic consisted of a host of unrelated facts and relatively independent skills acquired by repetition. In 1896, Paul Tillich (in Smith, 1911) reported that it is unpsychological to teach arithmetic by a mass of inherited rules. James McLellan and John Dewey (1895) felt purely intellectual problems had too weak an appeal for many pupils and insisted that personal and practical problems be included:

   Every special subject... represents a certain grouping of facts, classified on the basis of the mind's attitude toward these facts... Unless the fundamental interest and purpose which underlie this classification are discovered and appealed to, the subject which
deals with it cannot be presented along the lines of least resistance and in the most fruitful way. (p. 20)

2. Incidental Learning Theory (1890-1930). Because of the ideas advocated by Dewey, McLellan, Tillich, and others, the rigid system of mathematics instruction was altered. According to the Incidental Learning or Social Aspects Theory, all education must relate to the child's self-determined interests and needs. Problems and content should be related to daily uses of mathematics. Obsolete, impractical aspects of arithmetic should be eliminated. Forcing children to learn before they are ready and imposing burdensome work upon them results in emotional blocking and dislike for mathematics.

John Perry (1902) was an early advocate of individualized mathematics education, maintaining that mathematics should be taught differently to different students. He emphasized that all students were not planning to be mathematicians and should therefore not be treated alike. Perry was opposed to beginning advanced study of mathematics too soon. Henry Suzzallo (1911) warned of the danger of always using the same method and stressed that former teaching practices allowed the teacher to be the most active person in the classroom. More recent methods focus on the child as being an "active human factor"; consequently, teaching becomes less of a "ruthless external imposition of adult views" (p. 21). Suzzallo maintained that the tendency to leave the child overly dependent on the teacher should be replaced by a tendency in the direction of releasing the teacher's control of the child.

Charles Hubbard Judd (1915) wrote a book on the psychology of high school subjects, which included a discussion of the psychology of

Thorndike (1921) criticized the practice of using sarcasm in the mathematics classroom. He suggested associating arithmetic work with humor, sociability, variety, and action, explaining that learning accompanied or followed by annoying states of affairs is weakened (Law of Effect Connections). He maintained that differences in mathematical ability among children were due in a large measure to "inborn differences in their original natures" (1922, p. 203) and speculated that:

Interest in arithmetic and ability in arithmetic are probably correlated positively. . .These correlations are high. . .(p. 300)

3. **Meaningful Theory (Began about 1930).** Brownell (1935) and other educational psychologists found that meaningful learning of arithmetic was based upon understanding the structure of the number system—not merely mechanical facility, but an intellectual grasp of number relations and the ability to deal with arithmetical situations with proper comprehension of their mathematical as well as their practical significance. In the meaningful theory, the subject is encouraged to think, not merely perform operations mechanically.

Development of interest by the methods of the Incidental Learning Theory was criticized because: (a) Such interest may be in the extrinsic activity associated with the arithmetic, rather than in the
actual arithmetic problems. (b) The use of extra activities may give the impression that the desire to learn arithmetic for its own sake—intrinsic motivation—is somehow unnatural and something to be discouraged. Instead, Brownell considered learning arithmetic to be a natural process:

It is a wholesome situation, if not a common one, for children to want to learn arithmetic because they like it. Under the stimulation of such a motive, it is highly probable that the learning will be economical and thorough. (in Bidwell, p. 516)

Harry Grove Wheat (1937) wrote The Psychology and Teaching of Arithmetic. Guy Montrose Whipple (1939) listed the four functions of arithmetic as being computational, informational, sociological, and psychological. The Mathematical Association of America and National Council of Teachers of Mathematics Yearbook (1940) pointed out that the importance attached to learning mathematics may at times be exaggerated and suggested that teacher ineffectiveness or poor teacher personality may have contributed to unfavorable attitudes toward mathematics. The Yearbook maintained that all students should not be forced to study advanced mathematics; however, educators should not be content with providing a minimum education in mathematics in order to avoid this difficulty.

Attitudes Toward Mathematics

Liking Mathematics

Several reasons for liking arithmetic were listed in the Dutton (1954, 1956, 1962) studies. Included were the future need for arithmetic; the fact that arithmetic is interesting, fun, and challenging; the enjoyment obtained when problems can be worked with understanding; the challenge presented by an arithmetic problem; the appreciation of
the fact that arithmetic is definite and logical; and the satisfaction obtained in working problems when success is achieved.

Disliking Mathematics

William Bryan Crittenden (1968) listed sixteen deterrents to pupil progress identified by teachers in Houston, Texas: verbal problem mental block, pupil dependence on teacher, multi-step problem inertia, minimal-requirement thinking, scratch paper usage, quick answer emphasis, mathematical boredom, high mark expectation, anticipatory answer rigidity, substandard spelling, compartmentalization, lack of mathematics history knowledge, terminological carelessness, mixed-numeral emphasis, geometric symbolism misconception, and exactness of measurement. Leon Anson McDermott (1956) considered the following factors to contribute to dislike of mathematics: (a) giving up when faced with a difficult problem or resorting to rote or dishonest means, (b) becoming convinced that personal success in mathematics is not possible, (c) having to frequently rely on others for help, (d) encountering difficulty in grasping an idea when it is needed, and (e) disliking the definiteness of mathematics.

A. L. Bernstein (1964), Harold H. Larch (1961), M. K. Tulock (1957), and others have listed reasons given by students and prospective teachers for disliking mathematics. Reasons given include: failure, boring work, repetition, too much long work, rote learning procedures, too many rules to learn, the possibility of making mistakes, written problems, lack of understanding, division, square root, per cent, fractions, poor teaching, poor teaching techniques, lack of teacher enthusiasm, lack of teacher encouragement, and fear of mathematics.
Natkin (1966) considered early traumatic learning to be responsible for later mathematics anxiety.

Juanita A. Blexinger (1974) indicated that students with a strong foundation in mathematical concepts, but a weak foundation in computational skills, express little or no fear of mathematics at grade six; however, they tend to dislike mathematics. This may indicate that strong concept development in the early years promotes secure feelings toward mathematics by grade six. In a study by Richard Joseph Demars (1972), the belief that low achievers usually have negative attitudes toward mathematics was not supported. Instead, the low-achievers exhibited somewhat positive attitudes both before and after treatment.

Richard R. Skemp (1971) made some very interesting observations concerning attitude toward mathematics. He referred to three areas that may foster dislike: (a) dependence on the teacher, (b) failure to achieve readiness, and (c) the need for schematic learning. Skemp indicated that mathematics cannot be learned directly from the environment, but must be learned from other mathematicians. This may make the student dependent on the teacher or introduce the possibility of developing fear and dislike of mathematics. Suzzallo (1911) discussed the overdependence of the child upon the teacher. Attempting to teach particular skills before the child is ready may complicate learning procedures. The fact that much of mathematics needs to be learned in a particular sequence may inhibit the progress of the student. Skemp referred to this type of learning as schematic. If the child has not mastered earlier concepts, difficulty in mathematics
may increase and unfavorable attitudes may develop. Skemp stressed the fact that this may not be obvious to the teacher:

The amount which a bright child can memorize is remarkable, and the appearance of learning mathematics may be maintained until a level is reached at which only true conceptual learning is adequate to the situation. At this stage the learner tries to master the new tasks by the only means he knows -- memorizing the rule for each kind of problem. This task being now impossible, even the outward appearance of progress ceases... (p. 51)

An appropriate schema is one which takes into account the long term learning task and not just the immediate one.

**Grade Level for Developing Attitudes**

J. Peter Fedon (1958) and Virginia M. Stright (1960) concluded that definite attitudes toward mathematics developed as early as third grade. Fedon tested the attitudes of very young children toward mathematics by means of a color schema test.

L. M. Morissett and J. Vinsohaler (1965) reasoned that attitudes toward mathematics in adults can be traced to childhood. The majority of college students questioned by McDermott (1956) considered their feelings toward mathematics to be based upon elementary school experiences; the remainder indicated algebra or other advanced mathematics in high school had influenced attitudes.

Ralph C. Anttonen (1967) stated that research conclusions are not in agreement concerning the range of the critical period in the formation of attitudes toward mathematics, with different levels being given from preschool to seventh or eighth grade. Conclusions in the Dutton studies varied with the following levels given as being the most important: grades three through six and junior high school (1954); grades five and seven, with grades three through eight also important.
Tulock considered the seventh grade to be a critical and highly important level in the mathematics curriculum and maintained that many of our potential successes in mathematics are lost at this time. Forty per cent (40%) of the prospective teachers questioned by R. E. Reys and F. G. Delon (1968) listed junior high school as the period when attitudes developed. Walter J. Callahan (1971) reported that lasting attitudes were developed at each grade level; however, grades six and seven were most important.

Evans indicated that the establishment of attitude toward mathematics in a child's early school life was shown by many researchers. Albert Kenneth Mastantuono (1970) concluded that attitude began forming as early as preschool and continued developing throughout junior high school and in some cases high school years.

Deighan (1970) tested students in grades three, five, and six and discovered that student attitudes become less favorable as students progress in school. Daniel C. Neale (1969) had similar results. Susan Vanderwall Malcolm (1971) tested grades four, six, and seven and indicated that this decrease is gradual, with the decrease in grades six and seven being the most pronounced. A study by Judith Ellen Jacobs (1974) indicated that seventh grade students have more positive attitudes toward mathematics than eleventh grade students. Peter Arthur Muzeroll (1975) found a significant decline in student attitudes toward mathematics from the end of grade six through the end of grade seven. From a literature search, Robert Franklin Evans (1971) also concluded that attitudes become less positive as students progress in school.

Anttonen (1967) tested students in grade five or six and then again in
grade eleven or twelve and found that the correlation between elementary
and secondary attitudes toward mathematics was low, but significant.
Evans (1971) cited two explanations given for attitudinal decrease:
(a) a general decrease in feelings developed as a student progresses in
school, with mathematics attitude being just one of many subject attitudes
experiencing this attenuation, and (b) more sophisticated responses on
the part of older children involving less concern for replying in terms
of "what the teacher wants me to say". In contrast, Mastantuono (1970)
found no significant attitude change when third graders were retested
in grade five, and Ester Winkler Shapiro (1961) found no significant
change when fourth graders were retested in grade six.

J. J. Ryan (1968) measured student attitudes toward mathematics at
the beginning and end of the school year and found a decline over a five
found student attitudes toward many school subjects—not just mathematics
—were considerably less positive at the end of the year than at the
beginning.

Attitudes and Personal Characteristics

J. Rochlin (1952) found attitude toward mathematics significantly
related to leadership potential in the male and to adjustment to
reality in the female. Students making higher scores on these
personality variables had more favorable attitudes toward mathematics.
McDermott (1956) discovered that students in his study who had a fear
of mathematics had a tendency to rely on others for help.

Shapiro (1961) established a positive relationship between favorable
attitudes toward arithmetic and intelligence quotients, discovering that
perserverance toward solutions was higher in elementary students who
liked mathematics than in those who disliked it. Aiken (1963) and Wesley Cornelious McClure (1970) found very low correlations between achievement and attitudes toward mathematics. However, McClure (1970) indicated that intelligence quotient was the best predictor of attitude toward mathematics.

Aiken (1963) argued that students with better attitudes toward mathematics are more socially and intellectually mature, more self-confident, and have more theoretical interests than students with less desirable attitudes. Similarly, Aiken (1969) inferred that individuals with more positive attitudes toward mathematics and higher achievement in mathematics have better personal adjustment than those with negative attitudes and low achievement. Correlations, however, were relatively low.

E. A. Trown (1970) found introverts to be superior in original learning retention and transfer of a mathematics lesson when rules were presented before examples. Extroverts were superior when rules were presented after examples.

Aiken (1972) discovered that students with more positive attitudes toward mathematics: (a) liked detailed work, (b) see themselves as more persevering and self-confident, and (c) tend to make higher marks in mathematics and school work in general. D. C. May (1972) considered children with positive attitudes toward mathematics to be more "intuitive" than "sensing" in their personality type.

An analysis of research findings by Aiken (1976) led to the conclusion that some of the personality characteristics related to mathematics attitudes and achievement are: (a) a high sense of
personal worth, (b) a greater sense of responsibility, (c) high social standards, (d) high academic achievement, (e) moderation, and (f) greater freedom from withdrawing tendencies. Aiken (1963) indicated that research findings suggested attitude toward mathematics is related to a broad constellation of personality variables indicative of adjustment and interest.

Ralph Mason Dreger and L. R. Aiken (1957) indicated there is evidence that attitude toward mathematics is not highly related to measures of general anxiety. They also reported that attitude toward mathematics is not highly related to attitudes toward academic subjects in general.

Neale (1969) discovered that students who do well in mathematics are more conforming and obedient in school. In a study by F. Silverblank (1972), the high school students who were talented in mathematics were less sociable than those talented in English, and those students who majored in mathematics tended toward extremes on the anxiety scale—being either unusually secure or severely anxious.

Blezinger (1974) determined that students with higher achievement in mathematics in the upper grades feel very secure in mathematics and express interest in the subject. They express favorable attitudes toward working mathematics problems and view working problems as active. Students with a low rate of achievement in the upper grades fear mathematics and express little or no interest in the subject. They express unfavorable attitudes toward working mathematics problems and view working problems as inactive.

James B. Ellington (1962) discovered that high school students in college preparatory classes had somewhat more positive attitudes
toward mathematics than students in terminal or general mathematics classes. Wilbur H. Dutton and Martha Perkins Blum (1968) suggested that students have ambivalent feelings toward mathematics, liking some aspects and disliking others. Dutton (1954) reported that over thirty-two per cent (32%) of the students indicated their feelings were neutral or opposed to arithmetic. Callahan (1971) agreed with Dutton that students overrate themselves on their general feelings toward mathematics when employing self-appraising methods of attitude measurement.

There has been little research to date in the area of peer attitudes. Shapiro (1961) determined that boys and girls in the fifth and sixth grades seem to be more influenced by peer attitudes than students in other grades and found a significant positive influence of the peer group on the development of attitude toward mathematics in elementary school, especially for girls.

**Student Attitudes—Student Achievement**

Mastantuono (1970) discussed the controversy involved in analyzing the relationship of attitude and achievement, indicating that there is some opposition to the idea of attempting to form a relationship between symbolic behavior and nonsymbolic—an assumption which must be made when using a questionnaire. In an extensive literature survey, Aiken (1976) concluded:

> When attitude scores are used as predictors of achievement in mathematics, a low but significant positive correlation is usually found (Neale, 1969). This is true at the elementary (Evans, 1972; Mastantuono, 1971; Crosswhite, 1972; Spickerman, 1970), college undergraduate (Edwards, 1972; Whipkey, 1970; Wilson, 1973) and postgraduate (Webb, 1972) levels. It is also true of students in other countries (do Carmode Avila and
Gillett, 1970); Kulkarni and Naidu, 1970) and minority groups in the United States (Jackson, 1974). (p. 295-296)

H. Bassham, M. Murphy, and Katherine Murphy (1964) measured the attitudes of sixth graders with the Dutton scale and concluded that predicting achievement on the basis of attitude would be difficult. K. E. Brown and T. L. Abell (1965) examined the relationship between attitude and achievement, indicating that the correlation between student attitudes and student achievement was higher for arithmetic than for spelling, reading, and language.

Research studies attempting to correlate attitude toward mathematics with mathematics achievement have not found strongly conclusive evidence to date. Gordon (1975) stated that, "despite differences in samples and instruments, studies of the correlation between attitude toward mathematics and achievement in mathematics have consistently found coefficients in the .20-.40 range" (p. 26). Dutton (1962) indicated that students making C grades had poor attitudes toward mathematics; but on the other hand, there was an equally large group of students making B grades who disliked arithmetic almost as much. Neale (1969) maintained that attitudes account for only a five to fifteen per cent (5-15%) variation in achievement; however, Aiken (1970) developed alternate hypotheses for Neale's findings. Mastantuono indicated:

there is no strong agreement among researchers concerning the degree to which a student's attitude toward arithmetic affects his achievement in arithmetic, or to how much attitude scores contribute to the prediction of a student's achievement.

Gerald Cleveland (1961) maintained that attitude scale scores did not generally discriminate between high and low achievers.
Lois Stephens (1960) determined that attitude scores of seventh and eighth grade accelerated students on the Dutton scale were significantly higher than those of remedial students. Daniel Ford Keane (1968) found no significant relationship between student attitudes and student achievement.

McClure (1970) concluded there is no significant relationship between student attitudes toward mathematics and student achievement in mathematics when Dutton's Attitude Toward Arithmetic, Form C, is utilized; but found a significant relationship between the scores on the attitudinal scale he constructed and student achievement in mathematics.

P. D. Cristianello (1962) found mathematics ability to be a less important determiner of achievement for students having more extreme attitudes than for those having more moderate attitudes. Cristianello considered mathematics ability to be a good predictor of mathematics achievement for students with moderate attitudes, but a poor predictor when considering students with very positive or very negative attitudes toward mathematics. P. W. Jackson (1968) obtained little relationship between achievement and attitude scores in the middle range, maintaining that only at extremes does attitude reflect achievement in a significant way.

Aiken and Drager (1961) and Burbank (1968) established attitude as a significant predictor of achievement for females, but not for males. In a study by Neale, Gill, and Tismer (1970), boys' attitudes toward arithmetic correlated significantly with achievement; whereas, girls' attitudes did not. However, Evans (1971) listed several research studies which found no significant relationship between mathematics attitude and mathematics achievement due to the sex variable.
Most studies involving attitudes and achievement have utilized the mathematics score on a single standardized test to represent achievement. Karl Finley Neuman (1976) obtained a high correlation between mathematics attitude and mathematics achievement when classroom grade was used as the achievement criterion. In a longitudinal study, Anttonen (1967) tested students in grade five or six and then again in grade eleven or twelve. The following measures for achievement were employed: (a) Arithmetic Total of the Iowa Test of Basic Skills (for elementary achievement) and (b) Quantitative Thinking Subscore of the Iowa Tests of Educational Development (for secondary achievement). In addition, mathematics grade-point-averages were computed on the basis of grades seven through twelve and utilized as an additional achievement criterion. Anttonen (1967, 1969) reported low positive correlations between elementary mathematics attitude scores and the Iowa Arithmetic Total (elementary achievement) but higher correlations between secondary mathematics attitude scores and either Quantitative Thinking (secondary achievement) or mathematics grade-point-averages (secondary achievement). A study by Ellingson (1962) found a significant positive relationship between student attitudes as measured by teachers' ratings and (a) teachers' grades ($r = .87$), (b) grade-point-averages ($r = .66$), and (c) mathematics ITED standard scores ($r = .37$).

**Parent Attitudes—Student Attitudes**

A study by Poffenberger and Norton (1956) led to the suggestion that parents determine the initial attitudes of children toward mathematics. Three factors were found to influence student attitudes: (a) parental expectation of student mathematics achievement,
(b) parental encouragement to study mathematics, and (c) parental attitudes concerning mathematics. More than half of the students reported that parents expect above average achievement in most subjects, but only average achievement in mathematics. In these cases, students tend to do poorly in mathematics. Parents who had difficulties in mathematics generally express lower levels of expectation for their children in mathematics. Parental encouragement to study mathematics seems to affect students' interest and achievement positively. Children in the study tended to identify with their parents and adopt similar attitudes toward mathematics. A positive correlation was found between parental attitudes toward mathematics and student attitudes toward mathematics. The authors indicated that mathematics attitude may be so strongly developed in the home before school and strengthened by early elementary experiences that, by the time a student enters high school mathematics, student attitude toward mathematics may be highly resistant to change. Poffenberger and Norton (1956) concluded:

the best way for a child to get an initially positive attitude toward arithmetic and mathematics is to choose parents who like these subjects. . .

even if parents do not like the subjects, a favorable attitude on their part toward the subject will affect positively his mental set. (p. 114)

The area of parental expectations was again a focal point of the next Poffenberger and Norton (1959) study. For example, in the group of students reporting positive attitudes toward mathematics, nineteen per cent (19%) reported their fathers expected A grades in general school work; but only seven per cent (7%) reported their
fathers expected A's in mathematics. Percentages for mothers were very similar. The attitudes of students toward mathematics were positively related to the way in which they rated their fathers' attitudes toward mathematics. The attitudes reported by mothers were not significantly related to student attitudes. This may be due to the fact that only a small number of students indicated that their mothers liked mathematics. Data from the study suggested that the father's attitude influenced the child's attitude only if there was a close relationship between the father and the child. Sixty per cent (60%) of the fathers who were reported as liking mathematics had children who liked mathematics; seventy-eight per cent (78%) of the fathers who were reported as disliking mathematics had children who disliked mathematics.

Aiken and Dreger (1961) concluded that: (a) attitudes toward mathematics and memory of parental encouragement to study mathematics were not significantly related and (b) students' attitudes toward mathematics were not significantly related to the students' reported perceptions of their parents' attitudes toward mathematics.

R. Alpert, G. Stellwagon, and D. Becker (1963) established that student attitudes for both boys and girls were positively correlated with the amount of mathematics education desired by parents for their children. Boys' attitudes were positively correlated with the importance which parents placed on grades and with parental demands for higher grades. Girls' attitudes were negatively related to the importance which their parents placed on mathematics. Student attitudes for both were positively correlated with the parents' view of competition as necessary in the modern world and as good.
Shawky F. Karas (1964) suggested that home environments may have an impact on areas that are heavily loaded with verbal material and may not have such an impact on areas involving less familiar symbolic material.

J. P. Hill (1967) discovered greater similarity between the attitudes of mothers and sons than between the attitudes of fathers and sons. Similarity of attitudes between mothers and sons was related to: (a) maternal warmth, (b) use of psychological and control techniques, and (c) low parental participation in child rearing. Parental attitudes and expectations for their sons were not significantly related, but sons did show greater accordance with the expectations of their fathers than with those of their mothers.

Burbank (1968) tested seventh grade students and the parents of these students using Dutton's Attitude Toward Arithmetic, Form C. The following significant relationships were found: (a) mother and student attitudes toward mathematics; (b) father attitudes and student achievement in mathematics; and (c) student attitudes when linked with reasoning, concepts, computation, and overall achievement. Since the attitudes toward mathematics expressed by the parents may not be the same as the students perceive these attitudes, Burbank (1968) suggested that the study be repeated measuring parental attitudes in terms of the students' perceptions of these attitudes.

Weston (1968) observed that parental attitudes formed a less significant correlation with arithmetic achievement at grade four than at grade six. With older children, possessive attitudes in the home appear to have a highly significant relationship with arithmetic achievement.
Thomas S. Tocco (1971) conducted a study involving junior high school students and concluded that students' attitudes toward mathematics were directly related to their report of their parents' attitudes toward mathematics. Aiken (1972) found that the reported attitude and achievement of the father exerted a greater influence upon sons, and the reported attitude and achievement of the mother exerted a greater influence upon daughters in the area of student attitude toward mathematics. Aiken (1972) and Levine (1973) found pupils' attitudes and achievement in mathematics were positively related to the attitudes of their parents.

Teacher Attitudes—Student Attitudes

Over twenty years ago, an article in *Time Magazine* (1956) called attention to the problem of teacher-student mathematics attitude:

*Future teachers pass through the elementary schools learning to detest mathematics. They drop it in high school as early as possible. They avoid it in teachers' colleges because it is not required. They return to the elementary school to teach a new generation to detest it.* (June 18, p. 74)

A paradox exists concerning the possible situations that may foster the development of negative student attitudes. Negative attitudes may be fostered by the teacher who knows the material very well but cannot explain it in a simple manner that can be understood by beginning students, or may occur because the teacher either does not understand or does not like mathematics. Research studies attempting to determine the percentage of the prospective teachers liking and disliking mathematics have had varied results. Dutton (1951) referred to the "tremendous outpouring of unfavorable attitudes toward mathematics" (p. 85), seventy-four per cent (74%) on the part of the prospective
teachers surveyed. In a later study, Dutton (1962) found only thirty-eight per cent (38%) of the responses were unfavorable. Reys and Delon (1968) reported that education majors surveyed had a sixty per cent (60%) favorable response. Straight (1960) reported that a large percentage of elementary teachers really enjoyed teaching mathematics and tried to make it interesting. Aiken (1969) and J. H. Banks (1964) considered teacher attitudes to be important. Banks (1964) stated:

The teacher who feels insecure, who dreads and dislikes the subject, for whom arithmetic is largely rote manipulation, devoid of understanding, cannot avoid transmitting her feelings to the children. . . . On the other hand, the teacher, who has confidence, understanding, interest, and enthusiasm for arithmetic has gone a long way toward ensuring success. (p. 16-17)

Donovan A. Johnson (1957) stated, "teachers are likely to teach only those attitudes which they themselves possess" (p. 113-120).

Crittenden (1968) indicated that secondary teachers were more convinced that elementary teachers disliked mathematics than were the elementary teachers themselves. Bob Gene Raines (1970) concluded that teachers trained specifically for teaching elementary school were more likely to have favorable attitudes toward teaching mathematics than were elementary teachers whose training was not specifically for elementary teaching. Raines also stated that while upper elementary teachers had more favorable mathematics teaching attitudes than primary teachers, the difference was not significant. Specific attitudes depend more upon the nature of a teacher's training and his general behavioral disposition than upon any combination of situational or demographic factors. E. D. Brown (1961) found that experienced teachers had more
positive attitudes toward arithmetic and a better understanding of basic arithmetical concepts, but no significant relationship was observed between the number of years of teaching experience and either attitude or understanding.

Ann Stern Peskin (1964) found that teachers with a "middle" attitude and a "high" understanding had students with the best scores in geometry, but teachers with a "high" understanding and "low" attitudes had students with the poorest achievement in arithmetic and geometry. In a study on attitudes toward algebra, Meridon Vestal Garner (1963) obtained a significant relationship between: (a) teacher background in mathematics and student achievement in algebra, (b) teacher attitudes toward algebra and student attitudes, (c) teacher and student judgment concerning the practical value of algebra, and (d) teacher attitudes and changes in student attitudes toward algebra.

Aiken (1976) cautioned that the belief that teachers' attitudes affect students' attitudes has not been easy to confirm. According to K. T. Starkey (1971), the effect of teacher attitudes and behavior on student attitudes varies greatly from teacher to teacher. Particular teacher behaviors, such as failing to announce examinations, which has been studied by Clifton Farrel Gary (1973), may affect student attitudes. Merry Lewis Allen (1972) dealt with another example of teacher behaviors that may have an unanticipated effect—the writing of comments on returned test papers.

Poffenberger and Norton (1959) indicated that almost half of the students surveyed believed that their high school mathematics teachers had no effect on their attitudes toward mathematics. These teachers
seemed to be "neither good enough, nor bad enough, to change attitude toward mathematics in one direction or the other" (p. 175).

Peskín (1964) found no significant relationship between teacher and student attitudes or between teacher attitudes and student achievement at seventh grade level. However, Peskin obtained: (a) significant positive correlation between teacher-understanding-of-mathematics scores and student achievement scores and (b) a positive correlation between teacher-understanding-of-mathematics scores and student attitude scores. Roger George Wess (1969) discovered no significant relationship between teacher and student attitudes, except for those students with low ability and teachers with low attitudes toward mathematics.

Joseph Everett Early (1969) observed that the attitudes toward arithmetic of those prospective elementary teachers in the study who finally selected the intermediate level, grades 4 through 6, to teach were significantly higher than the attitudes toward mathematics of those who finally selected the primary level, grades 1 through 3.

Deighan (1970) maintained there was no support for the hypothesis that student attitudes are related to the attitudes of their teachers. John Francis Caezza (1970), John Arthur Van de Walle (1973), and Roger George Wess (1969) did not find a statistically significant relationship between teacher attitudes and either the attitudes or changes in attitudes of their pupils. Aiken (1969) mentioned that students who do not do well in a subject may develop negative attitudes toward the subject, blaming their teachers for their failures even though the teachers have been conscientious.

Phillips (1969) administered Dutton's Attitude Toward Arithmetic, Form C, to the students and University of California Arithmetic Attitude
Scale Three to the teachers in the sample population. He tested the attitudes of students at beginning seventh grade level and the attitudes of the past three teachers of these students, developing the following conclusions: (a) Most recent teacher attitude toward arithmetic was significantly related to student attitude toward arithmetic, but not significantly related to student achievement in arithmetic. (b) Type of teacher attitude encountered by the student for exactly two of his past three years was significantly related to the student's present attitude toward arithmetic as well as to the student's achievement in arithmetic. (c) Type of teacher attitude toward arithmetic encountered by the student for all three of his past three years was significantly related to the student's present attitude toward arithmetic and significantly related to the student's achievement in arithmetic. Students with the highest attitudes and achievement had teachers with high attitudes toward arithmetic. The final conclusion of the Phillips study was that students achieve better in arithmetic if they have a sequence of three teachers all of whom have had favorable attitudes toward arithmetic.

Poffenberger and Norton (1956) stated that mathematics teachers can have a strong positive or negative effect upon students' attitudes and achievement by: (a) building upon attitudes established by parents; (b) leading students to like mathematics; and (c) possessing good knowledge of subject-matter, strong interest in the subject, the desire to have students understand the material, and good control of the class without being overly strict. These qualities were found to affect student attitudes and achievement positively. No student considered a completely permissive teacher to be a good one, but few students
cared for overly strict teachers. This leads to the question: Which is more responsible for the development of negative attitudes toward mathematics—disliking the teacher or disliking the subject? Lerch (1961) maintained that the teacher's attitudes and methods were more important than the organization of the classroom.

McClure (1970) found teachers' attitudes were significantly higher toward mathematics than students' attitudes. Teachers had significantly more favorable attitudes toward ten components of the learning environment: content, problem-solving, sets and set language, geometry, measurement, word problems, equations and inequalities, graphs, proofs, and parents. Students were ahead in five categories: numbers, teachers' knowledge, teachers' instructional ability, and classroom equipment.

McClure (1970) obtained conflicting results when attempting to relate teacher and student attitudes toward mathematics by means of an inventory he constructed. McClure's conclusions were: (a) There is a significant difference between student and teacher attitudes toward elementary mathematics as measured by Dutton's Attitude Toward Arithmetic, Form C (for students), and the University of California Arithmetic Scale Three (for teachers). (b) There is no significant difference between student and teacher attitudes toward elementary mathematics as measured by the writer-constructed inventory. However, McClure found a significant relationship between attitude scores on the two Dutton scales and the overall scores on the attitude scale which he constructed. A study by Keane (1968) also obtained inconclusive results concerning the relationship between teacher and student attitudes toward arithmetic. McClure (1970) concluded:
The literature itself is indeed confusing. The relationship of achievement in mathematics and ability to attitude toward mathematics is still shrouded in a maze of isolated results. Only the teacher seems to have emerged as a clear-cut force on the attitudes of students toward mathematics. (p. 38)

**Teacher Attitudes—Student Achievement**

Peskin (1964) and Wess (1969) found no significant correlation between teacher attitudes toward arithmetic and student achievement in arithmetic.

**Factors Affecting Attitudes and Achievement**

**Sex Differences**

According to Evans (1971), some early studies reported that boys like arithmetic and achieve higher scores in arithmetic than girls. Thorndike (1923), however, cited three early studies of school marks which showed no notable differences in algebraic ability between boys and girls. He indicated that boys in grade twelve placed algebra somewhat higher than girls in preference ratings, but explained that the information available was not adequate to examine differences between the sexes in algebraic learning. The data did indicate that girls liked the major problem types in the study less than boys. Problem situations used in algebra textbooks more frequently involved male activities. Thorndike stated that:

> If girls disliked the aggressive planning and selection required for solving verbal problems, in general, it would be evidence for the once orthodox but now discredited doctrine of a general passivity of the feminine intellect.

(p. 415-416)

The need for a revision of educational materials and methods in mathematics to include feminine interests was evident.
W. Linwood Chase (1949) stipulated that arithmetic was one of the most liked and disliked subjects in the curriculum. Boys preferred content subjects (reading, geography, history, and science). Girls preferred skill subjects (arithmetic, penmanship, spelling and aesthetics—art and music).

Poffenberger and Norton (1956) discovered that twice as many women as men were in the group disliking mathematics, but the percentages of men and women in the group liking mathematics were equal. Poffenberger and Norton (1959) reported that forty-two per cent (42%) of the students surveyed believed their fathers liked mathematics very much; whereas, only eleven per cent (11%) believed that their mothers strongly liked mathematics. In a study by Rosalind L. Feierbend (1960), women's interest in mathematics was tied to identification with a strong male figure who was himself interested in mathematics and with a lack of feminine identification or conflict in this area.

Sharpiro (1961) found that girls in grades four, five, and six who liked arithmetic would seek help more frequently in the solution of an arithmetic problem than boys. Sixth grade boys preferred to work independently if they liked arithmetic, but sought help if they did not like arithmetic. Shapiro (1961) found that girls were more persevering than boys. Aiken (1963) found that:

women with more favorable attitudes toward mathematics tend to be more outgoing, conscientious, self-controlled, intellectually mature and placed more value on theoretical matters than those with less favorable attitudes toward mathematics. (p. 479)

Keane (1968) obtained no significant difference between the attitudes of boys and girls toward arithmetic as measured by the
Dutton scale. There was a significant difference between the sexes in their preferences for the subject areas on the student subject-ranking scale for all subjects (English, geography, spelling, reading, science, history), except arithmetic. Dutton and Blum (1968) indicated there seemed to be considerable evidence that girls liked arithmetic as well as boys.

McClure (1970) concluded: (a) Males in the study had better attitudes toward numeration than females, but females liked to perform the basic operations (addition, subtraction, multiplication, and division) better than males. (b) There is no significant difference between male and female attitudes toward mathematics as measured by the Dutton University of California Arithmetic Attitude Scale, Form C. (c) There is no significant difference between male and female attitudes toward the content of elementary school mathematics. McClure speculated that: (a) girls may have negative attitudes toward mathematics for different reasons than boys and (b) external cultural factors may force girls to react differently toward mathematics than boys do. He concluded there is no significant difference between the attitudes of males and females toward elementary school mathematics.

In a study by Callahan (1971), boys showed just about the same disliking for mathematics; girls showed more dislike for word problems. Several studies (reported in Evans, 1971, p. 31-32) found no variation in attitudes due to sex. In the Alexander H. Fluellen (1975) study, no factors were found that contributed more to the development of negative attitudes on the part of boys than of girls. At seventh grade level, there were no significant differences between the sexes with
regard to attitudes toward mathematics or achievement in mathematics in a study performed by Jacobs (1974).

Elizabeth Fennema and Julia Sherman (1977) stated that the data in their study did not support either the expectation that males are invariably superior in mathematics achievement or the idea that differences between the sexes increase with age and/or mathematics difficulty. Patricia Lund Casserly (1978) found no evidence that mathematics anxiety is more prevalent among girls than boys or that it prevents young women from entering mathematics related fields.

Although some early studies on mathematics attitude indicated that a difference in mathematics attitudes on the part of the sexes was prevalent, more recent studies indicate that males and females do not differ significantly in attitudes toward mathematics. There has been a change in the attitude concerning ability of women to succeed in technical fields and a corresponding change in the educational curriculum of female students.

Type of School or System

One research study indicated that negative attitudes toward mathematics do not appear to be produced by only one type of school or system. McDermott (1956) found that students who are afraid of mathematics are from all sizes and types of school systems from one-room rural schools to large city systems.

Socioeconomic Status

Tocco (1967) indicated that neither achievement in mathematics nor attitude toward mathematics appear to be related to socioeconomic status. Keane (1968) found that economic environment seems to
influence achievement. In the Keane study, residence (urban, suburban, rural) did not appear to influence either attitude or achievement.

**Attitude Change**

There have been numerous studies in the area of attitude change. Since the concept of attitude is somewhat nebulous, the concept of attitude change is even more remote. Caroline W. Sherif, M. Sherif, and R. E. Nebergall (1965) referred to this by stating that, "before tackling the problem of attitude change we must have a clearer notion of what it is that changes and what it is that is resistant to change" (p. vi). Rokeach (1969) maintained that, "any consideration of the relationship between attitude change and behavioral change necessarily rests on a prior consideration of the relation between attitude and behavior" (p. 134). There are several research studies which indicate that the attitude toward mathematics of students, prospective teachers, and teachers in-service may be changed favorably.

Poffenberger and Norton (1959) concluded that the findings of the research effort seemed to support the hypothesis that the development of attitudes toward mathematics is a cumulative phenomenon with each new experience building upon the preceding one.

W. J. Lyda and Evelyn C. Morse (1963) reported that when meaningful methods of arithmetic were employed with fourth graders, changes in attitudes toward mathematics took place. Negative attitudes became positive, and the intensity of positive attitudes was increased. These attitude changes were significantly related to gains in mathematics achievement, both in computation and in reasoning.

Poffenberger and Norton (1959) proposed that students with an initially negative attitude toward mathematics may go into the
classroom with a mental attitudinal set against the subject which may be maintained even when positive identification with the teacher is made. Dutton (1962) insisted that, once attitudes toward arithmetic are developed, these attitudes are tenaciously held by prospective elementary teachers. Continued efforts are required to redirect unfavorable teacher attitudes into constructive channels. McClure (1970) argued that, after the intermediate grades, attitude toward most aspects of the mathematics learning environment remains relatively stable throughout the student's formal education. Raines (1970) indicated that, as a general rule, the attitude that an elementary teacher holds toward the teaching of mathematics developed during elementary or junior high school and has changed very little since he started teaching. This attitude, according to Raines, is not related to the general teaching situation.

Robert Marion Todd (1966) reported that a course, "Mathematics for Teachers," taught in Virginia in 1964 produced significant changes in attitude toward arithmetic and in understanding of arithmetic for the teachers who completed the course. George Kaprelian (1961) reported that seventy-five per cent (75%) of the fourth graders who watched an educational television program, "Patterns in Arithmetic," reported an improvement in attitudes toward arithmetic. There are several other reports of televised mathematics instruction giving similar results. Janet Gehring Robbins (1973) reported an improvement in the attitudes toward mathematics of inner-city third graders when verbal and physical reinforcement were employed with seven to nine year old students in mathematics classes. Roderick Jackson Earle (1973) reported a significant change in mathematics attitudes of disadvantaged students
when the students were taught in small groups by competent, experienced mathematics teachers. Anttonen (1967) reported a low positive correlation between elementary and secondary mathematics attitudes. These results could serve as evidence that mathematics attitude can be changed.

There are several reports of mathematics attitude change on the part of prospective teachers. Dutton (1951) recommended having teacher education students isolate their attitudes toward mathematics and indicated that this had proven helpful to prospective teachers in overcoming unfavorable attitudes and feelings toward mathematics. Dutton (1962) considered the best method of improving teacher and student attitudes and achievement to be an inservice program for teachers during the school year, when the teachers are working with the students. Alice S. Hilton (1969) reported a significant change in attitude toward mathematics on the part of prospective teachers in the study. Aiken (1976) reported improvement in prospective teachers' attitudes toward mathematics as a result of a method-content course in teacher education.

Bassham, Murphy, and Murphy (1964) have suggested that changing a student's attitude toward mathematics involves changing his perceptions in relation to mathematics materials. Gerald Lewis Natkin (1966) attempted to improve attitudes toward mathematics experimentally by getting students to associate mathematics with something pleasant. Natkin measured galvanic skin responses (GSR's) of the subjects to mathematical and non-mathematical stimuli. Subjects learned to associate mathematics stimuli with nonsense syllables or with strongly pleasant phrases. When mathematical stimuli were associated with
pleasant expressions, scores on a test of anxiety toward mathematics showed a significant decrease.

Rodríguez Feijoo (1974) indicated that efforts to improve mathematics attitude and achievement by introducing new teaching methods are complicated by the complex number of variables that must interact in the formation or change of attitude toward mathematics. McClure (1970) emphasized that attitude may be radically affected by certain conditions in a relatively short time.

The existence of numerous innovations and educational techniques in mathematics have encouraged researchers to study the effects of specific teaching techniques on student attitudes toward mathematics. Gordon (1975) referred to teaching style as being "fixed and rigid" or "flexible and developing" (p. 33). Students who favored low structure tended to obtain high grades and were low in discomfort. Students who scored high on attitude toward mathematics as a process tended to favor low structure.

After studying the effects of ability grouping on attitude change, Lerch (1961) concluded that attitudes toward arithmetic are less dependent upon classwork organization than upon teacher attitudes and the methods teachers employ. After comparing ability versus non-ability groups, O. L. Davis and N. H. Tracy (1963) concluded that differences among teachers in their knowledge of arithmetic, attitudes toward arithmetic, and their variability in methods of teaching—factors not measured in this particular study—were important variables to be considered in further research on ability grouping.

A. L. Bernstein (1964) thought that the use of School Mathematics Study Group (SMSG) materials might improve attitudes toward
mathematics. McClure (1970) found little or no differences between the attitudes of students using these materials and the attitudes of students using the traditional curriculum. R. E. Comley (1966) noted that students in his study using University of Illinois Committee on School Mathematics (UICSM) materials had significantly more favorable mathematics attitudes than the other groups. D. F. Devine (1967) concluded that when an average or above average teacher is available, greater achievement is obtained in a more conventional teacher-centered approach.

Aiken (1976) indicated that when an experimental instructional approach is compared with a traditional approach, the improvement is usually approximately the same:

This is so whether the traditional-lecture, one-teacher approach is compared with enrichment (Wardrop, 1972), laboratory (Flexer, 1974), programmed (Beattie, 1970; Drum, 1974), individualized (Kontogianes, 1974), micro-teaching (Kilman, 1971), in-context (McNerney, 1969), or two-teachers (Williams, P. H., 1971) approaches to instruction. (p. 298-299)

The strong impression which emerges from the studies examined by Aiken is that experimental methods of teaching mathematics are not superior to traditional methods with respect to changes in attitude toward mathematics. Some of the conclusions found in research studies have been listed by Aiken (1976) as follows:

1. Modern mathematics programs do not improve attitudes more than traditional programs (Demars, 1972; Joyner, 1974).

2. Compared to regular classes, "continuous progress" classes do not have a different effect on attitudes toward mathematics (Williams, B. G., 1974).
3. Discovery methods are not superior in their effects on attitudes toward mathematics (Richard and Bolton, 1971; Struder, 1972).

4. Neither follow-up instructions (Avenoso, 1971) nor flexible scheduling (Faist, 1972) improves attitudes more than traditional instruction.

5. An individualized approach to instruction in elementary and junior high mathematics sometimes has a more positive effect on attitudes than a traditional approach. (Maquire, 1971; Malcolm, 1973; Scharf, 1971), but sometimes no difference in the effects of the two types of programs is found (Corbin, 1974; Ronshausen, 1972).

6. Certain units or topics in mathematics have a more positive (Duncan, 1971; McBride, 1974; Silverman, 1974) or a more negative (McCord, 1970) effect on attitudes than other topics. (p. 300-301)

Alpert et al. (1963) concluded that interpersonal variables were found to have a greater effect on pupils' attitudes when pupil and teacher were of the same sex. N. Maertens (1968) concluded that arithmetic homework does not uniformly affect pupils' attitudes toward mathematics. Further research needs to be done in these areas.

Aiken (1976) reported several studies involving efforts to change attitudes toward mathematics by the use of calculators in the classroom. In these studies, although change occurred in the groups that used calculators, changes also occurred in the control groups. According to Aiken (1976), one researcher reported more favorable attitudes toward mathematics when computer-assisted instruction was used with seventh graders; but another researcher, working with the same group, found no differential increase in positive attitudes. Phelps Wallace Wilkins (1975) reported a positive significant change in the attitude toward mathematics and mathematics related concepts in the computer-assisted class; whereas, no significant change was reported in the attitude
toward either in the control group. More research needs to be done to
determine the possibilities for changing attitude toward mathematics by
the use of calculators and computers.

Summary

Researchers are not in agreement concerning the range of the
critical period in the formation of student attitude toward mathematics.
Different grade levels from preschool to seventh or eighth grade and in
some cases high school years have been cited as being important. Student
attitudes toward mathematics appear to become less favorable as students
progress in school. There is evidence of a decline as students progress
from one grade level to the next and also a decline from the beginning to
the end of the school year. Attitude toward many school subjects, not
just mathematics, is considerably less positive at the end of the year
than at the beginning.

A low, but significant, positive correlation is usually found
between student attitude toward mathematics and student achievement in
mathematics. Usually the achievement criterion is a single standardized
mathematics test. Higher correlations have been obtained when classroom
grade is the achievement factor. A study by Anttonen (1967) utilized
mathematics grade-point-averages for grades 7 through 12 as the achieve­
ment criterion. No studies correlating mathematics attitude with
grade-point-average for grades 1 through 6 were located.

The literature contains both scientific research and mere speculation
concerning the relationship between parental and student mathematics
attitudes. Parental expectations, parental encouragement, and parental
attitudes toward mathematics are all factors to be considered in the
development of student attitudes. There may be a difference in the
influence of the mother's attitude toward mathematics and the father's attitude toward mathematics. The sex of the child may be a factor in determining whether the child is more influenced by the mother's attitude or the father's attitude toward mathematics. Research to date seems to indicate that there is a positive correlation between student and parent attitudes toward mathematics; however, there have been few studies in this area.

Some factors relevant to the teacher in the area of mathematics attitude development include the attitude of the teacher toward mathematics, the attitude of the students toward the teacher, and the effect of specific teaching techniques upon student mathematics attitudes. Statements indicating that the teacher is an important factor in the development of student attitude toward mathematics are not always supported by scientific evidence. The belief that teacher attitudes toward mathematics and student attitudes toward mathematics are significantly related has not yet been established by the literature. Some researchers have obtained conflicting or inconclusive evidence when attempting to correlate teacher and student mathematics attitudes. Phillips (1969) conducted a study at seventh grade level in which teacher attitudes for the last three years of elementary school were examined. No studies were located involving teacher attitudes for all six years of elementary school.

Most researchers have analyzed the relationship between two major factors; for example, student and teacher attitudes or student and parent attitudes toward mathematics. No studies were located in which parent attitudes, teacher attitudes, and student attitudes were examined simultaneously.
Chapter 3
THE METHOD

The problem was to measure and analyze the relationships between the expressed attitudes toward mathematics of selected seventh grade students, their parents, and their former elementary school teachers (grades 1-6) and to relate these attitudes to student achievement in mathematics in elementary school. The specific relationships analyzed were:

1. Student and Parent Attitudes
2. Student and Teacher Attitudes
3. Student Attitudes and Student Grades in Mathematics
4. Teacher Attitudes and Student Grades in Mathematics
5. Teacher and Parent Attitudes
6. Student Attitudes and Teacher-and-Parent Attitudes.

The Sample

A total of 256 students representing a student population of 500 seventh graders, 256 parents representing a possible parent population of 1000, and 86 elementary teachers representing a teacher population of 106 participated in the study. From the participants, 149 students and 212 parents were selected for the analysis. Those teachers who taught each of the 149 students were selected on an individual basis.

The Sample Student Group consisted of those students currently enrolled in the school system at seventh grade level who completed grades 1 through 6 in the system. The Sample Student Group was further
qualified to include only those students whose teachers were still teaching in the system and whose teachers and parents responded to the attitude measure. Students representing all levels of academic achievement in mathematics were included. In order for a particular student to be included in the Sample Student Group, a minimum of four of that student's elementary teachers and one parent had to respond to the attitude scale. When only one parent responded, the attitude score of that parent was used to represent Mean Parent Attitude for that particular student. Thirty-one students were assigned to the Sample Student Group. The group contained 14 male and 17 female students. All six hypotheses were tested on the Sample Student Group.

The Sample Parent Group included 48 parents of the students in the Sample Student Group. The Sample Teacher Group included those teachers currently teaching in the system who taught the members of the Sample Student Group in grades 1 through 6. The teachers who taught each student were selected on an individual basis.

After the selection of the Sample Student, Parent, and Teacher Groups, sufficient data were available to identify two additional student groups. Group A consisted of those students for whom a parent attitude and not a teacher attitude was available. Group A combined with the Sample Group was utilized for an additional test of Hypothesis I and Hypothesis III. In order for a student to be included in Group A, at least one parent had to respond to the attitude scale. Seventy-five students were assigned to Group A. Group B consisted of those students for whom a teacher attitude and not a parent attitude was available. Group B combined with the Sample Group was utilized for an additional test of Hypothesis II. In order for a student to be included in
Group B, a minimum of four of that student's former elementary teachers had to respond to the attitude scale. Forty-three students were assigned to Group B. The parent group corresponding to Group A consisted of 164 parents of the students in Group A. The teacher group corresponding to Group B consisted of those teachers currently teaching in the system who taught the students in Group B in grades 1 through 6.

Available Methods for Appraising Attitudes

According to Mary E. Corcoran and E. Glanadine Gibb (1961), there are three primary methods for appraising attitudes toward mathematics: (a) self-report methods which include questionnaires, incomplete questions, essays, and diaries of mathematical activities; (b) observational methods; and (c) interviews. A particular type of questionnaire known as the attitude scale has been developed as an attempt to provide a more objective method of evaluating and comparing attitudes. Attitude scales are developed using principles devised by L. L. Thurstone (1928) and Rensis Likert (1932). When responding to a Thurstone scale, an individual agrees or disagrees with each statement given. When responding to a Likert scale, the individual has five choices: Strongly Disagree, Disagree, Undecided, Agree, or Strongly Agree.

To construct a Thurstone scale, a list of brief statements is prepared by searching the literature and by asking individuals to submit opinions concerning the subject in question. The list of statements is then reduced to a shorter, more manageable, list that is still representative of all graduations of opinion. These opinions are arranged along a single continuum including positive, negative, and neutral categories.
Attitude scales that have been used in mathematics include:

(a) Dutton Thurstone Scale, (b) Dutton-Blum Likert Scale, (c) Anttonen-Hoyt Scale, (d) Semantic Differential, and (e) Aiken-Dreger Likert Scale. These scales, excluding Aiken-Dreger, have been carefully examined by Mastantuono (1970) and Evans (1971). The Aiken-Dreger Scale is described in Marvin E. Shaw and Jack M. Wright (1967).

Evans examined the reliability of the scales, and Mastantuono (1971) examined the validity. In examining the four attitude scales, Mastantuono (1970) stated:

Due to the significant intercorrelations among the four arithmetic attitude scales, another implication of the present research, appears to be that all of the scales were tapping the same general area of the affective domain, despite differences in the attitude scaling theories used as a basis for constructing each scale. This would seem to contribute to the construct validity of each scale. (p. 100)

Evans (1971) found significant test-retest correlations for all four scales in the range of .353-.611 and found inter-correlations in the range of .587-.827.

In addition to the widely used scales, a number of researchers have used personally constructed scales for their research studies, including a recent one by Roderick Earle Jackson (1973), constructed to study the attitudes of disadvantaged students toward mathematics. According to Jackson, this scale uses non-standardized English, "Ghettoese"--not the type of language used in polite society.

**The Instruments**

The present study utilized the Dutton Thurstone Scale, which will subsequently be referred to as the Dutton Scale. According to Aiken (1969), the Dutton Scale has probably been used more than any other
mathematics attitude scale. The Dutton Scale has been employed with parents, teachers, prospective teachers, and students.

In the preparation of the Dutton Scale (Dutton, 1954), more than 600 prospective teachers, enrolled in education classes at the University of California, over a five-year period, were asked to write out their feelings toward arithmetic. After the statements obtained were edited, a group of 120 university students, representing all classifications enrolled, sorted the statements into eleven categories numbered from 1 (for extreme disliking) to 11 (for extreme liking). Twenty-two statements were selected for the final scale (Dutton, 1957). The original twenty-two item scale was reduced to fifteen items (Dutton, 1962).

There are two variations (Appendix C) of the Dutton Scale:
(a) Dutton's Attitude Toward Arithmetic, Form C (for students), prepared by Wilbur H. Dutton, and (b) University of California Arithmetic Attitude Scale Three (for teachers), published in W. H. Dutton and J. J. Adams (1961). Phillips (1969, p. 16) indicated that both the Dutton Attitude Toward Arithmetic Scale, Form C, and the University of California Arithmetic Attitude Scale Three have a reliability of .94 as measured by test-retest methods and are considered valid for measuring feelings toward mathematics. Each of these contains 15 scale items plus five additional items. The two scales are almost identical. Variations in wording for teachers and for students is the main difference.

The present study employed:
1. Dutton's Attitude Toward Arithmetic, Form C (for students)
2. University of California Arithmetic Attitude Scale Three (for teachers)
3. University of California Arithmetic Attitude Scale Three (modified for parents).

The Dutton scales were used in the present study because of the high reliability, the indications of validity, the existence of both a student and a teacher version, and because of the ease with which a parent version could be constructed (permission for use, Appendix D).

Reliability and Validity of the Parent Scale

For the purpose of this study, an additional scale for parents was needed that would be similar to the existing Dutton student and teacher scales, so that comparisons could be made with these scales. An attitudinal scale for measuring parent attitude toward mathematics was not located; therefore, the University of California Arithmetic Scale Three (for teachers) was modified by the investigator to provide a parent scale (Appendix C, p. 103) similar in content and number of items to the other Dutton scales. This was preferred to preparing a new scale that might not parallel existing scales.

A field test of the parent scale was conducted by giving the scale to the parents of twenty-two students. The students were similar in grade, age, and academic ability to those students who later participated in the study. Eleven parents of these students responded to the parent scale. On the field test a reliability coefficient (Table A, Appendix E) of .852 was calculated for the parent scale.

The split-halves method was used to determine the reliability-coefficient corrected by the Spearman-Brown formula (Appendix E, p. 115). Since each item on the parent scale is assigned a different numerical value, the usual method of dividing the instrument into two halves would give unequal values for the two parallel forms; therefore, the
parent scale was divided into two parts having approximately the same total scale value by utilizing the techniques described in Thurstone and Chave (Appendix E, p. 115).

The students of the first parent group were given the Dutton student scale. The test-retest reliability (Table B, Appendix E) of the Dutton student scale has been reported by Dutton and other researchers as .94. On the field test, a split-halves reliability of .934 was calculated for the student scale.

The parent scale was administered to a second group of parents. These were the parents of students similar in grade, age, and academic ability to those students who would later participate in the study. The mean for the first administration of the parent scale was 6.81, and the mean for the second administration was 6.93. There was no significant difference (Table C, Appendix E) between the two means. As an additional index of validity, a third group of parents was asked to list their attitudes toward mathematics. Comparisons between the attitudes listed and the attitudinal items on the parent scale revealed many similarities.

Collection of the Data

Parental permission (Appendix A) was obtained for all seventh grade students participating in the study. Names of those students who attended elementary school in the system for all six years of elementary school and the names of their former elementary teachers were secured by giving each student a copy of the Student Information Form (Appendix B). Yearly mathematics grades of these students for grades 1 through 6 were obtained.
One seventh grade mathematics teacher was selected to act as coordinator to distribute and collect student and parent scales from each seventh grade mathematics teacher. An envelope containing the appropriate number of attitudinal instruments for each mathematics class was provided.

The principal of each elementary school was asked to distribute and collect a copy of the teacher scale from each teacher and return these to the investigator. An envelope containing the appropriate number of attitudinal instruments was prepared for each school.

For the purposes of correlation, letter grades were converted to the following numerical equivalents or graduations in between:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Numerical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Students' grade-point-averages for elementary school were then calculated.

**Administration of the Instruments**

Researchers frequently read the Dutton Scale aloud, especially when working with very young children. Dutton (1956) had statements read aloud to the junior high school students participating in his study. In the current research, statements were not read aloud. If the scale is read aloud, students might be influenced by the verbal and nonverbal actions of the reader to express attitudes similar to those of the reader instead of expressing personal attitudes toward mathematics.
Each participant was given a letter and an attitude scale. All participants completed the attitude scale during the same week. Written instructions to the classroom teachers who administered the attitude scale requested that the teachers: (a) give each student a copy of the student scale and sufficient copies of the parent scale, (b) remind the students that parent and student responses are confidential and will not affect student grade, (c) indicate to the student that a list of definitions (as utilized by Evans, 1971) for some of the terms on the scale is available at the teacher's desk, and (d) administer the scale without reading it aloud or commenting on personal attitudes toward mathematics. Written instructions to the teachers of each elementary school assured that teacher responses would be kept confidential.

Scoring the Instruments

On the Dutton scales, respondents were directed to check only those statements which expressed their "true feelings" toward mathematics—probably not more than five statements. Each item on the Dutton scales has been assigned a number between 1.0 (extreme dislike) and 10.5 (extreme liking) to correspond with the scaled values of that particular attitude toward arithmetic as determined by the techniques of Thurstone and Chave (1929). The attitude scale score was the mean of the scale values of the selected statements. This method of scoring was used in the current research. Mastantuono (1970), Evans (1971), and others have suggested that the score could alternately be the sum of the scale values of the sentences the subject endorses.
Data Compilation

Data were compiled and analyzed by means of the IBM 370/135 Computer at East Tennessee State University utilizing the SPSS Statistical Package for the Social Sciences, which involves the Pearson product-moment and multiple correlation coefficients (Appendix F). Data on all subjects is listed in Appendix G.
Chapter 4

THE ANALYSIS

The data were analyzed by utilizing correlational techniques. Correlation does not indicate that one variable caused a given change in the other, but only that the two variables are experiencing simultaneous alteration.

Statistical Treatment

For Hypotheses I-V. The Pearson product-moment coefficient of correlation was used to test the following relationships:

Hypothesis I  SA-PA
Hypothesis II SA-TA
Hypothesis III SA-SC
Hypothesis IV TA-SG
Hypothesis V TA-PA.

For Hypothesis VI. Multiple correlation (Appendix F) was used to test the relationship:

Hypothesis VI SA—(TA-PA).

To test the significance of r (or R). The R value obtained by the multiple correlation is greater than the individual r correlations between the criterion variable (student attitude) and either predictor variable (teacher attitude or parent attitude), but the interpretation of the significance of R is precisely the same as in the case of two predictors (Popham, 1973, p. 89).
Statistical Analysis

Null Hypotheses

To facilitate statistical analysis, the research hypotheses (Chapter 1, pp. 2-3) were presented here in the null hypothesis format. The correlation coefficients were tested at the .05 level, utilizing a one-tailed test for significance.

Hypothesis I. There will be no significant relationship between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics.

\[ H_{01}: \rho_{SA-PA} = 0. \]

For an individual student, the student’s score on the attitude scale was paired with the mean value of the set of attitude scores of that student’s parents:

<table>
<thead>
<tr>
<th>Student Attitude (SA)</th>
<th>Mean Parent Attitude (PA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_i )</td>
<td>( \frac{PA + MA}{2} )</td>
</tr>
</tbody>
</table>

The correlation (Table 1-A) between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics for the Sample Student Group (n = 31) was .3007. This value of \( r \) was significant at the .05 level. When Hypothesis I was retested on the Sample Group combined with Group A (n = 106), a correlation (Table 1-B) of .1967 was obtained. This value was significant at the .02 level. Therefore, the null hypothesis was rejected, indicating that there was a significant relationship between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics.

For the Sample Student Group (n = 29), the correlation (Table 1-A) between the attitudes of students toward mathematics and the attitudes
Table 1-A

Correlation of Student Attitudes Toward Mathematics with Parent and Teacher Attitudes Toward Mathematics

<table>
<thead>
<tr>
<th>Sample Group</th>
<th>(n = 19)</th>
<th>(n = 29)</th>
<th>(n = 31)</th>
<th>(n = 31)</th>
<th>(n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fathers' Math Attitudes FA</td>
<td>r = .1289</td>
<td>r = .4027*</td>
<td>r = .3007*</td>
<td>r = .0664</td>
<td>R = .3090*</td>
</tr>
<tr>
<td>Mothers' Math Attitudes MA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents' Math Attitudes PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers' Math Attitudes TA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents' and Teachers' Math Attitudes TA-PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students' Math Attitudes SA

- Level of Significance: .29, .01, .05, .36, .05
- Mean: 7.0642, 7.0866, 7.1032, 7.5926
- Standard Deviation: 2.0651, 1.6928, 1.5277, 0.7106

r and R = Correlation Coefficients

*p ≤ .05

Hypotheses I, II, and VI
Table 1-B
Correlation of Student Attitudes Toward Mathematics with Parent and Teacher Attitudes Toward Mathematics

<table>
<thead>
<tr>
<th></th>
<th>Sample Group and Group A (n = 71)</th>
<th>Sample Group and Group B (n = 106)</th>
<th>Sample Group and Group A (n = 93)</th>
<th>Sample Group and Group B (n = 74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fathers' Math Attitudes</td>
<td>FA</td>
<td>Parents' Math Attitudes</td>
<td>PA</td>
<td>Teachers' Math Attitudes</td>
</tr>
<tr>
<td>Mothers' Math Attitudes</td>
<td>MA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students' Math Attitudes</td>
<td>SA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>r = .1521</td>
<td>r = .1788*</td>
<td>r = .1967*</td>
<td>r = .0428</td>
</tr>
<tr>
<td></td>
<td>.10</td>
<td>.04</td>
<td>.02</td>
<td>.35</td>
</tr>
<tr>
<td></td>
<td>7.1859</td>
<td>6.8590</td>
<td>7.0448</td>
<td>7.5273</td>
</tr>
<tr>
<td></td>
<td>1.6089</td>
<td>1.6457</td>
<td>1.3734</td>
<td>0.6603</td>
</tr>
</tbody>
</table>

r and R = Correlation Coefficients
*p ≤ .05
Hypotheses I and II
of their mothers toward mathematics was .4027, which was significant at the .01 level. For the Sample Group combined with Group A (n = 93), this correlation (Table 1-B) was .1788, which was significant at the .04 level. The attitudes of students toward mathematics and the attitudes of their mothers toward mathematics were significantly related.

For the Sample Student Group (n = 19), the correlation (Table 1-A) between the attitudes of students toward mathematics and the attitudes of their fathers toward mathematics was .1289, which was not significant. For the Sample Group combined with Group A (n = 71), this correlation (Table 1-B) was .1521, which also was not significant. Thus, the attitudes of students toward mathematics and the attitudes of their fathers toward mathematics were not significantly related.

The mean attitude score toward mathematics for female students (5.8606) was higher than the mean attitude score for male students (5.2400) in the Sample Group (n = 31). The mean mathematics grade for male students (3.1507) was higher than for female students (3.1247) in the Sample Group. However, for the Sample Group combined with Group A (n = 106), both the mean attitude toward mathematics (6.2162) and the mean mathematics grade (3.1553) were higher for female students than the mean attitude toward mathematics (5.5840) and the mean mathematics grade (3.1272) for male students, respectively.

Hypothesis II. There will be no significant relationship between the attitudes of students toward mathematics upon completing elementary school and the attitudes of the students' former elementary teachers toward mathematics.

H₀²: ρₜₐ = 0.
For an individual student, the student's score on the attitude scale was paired with the mean value of the set of attitude scores of that student's elementary school teachers (grades 1-6):

\[
\text{Student Attitude (SA)} \quad \text{Mean Teacher Attitude (TA)}
\]
\[
S_i \quad \frac{T_1 + T_2 + T_3 + T_4 + T_5 + T_6}{6}
\]

The correlation (Table 1-A) between the attitudes of students toward mathematics and the attitudes of the students' former elementary teachers toward mathematics for the Sample Student Group (n = 31) was 0.0664, which was not significant. When Hypothesis II was retested on the Sample Group combined with Group B (n = 74), this correlation (Table 1-B) was 0.0428, which also was not significant. Therefore, the null hypothesis failed to be rejected, indicating that there was no significant relationship between the attitudes of students toward mathematics upon completing elementary school and the attitudes of the students' former elementary teachers toward mathematics.

**Hypothesis III.** There will be no significant relationship between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

\[H_0: \rho_{SA-SG} = 0.\]

For an individual student, the student's score on the attitude scale was paired with the mean of the student's yearly grades in mathematics (grades 1-6):

\[
\text{Student Attitude (SA)} \quad \text{Math Grade-Point-Average (SG)}
\]
\[
S_i \quad \frac{G_1 + G_2 + G_3 + G_4 + G_5 + G_6}{6}
\]
Table 2

Correlation of Student Attitudes Toward Mathematics with Student Grades in Mathematics

<table>
<thead>
<tr>
<th></th>
<th>Sample Group (n = 31)</th>
<th>Sample Group and Group A (n = 106)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students' Math Grades SG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students' Math Attitudes SA</td>
<td>$r = .4108^*$</td>
<td>$r = .1974^*$</td>
</tr>
<tr>
<td>Level of Significance</td>
<td>.01</td>
<td>.02</td>
</tr>
<tr>
<td>Mean</td>
<td>3.1365</td>
<td>3.1447</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.6125</td>
<td>0.7358</td>
</tr>
</tbody>
</table>

$r = \text{Correlation Coefficient}$

*$p \leq .05$

Hypothesis III
The correlation (Table 2) between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school for the Sample Student Group (n = 31) was .4108. This value of \( r \) was significant at the .01 level. When Hypothesis III was retested on the Sample Student Group and Group A combined (n = 106), a correlation (Table 2) of .1974 was obtained. This value was significant at the .02 level. Therefore, the null hypothesis was rejected, indicating that there was a significant relationship between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

**Hypothesis IV.** There will be no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

\[ H_0^4: \rho_{TA-SG} = 0. \]

For an individual student, the mean attitude of that student's former elementary teachers (grades 1-6) toward mathematics was paired with the mean of that student's yearly grades in mathematics (grades 1-6). For \( S_4^4 \):

\[
\begin{align*}
\text{Mean Teacher Attitude (TA)} & \quad \text{Math Grade-Point-Average (SG)} \\
T_1 + T_2 + T_3 + T_4 + T_5 + T_6 & \quad G_1 + G_2 + G_3 + G_4 + G_5 + G_6 \\
6 & \quad 6
\end{align*}
\]

The correlation (Table 3) between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school for the Sample Student Group (n = 31) was -.0818, which was
### Table 3

Correlation of Teacher Attitudes Toward Mathematics with Student Grades in Mathematics and with Parent Attitudes Toward Mathematics

<table>
<thead>
<tr>
<th>Sample Group (n = 31)</th>
<th>Students' Math Grades</th>
<th>Parents' Math Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers' Math Attitudes TA</td>
<td>r = -0.0818</td>
<td>r = 0.2651</td>
</tr>
<tr>
<td>Level of Significance</td>
<td>0.33</td>
<td>0.07</td>
</tr>
<tr>
<td>Mean</td>
<td>3.1365</td>
<td>7.1032</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.6125</td>
<td>1.5277</td>
</tr>
</tbody>
</table>

* r = Correlation Coefficient

Hypotheses IV and V
not significant. Therefore, the null hypothesis failed to be rejected, indicating that there was no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school. Even though the relationship was not significant, the inverse correlation suggested that higher teacher attitudes toward mathematics resulted in lower student grades.

**Hypothesis V.** There will be no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the attitudes of the students' parents toward mathematics.

\[ H_0:5: \rho_{TA-PA} = 0. \]

The mean value of the set of attitude scores of an individual student's former elementary teachers (grades 1-6) was paired with the mean value of the set of attitude scores of that student's parents. For \( S_i \):

\[
\text{Mean Teacher Attitude (TA)} = \frac{T_1 + T_2 + T_3 + T_4 + T_5 + T_6}{6}, \quad \text{Mean Parent Attitude (PA)} = \frac{FA + MA}{2}.
\]

The correlation (Table 3) between the attitudes of students' former elementary teachers toward mathematics and the attitudes of the students' parents toward mathematics for the Sample Group (\( n = 31 \)) was .2651, which was not significant. Therefore, the null hypothesis failed to be rejected, indicating that there was no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the attitudes of the students' parents toward mathematics.
Hypothesis VI. There will be no significant relationship between the attitudes of students toward mathematics and the attitudes of former elementary teachers and the parents of the students toward mathematics when considered simultaneously.

\[ H_06: \rho_{SA-\text{TA-PA}} = 0. \]

For an individual student, the student's score on the attitude scale was paired simultaneously with the mean value of the set of attitude scores of that students' former elementary teachers and the mean value of the set of attitude scores of that students' parents. For \( S_i \):

<table>
<thead>
<tr>
<th>Student Attitude</th>
<th>Teacher Attitude-Parent Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>TA-PA</td>
</tr>
</tbody>
</table>

The multiple correlation (Table 1-A) between the attitudes of students toward mathematics and the attitudes of former elementary teachers and the parents of the students toward mathematics when considered simultaneously was .3090. This value of \( R \) was significant at the .05 level. Therefore, the null hypothesis was rejected, indicating that there was a significant relationship between the attitudes of students toward mathematics and the attitudes of former elementary teachers and the parents of the students toward mathematics when considered simultaneously.

Correlation of Attitude Self-Ratings

On all three attitudinal scales (student, parent, and teacher) subjects were asked to circle a number between 1 (Dislike) and 11 (Like) as an indication of attitude toward mathematics. A correlation (Table 4) of the actual attitude score obtained from the response of the subject to the appropriate scale with the number circled in the self-rating
Table 4
Correlation of Self-Ratings with Actual Scores on the Mathematics Attitude Scales

<table>
<thead>
<tr>
<th>Estimation</th>
<th>Student Math Attitude</th>
<th>Father Math Attitude</th>
<th>Mother Math Attitude</th>
<th>Teacher Math Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESA</td>
<td>(n = 31)</td>
<td>(n = 19)</td>
<td>(n = 29)</td>
<td>(n = 86)</td>
</tr>
<tr>
<td>Student Attitude</td>
<td>r = .7044*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father Attitude</td>
<td>r = .6812*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother Attitude</td>
<td>r = .6472*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Attitude</td>
<td>r = .6019*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

r = Correlation Coefficient

*p = .001
activity was made for the Sample Group. In each case, the number circled was referred to as the estimated attitude of the participant. For students \((n = 31)\), a correlation of .7044 was obtained; for parents \((n = 48)\), a correlation of .6812 was obtained for fathers \((n = 19)\) and .6472 for mothers \((n = 29)\) and for teachers \((n = 86)\), a correlation of .6019 was obtained. All four of these correlations were significant at the .001 level, contributing to the validity of the three attitude scales.

**Reasons Given for Specific Attitudes**

**Liking Mathematics**

Students, parents, and teachers participating in the study were asked to list reasons for liking and disliking mathematics. The five reasons most frequently given by students for liking mathematics in order of importance were: (1) mathematics is challenging, (2) it is fun, (3) there is a certain beauty and order present when working with numbers, (4) addition and multiplication are interesting topics, and (5) the teacher exerts an important influence.

Both parents and teachers listed the same four reasons in identical order as being the most important: (1) mathematics is useful in daily living, (2) challenging, (3) logical, and (4) definite. Parents listed the fifth most important reason as being the sense of accomplishment occurring when problems are worked correctly. Teachers listed the miracle of numbers and how they work.

**Disliking Mathematics**

The five reasons most frequently given by students participating in the study for disliking mathematics in order of importance were: (1) homework, (2) considered mathematics to be boring, (3) difficulty
encountered in working mathematics problems, (4) word problems and
division (ranked equally), and (5) decimals. Parents listed: (1) word
problems, (2) the "new" mathematics, (3) working with fractions,
(4) drill and repetition, and (5) ineffective teaching methods as being
the most important factors. Teachers listed: (1) repetitive drill,
(2) written problems, (3) the amount of time that is required to work
mathematics problems and the fact that all mathematics is not applicable
to daily life (ranked equally), (4) the specific subject of geometry,
and (5) the fact that some teachers considered mathematics boring to
teach. Word problems were listed fourth by students, first by parents,
and second by teachers as a reason for disliking mathematics.
Chapter 5
THE SUMMARY

Since attitudes are thought to be learned and capable of being modified, research into the origin, existence, occurrence, and development of attitudes toward mathematics is important to the mathematics educator.

Problem

The problem was to measure and analyze the relationship between the expressed attitudes toward mathematics of selected seventh grade students, their parents, and their former elementary school teachers and to relate these attitudes to student achievement in mathematics in the elementary school.

Procedures

One hundred and forty-nine students, 212 parents, and 86 teachers were selected for the analysis. Student attitudes toward mathematics at seventh grade level and the attitudes toward mathematics of the parents and former elementary teachers of the students were measured utilizing: (a) Dutton's Attitude Toward Arithmetic, Form C (for students), (b) University of California Attitude Scale Three (for teachers), and (c) University of California Attitude Scale Three (modified by the investigator for use with parents). Mathematics grade-point-averages for each student for elementary school (grades 1-6) were calculated. The following relationships were examined: (a) student and parent attitudes, (b) student and teacher attitudes, (c) student attitudes and student grades in mathematics, (d) teacher attitudes and
student grades in mathematics, (e) teacher and parent attitudes, and (f) student attitudes and the attitudes of teachers and parents toward mathematics considered simultaneously.

Results

Student attitudes toward mathematics were found to be significantly related to (a) parent attitudes toward mathematics, (b) student grades in mathematics, and (c) the attitudes of teachers and parents toward mathematics considered simultaneously. Teacher attitudes toward mathematics were not significantly related to either (a) parent attitudes toward mathematics, (b) student attitudes toward mathematics, or (c) student grades in mathematics.

Findings

The findings of the study revealed that:

1. There was a significant relationship between the attitudes of students toward mathematics and the attitudes of their parents toward mathematics.

2. There was no significant relationship between the attitudes of students toward mathematics upon completing elementary school and the attitudes of the students' former elementary teachers toward mathematics.

3. There was a significant relationship between the attitudes of students toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.

4. There was no significant relationship between the attitudes of students' former elementary teachers toward mathematics and the grade-point-averages of the students in mathematics upon completing elementary school.
5. There was no significant relationship between the attitudes of
student's former elementary teachers toward mathematics and
the attitudes of the students' parents toward mathematics.

6. There was a significant relationship between the attitudes of
students toward mathematics and the attitudes of former elementary
teachers and the parents of the students toward mathematics when
considered simultaneously.

Conclusions

The attitudes of students and their mothers toward mathematics were
significantly related; whereas, the attitudes of students and their
fathers were not significantly related. The correlation between the
attitudes of students and their mothers toward mathematics was higher
than the correlation between the attitudes of students and the mean
attitudes of both parents toward mathematics. The correlation between
student and father attitudes toward mathematics was less than the
correlation between student attitudes and the mean attitudes of both
parents toward mathematics. Although there was not a significant
correlation between student and father attitudes, when student attitudes
were correlated with the mean attitudes of both parents toward
mathematics, the correlation was significant. Even though the relation-
ship between student and teacher attitudes was not significant, an
inverse correlation suggested that higher teacher attitudes toward
mathematics resulted in lower student grades. All other correlations
were positive. Although teacher attitudes were not significantly related
to either parent or student attitudes toward mathematics, student
attitudes when correlated with the combined effect of teacher and parent
attitudes resulted in a significant relationship.
The mean of teacher attitudes was higher than the mean of parent attitudes. Both means were considerably higher than the mean of student attitudes. A direct comparison of these means could not be made, since three different attitude scales were employed.

The standard deviations for both teacher attitudes and student grades were small, indicating that there was little variation in these factors. The similarities occurring in both teacher attitudes and student grades should be considered in any interpretation of the correlation between teacher attitudes and student grades. Student attitudes and student grades were significantly related; whereas, teacher attitudes and student grades were not.

Recommendations

After examining the results of the study, the following recommendations were made:

1. Since student attitudes toward mathematics and student grades in mathematics were significantly related in this study, developing favorable attitudes and attempting to change negative attitudes toward mathematics are worthwhile and desirable goals. Further research should be conducted to determine the effects of specific practices of teachers and parents upon changing negative student attitudes toward mathematics.

2. Teacher attitude toward mathematics is very complex. There is not just one attitude—a combination of attitudes exists. The teacher has an attitude toward the subject of mathematics, an attitude toward pursuing mathematics courses, and an attitude toward teaching mathematics. An effort should be made to measure and determine the
extent to which all three of these mathematics attitudes may influence student attitudes toward mathematics and student grades in mathematics. An instrument should be designed to measure all three types of teacher mathematics attitudes.

3. The Parent Scale developed in this study by modifying the University of California Attitude Scale Three could be used in future studies to provide more information concerning the relationship of parent and student attitudes toward mathematics.

4. With the advent of calculators and computers, attitudes toward mathematics may drastically change, with students no longer seeing a need to study mathematics in the present manner. Research is needed to determine the ways in which the mathematics curriculum should be altered to provide for the inclusion of calculator and computer technology. Further research is needed to determine the effects of the use of calculators and computers upon attitudes toward mathematics.
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APPENDICES
EAST TENNESSEE STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Informed Consent Form

PRINCIPAL INVESTIGATOR: Mrs. Sandra Blevins, Doctoral Candidate

TITLE OF PROJECT: Parent, Student, and Teacher Attitudes

Toward Mathematics and Student Achievement in Mathematics

1) Indicated below are the (a) purpose of this study, (b) the procedure to be followed and (c) the approximate duration of this study.

The purpose of this study is to discover ways in which parents, their children and teachers of mathematics can work better together to make mathematics courses more interesting and worthwhile to students. Although you and your child are requested to put your names on the questionnaires, when the results are finally reported no names will appear in the written report. Answers given by students and parents will in no way affect the student's grade in mathematics. The study will be completed in one week.

2) Discomforts, inconveniences and/or risks that can be reasonably expected are:

No discomforts, inconveniences, or risks are anticipated.

3) I understand the procedures to be used in this study and the possible risks involved. All my questions have been answered. I also understand that while my rights and privacy will be maintained, the Secretary of the Department of Health, Education and Welfare does have free access to any information obtained in this study should it become necessary and I freely and voluntarily choose to participate. I understand that I may withdraw at any time without prejudice to me.

Date

Signature of Student

Date

Signature of Investigator

Date

Date

Signature of Directing Professor

Signature of Directing Professor

East Tennessee State University
STUDENT INFORMATION FORM

Name______________________________

Parents/Guardian______________________________

List the names of all the elementary schools you have attended and the names of your elementary teachers for each grade.

Have you attended school in the ________________________ System for all the years of elementary school?

<table>
<thead>
<tr>
<th>Grade</th>
<th>School Attended</th>
<th>Teacher (or Teachers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DUTTON'S ATTITUDE TOWARD ARITHMETIC, FORM C
(STUDENTS)

Read the statement below. Choose statements which show your feelings toward arithmetic. Place a check before the statements which tell how you feel about arithmetic. Check only those statements which express your true feelings—probably not more than five statements.

___ 1. I avoid arithmetic because I am not very good with figures.
___ 2. Arithmetic is very interesting.
___ 3. I am afraid of doing word problems.
___ 4. I have always been afraid of arithmetic.
___ 5. Working with numbers is fun.
___ 6. I would rather do anything else than do arithmetic.
___ 7. I like arithmetic because it is practical.
___ 8. I have never liked arithmetic.
___ 9. I don't feel sure of myself in arithmetic.
___ 10. Sometimes I enjoy the challenge presented by an arithmetic problem.
___ 11. I am completely indifferent to arithmetic.
___ 12. I think about arithmetic problems outside of school and I like to work them out.
___ 13. Arithmetic thrills me and I like it better than any other subject.
___ 14. I like arithmetic but I like other subjects just as well.
___ 15. I never get tired of working with numbers.

Place a circle around one number to show how you feel about arithmetic in general.

1 2 3 4 5 6 7 8 9 10 11
Dislike
Like

My feelings toward arithmetic were developed in grades:
1 2 3 4 5 6

My average grade made in arithmetic has been:
(Circle One) A B C D

List two things you like about arithmetic:
(1)
(2)

List two things you dislike about arithmetic:
(1)
(2)
Read the statements below. Choose statements which show your feelings toward arithmetic. Place a check before the statements which tell how you feel about arithmetic. Check only those statements which express your true feelings—probably not more than five statements.

1. I feel arithmetic is an important part of the school curriculum.
2. Arithmetic is something you have to do even though it is not enjoyable.
3. Working with numbers is fun.
4. I have never liked arithmetic.
5. Arithmetic thrills me and I like it better than any other subject.
6. I get no satisfaction from studying arithmetic.
7. I like arithmetic because the procedures are logical.
8. I am afraid of doing word (written) problems.
9. I like working all types of arithmetic problems.
10. I detest arithmetic and avoid using it whenever possible.
11. I have a growing appreciation of arithmetic through understanding its values, applications, and processes.
12. I am completely indifferent to arithmetic.
13. I have always liked arithmetic because it has presented me with a challenge.
14. I like arithmetic but I like other subjects just as well.
15. The completion and proof of accuracy in arithmetic give me satisfaction and feelings of accomplishment.

Place a circle around one number to show how you feel about arithmetic in general.

1 2 3 4 5 6 7 8 9 10 11
Dislike
Like

My feelings toward arithmetic were developed in grades:
1 2 3 4 5 6 7 8 9 10 11
Other

My average grade made in arithmetic has been:
(Circle One) A B C D

List two things you like about arithmetic:
(1)
(2)

List two things you dislike about arithmetic:
(1)
(2)
UNIVERSITY OF CALIFORNIA ARITHMETIC ATTITUDE SCALE THREE
(PARENTS)

Name ___________________________ Male ___ Female ___ Age _____

Read the statement below. Choose statements which show your feelings toward arithmetic. Place a check before the statements which tell how you feel about arithmetic. Check only those statements which express your true feelings—probably not more than five statements.

1. I feel arithmetic is an important part of the school curriculum.
2. Arithmetic is something you have to do even though it is not enjoyable.
3. Working with numbers is fun.
4. I have never liked arithmetic.
5. Arithmetic thrills me and I like it better than any other school subject.
6. I got no satisfaction from studying arithmetic when I was in school.
7. I like arithmetic because the procedures are logical.
8. I am afraid of doing word (written) problems.
9. I like working all types of arithmetic problems.
10. I detest arithmetic and avoid using it whenever possible.
11. I have a growing appreciation of arithmetic through understanding its values, applications, and processes.
12. I am completely indifferent to arithmetic.
13. I have always liked arithmetic because it has presented me with a challenge.
14. I like arithmetic but I like other school subjects just as well.
15. The completion and proof of accuracy in arithmetic give me satisfaction and feelings of accomplishment.

Place a circle around one number to show how you feel about arithmetic in general.

1 2 3 4 5 6 7 8 9 10 11
Dislike ___ Like ___

My feelings toward arithmetic were developed in grades:

1 2 3 4 5 6 7 8 9 10 11 Other ___

My average grade made in arithmetic when I was in school was:

(Circle One) A B C D

List two things you like about arithmetic:

(1) ____________________________ (2) ____________________________

List two things you dislike about arithmetic:

(1) ____________________________ (2) ____________________________
<table>
<thead>
<tr>
<th>Item</th>
<th>Attitude Statement</th>
<th>Scale Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I avoid arithmetic because I am not very good with figures.</td>
<td>3.2</td>
</tr>
<tr>
<td>2</td>
<td>Arithmetic is very interesting.</td>
<td>8.2</td>
</tr>
<tr>
<td>3</td>
<td>I am afraid of doing word problems.</td>
<td>2.0</td>
</tr>
<tr>
<td>4</td>
<td>I have always been afraid of arithmetic.</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>Working with numbers is fun.</td>
<td>8.7</td>
</tr>
<tr>
<td>6</td>
<td>I would rather do anything else than do arithmetic.</td>
<td>1.0</td>
</tr>
<tr>
<td>7</td>
<td>I like arithmetic because it is practical.</td>
<td>7.7</td>
</tr>
<tr>
<td>8</td>
<td>I have never liked arithmetic.</td>
<td>1.5</td>
</tr>
<tr>
<td>9</td>
<td>I don't feel sure of myself in arithmetic.</td>
<td>3.7</td>
</tr>
<tr>
<td>10</td>
<td>Sometimes I enjoy the challenge presented by an arithmetic problem.</td>
<td>7.0</td>
</tr>
<tr>
<td>11</td>
<td>I am completely indifferent to arithmetic.</td>
<td>5.2</td>
</tr>
<tr>
<td>12</td>
<td>I think about arithmetic problems outside of school and like to work them out.</td>
<td>9.5</td>
</tr>
<tr>
<td>13</td>
<td>Arithmetic thrills me and I like it better than any other subject.</td>
<td>10.5</td>
</tr>
<tr>
<td>14</td>
<td>I like arithmetic but I like other subjects just as well.</td>
<td>5.6</td>
</tr>
<tr>
<td>15</td>
<td>I never get tired of working with numbers.</td>
<td>9.8</td>
</tr>
<tr>
<td>Item</td>
<td>Attitude Statement</td>
<td>Scale Value*</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>1</td>
<td>I feel arithmetic is an important part of the school curriculum.</td>
<td>7.2</td>
</tr>
<tr>
<td>2</td>
<td>Arithmetic is something you have to do even though it is not enjoyable.</td>
<td>3.3</td>
</tr>
<tr>
<td>3</td>
<td>Working with numbers is fun.</td>
<td>8.7</td>
</tr>
<tr>
<td>4</td>
<td>I have never liked arithmetic.</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>Arithmetic thrills me and I like it better than any other subject.</td>
<td>10.5</td>
</tr>
<tr>
<td>6</td>
<td>I get no satisfaction from studying arithmetic.</td>
<td>2.6</td>
</tr>
<tr>
<td>7</td>
<td>I like arithmetic because the procedures are logical.</td>
<td>7.9</td>
</tr>
<tr>
<td>8</td>
<td>I am afraid of doing word problems.</td>
<td>2.0</td>
</tr>
<tr>
<td>9</td>
<td>I like working all types of arithmetic problems.</td>
<td>9.6</td>
</tr>
<tr>
<td>10</td>
<td>I detest arithmetic and avoid using it whenever possible.</td>
<td>1.0</td>
</tr>
<tr>
<td>11</td>
<td>I have a growing appreciation of arithmetic through understanding its values, applications, and processes.</td>
<td>8.3</td>
</tr>
<tr>
<td>12</td>
<td>I am completely indifferent to arithmetic.</td>
<td>5.2</td>
</tr>
<tr>
<td>13</td>
<td>I have always liked arithmetic because it has presented me with a challenge.</td>
<td>9.5</td>
</tr>
<tr>
<td>14</td>
<td>I like arithmetic but I like other subjects just as well.</td>
<td>5.6</td>
</tr>
<tr>
<td>15</td>
<td>The completion and proof of accuracy in arithmetic gives me satisfaction and feelings of accomplishment.</td>
<td>9.0</td>
</tr>
</tbody>
</table>

*Similar items on the revised scale for parents will be assigned the same scale value.
<table>
<thead>
<tr>
<th>Item Number</th>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>word</td>
<td>story, verbal</td>
</tr>
<tr>
<td>5</td>
<td>figures</td>
<td>numbers; numerals</td>
</tr>
<tr>
<td>5</td>
<td>avoid</td>
<td>try to get away from; to keep from doing</td>
</tr>
<tr>
<td>7</td>
<td>practical</td>
<td>you can use it; helpful outside of school</td>
</tr>
<tr>
<td>10</td>
<td>challenge</td>
<td>something you have to work at; hard to do but you like it</td>
</tr>
<tr>
<td>11</td>
<td>indifferent</td>
<td>you don't really care; neutral; half-and-half</td>
</tr>
</tbody>
</table>
APPENDIX D
Dr. Wilbur H. Dutton  
Department of Education  
University of California  
Los Angeles, California  

Dear Dr. Dutton:

I am a doctoral student at East Tennessee State University interested in doing research on Parent, Teacher and Student Attitude toward Mathematics. I have read with interest several articles concerning your research.

I would like to request permission to use:

(a) Dutton's Attitude toward Arithmetic, Form C (students)  
(b) University of California Arithmetic Attitude Scale Three (teachers).

I will need an additional scale to measure parent attitude. Do you have a scale for parents? If not, with your permission I would like to modify the scale for teachers to provide a parent scale.

Can you provide a complete bibliography of your research in this area?

I would appreciate any assistance or suggestions that you can provide concerning my proposed research.

Thank you very much.

Sincerely,

(Mrs.) Sandra Blevins
Dr. Wilbur H. Dutton
1913 Greenfield Avenue
Los Angeles, California 90023

Dear Dr. Dutton,

Thank you very much for giving me permission to use the Dutton scale for attitude toward arithmetic in my research study.

I have received permission to conduct the study from the Institutional Review Board of our university and the permission of the superintendent of the school system. I will be meeting with the seventh grade teachers next week.

My thanks, again, for your help.

Sincerely,

(Mrs.) Sandra Blevins
November 6, 1976

Sandra Blevins
1302 Muskogeean Drive
Johnson City, Tenn 37601

Dear Mrs. Blevins:

We are very glad to give you permission to quote from our book(s), ARITHMETIC FOR TEACHERS by Dutton and Adams

In accordance with the conditions outlined in your letter of 10/24/76.

PERMISSION GRANTED FOR THIS ONE TIME USE ONLY.

Please give credit to the author(s), the title(s), and the publisher with copyright year date(s). Our usual credit line appears below:


Sincerely,

[Signature]

Emily McGee,
Asst. Permissions Editor
Dear Dr. Shepard:

I am a doctoral candidate in the College of Education, Department of Supervision and Administration, at East Tennessee State University. I am hoping to pursue a study on Parent, Teacher, and Student Attitudes Toward Mathematics and Student Achievement in Mathematics at the dissertation level. My research prospectus has been approved by my Graduate Committee. The chairman of my committee is Dr. Charles C. Bausada, Department of Curriculum and Instruction, East Tennessee State University.

Enclosed is a summary of my research proposal. I will be happy to provide a complete research prospectus, if desired. All student grades and parent, teacher, and student responses will be kept confidential and destroyed upon completion of the study. In the study, specific subjects will be referred to by number and not by name. The identity of the school system will not be revealed unless the superintendent desires that this be done.

I would appreciate your prompt assistance in bringing my research proposal before the Institutional Review Board for approval in view of the fact that I am working under a specific time frame.

Sincerely,

(Signed)

(Mrs.) Sandra Blevins
January 31, 1979

Mrs. Sandra Blavins
1502 Muskhogean Drive
Johnson City, Tennessee

Dear Mrs. Blavins:

The Institutional Review Board Subcommittee has reviewed and approved your proposal "Parent, Student and Teacher Attitudes Toward Mathematics and Student Achievement in Mathematics". I find the study acceptable in all aspects of protection of human subjects, including the matter of informed consent protection of subject confidentiality. If any untoward events do occur during the conduct of study, we request that you inform the Institutional Review Board of such.

We wish you the best of luck in the conduct of your study.

Sincerely yours,

Frank M. Shapard, M.D.
Professor and Chairman
Department of Pediatrics
Chairman, Institutional
Review Board

PMS/ksr
TECHNIQUE FOR DETERMINING SPLIT-HALVES RELIABILITY FOR
THE STUDENT AND PARENT SCALES

In the manner described by Thurstone and Chave (1929, p. 65) all
options on the scale were arranged in rank-order according to their
scale values and marked off in successive pairs. The first option in
each pair always has a slightly lower scale value than the second. In
the odd-numbered pairs the first opinion with the lower value was
assigned to Part A, and in the even numbered pairs the second opinion
with the higher value was assigned to Part A. The other item was
assigned to Part B. In this manner, the parent scale was divided into
two parts, A and B, each half as long and each having approximately the
same total scale value. The two sets of partial scores were then
correlated by utilizing the Pearson product-moment coefficient of
correlation. The correlation was interpreted by means of the Spearman-
Brown formula (Gronlund, 1965, p. 85) to give an estimate of the
reliability of the whole scale:

$$r_{xy} = \frac{n \bar{XY} - (\bar{X})(\bar{Y})}{\sqrt{[n \bar{X}^2 - (\bar{X})^2][n \bar{Y}^2 - (\bar{Y})^2]}}$$

Correction for full test:

Reliability for full test = \frac{2 \times \text{reliability on } \frac{1}{2} \text{ test}}{1 + \text{reliability on } \frac{1}{2} \text{ test}}.
Table A  

Split-Halves Reliability of the Parent Scale  

Utilizing the First Parent Group  

<table>
<thead>
<tr>
<th>Parent Number</th>
<th>Score on Part A</th>
<th>Score on Part B</th>
<th>Score on Whole Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.58</td>
<td>6.44</td>
<td>6.44</td>
</tr>
<tr>
<td>2</td>
<td>7.38</td>
<td>7.80</td>
<td>7.54</td>
</tr>
<tr>
<td>3</td>
<td>5.53</td>
<td>7.50</td>
<td>6.37</td>
</tr>
<tr>
<td>4</td>
<td>7.38</td>
<td>8.03</td>
<td>7.67</td>
</tr>
<tr>
<td>5</td>
<td>5.25</td>
<td>7.97</td>
<td>6.88</td>
</tr>
<tr>
<td>6</td>
<td>8.82</td>
<td>9.25</td>
<td>9.01</td>
</tr>
<tr>
<td>7</td>
<td>6.98</td>
<td>8.22</td>
<td>7.67</td>
</tr>
<tr>
<td>8</td>
<td>8.40</td>
<td>8.03</td>
<td>8.21</td>
</tr>
<tr>
<td>9</td>
<td>6.85</td>
<td>4.85</td>
<td>6.18</td>
</tr>
<tr>
<td>10</td>
<td>5.90</td>
<td>7.97</td>
<td>7.02</td>
</tr>
<tr>
<td>11</td>
<td>2.15</td>
<td>1.75</td>
<td>1.95</td>
</tr>
</tbody>
</table>

**TOTALS**  
70.92  
76.97  
74.94  

\[ r = .7412 \]  

Reliability on full test = .852
Table B

Split-Halves Reliability of the Student Scale

Utilizing the Students of the First Parent Group

<table>
<thead>
<tr>
<th>Student Number</th>
<th>Score on Part A</th>
<th>Score on Part B</th>
<th>Score on Whole Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.90</td>
<td>3.60</td>
<td>4.65</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>1.50</td>
<td>1.25</td>
</tr>
<tr>
<td>3</td>
<td>5.58</td>
<td>5.78</td>
<td>5.68</td>
</tr>
<tr>
<td>4</td>
<td>7.70</td>
<td>5.97</td>
<td>6.96</td>
</tr>
<tr>
<td>5</td>
<td>7.20</td>
<td>7.43</td>
<td>7.30</td>
</tr>
<tr>
<td>6</td>
<td>2.23</td>
<td>2.40</td>
<td>2.32</td>
</tr>
<tr>
<td>7</td>
<td>7.95</td>
<td>8.28</td>
<td>8.13</td>
</tr>
<tr>
<td>8</td>
<td>7.10</td>
<td>7.95</td>
<td>7.44</td>
</tr>
<tr>
<td>9</td>
<td>2.10</td>
<td>1.50</td>
<td>1.90</td>
</tr>
<tr>
<td>10</td>
<td>7.70</td>
<td>6.45</td>
<td>7.28</td>
</tr>
<tr>
<td>11</td>
<td>5.10</td>
<td>3.70</td>
<td>4.75</td>
</tr>
<tr>
<td>12</td>
<td>1.00</td>
<td>1.50</td>
<td>1.25</td>
</tr>
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<td>13</td>
<td>2.23</td>
<td>2.40</td>
<td>2.32</td>
</tr>
<tr>
<td>14</td>
<td>7.85</td>
<td>6.53</td>
<td>7.06</td>
</tr>
<tr>
<td>15</td>
<td>1.75</td>
<td>3.60</td>
<td>2.68</td>
</tr>
<tr>
<td>16</td>
<td>7.70</td>
<td>6.70</td>
<td>7.37</td>
</tr>
<tr>
<td>17</td>
<td>7.10</td>
<td>8.20</td>
<td>7.38</td>
</tr>
<tr>
<td>18</td>
<td>8.26</td>
<td>7.98</td>
<td>8.12</td>
</tr>
<tr>
<td>19</td>
<td>7.53</td>
<td>5.70</td>
<td>6.80</td>
</tr>
<tr>
<td>20</td>
<td>7.10</td>
<td>5.97</td>
<td>6.53</td>
</tr>
<tr>
<td>21</td>
<td>7.15</td>
<td>5.04</td>
<td>5.64</td>
</tr>
<tr>
<td>22</td>
<td>5.58</td>
<td>2.60</td>
<td>4.58</td>
</tr>
</tbody>
</table>

**TOTALS**

122.81          110.78          117.39

\( r = .876 \)

Reliability on full test = .934
Table C

Scores from Two Administrations of the Parent Scale

Utilizing the t Test for Two Independent Means

<table>
<thead>
<tr>
<th>Parent Number</th>
<th>Scores Group 1</th>
<th>Parent Number</th>
<th>Scores Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.44</td>
<td>12</td>
<td>7.31</td>
</tr>
<tr>
<td>2</td>
<td>7.54</td>
<td>13</td>
<td>7.36</td>
</tr>
<tr>
<td>3</td>
<td>6.37</td>
<td>14</td>
<td>6.95</td>
</tr>
<tr>
<td>4</td>
<td>7.67</td>
<td>15</td>
<td>4.72</td>
</tr>
<tr>
<td>5</td>
<td>6.88</td>
<td>16</td>
<td>7.64</td>
</tr>
<tr>
<td>6</td>
<td>9.01</td>
<td>17</td>
<td>6.82</td>
</tr>
<tr>
<td>7</td>
<td>7.67</td>
<td>18</td>
<td>6.82</td>
</tr>
<tr>
<td>8</td>
<td>8.21</td>
<td>19</td>
<td>6.37</td>
</tr>
<tr>
<td>9</td>
<td>6.18</td>
<td>20</td>
<td>6.40</td>
</tr>
<tr>
<td>10</td>
<td>7.02</td>
<td>21</td>
<td>7.67</td>
</tr>
<tr>
<td>11</td>
<td>1.95</td>
<td>22</td>
<td>8.21</td>
</tr>
</tbody>
</table>

TOTALS 74.94 76.27

MEAN 6.81 6.93

VARIANCE 3.32 .8520

\( F = 3.8967 \)

\( t = -0.015 \)
MULTIPLE CORRELATION

A multiple $R$ indicates the relationship between one dependent (criterion) variable ($Y$) and two or more independent (predictor) variables ($X_1$ and $X_2$) considered simultaneously. If student attitude is considered to be the dependent variable ($Y$), the relationship between student attitude and teacher-and-parent attitude ($X_1$ and $X_2$) considered simultaneously can be examined.

The multiple $R$ provides an index of the relationship between student attitude and a combination of teacher-and-parent attitude. The multiple correlation coefficient is not merely a sum of the relationships between $Y$ and $X_1$ and $X_2$ considered simultaneously. Instead $R$ is based on the intercorrelations between the variables. The calculation of the multiple $R$ makes use of the individually computed $r$'s between the variables in the problem.

The following coefficients were utilized in calculating the multiple $R$ for Hypothesis VI:

(a) the product-moment correlation coefficient between SA and PA (Hypothesis I)

(b) the product-moment correlation coefficient between SA and TA (Hypothesis II)

(c) the product-moment correlation coefficient between TA and PA (Hypothesis V).

The multiple $R$ was calculated by the SPSS computer program.
<table>
<thead>
<tr>
<th>Student Number</th>
<th>Student Attitude Score</th>
<th>Father Attitude Score</th>
<th>Mother Attitude Score</th>
<th>Parent Attitude Score</th>
<th>Teacher Attitude Score</th>
<th>Student Math Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M 2.07</td>
<td>4.04</td>
<td>4.68</td>
<td>4.36</td>
<td>7.43</td>
<td>3.50</td>
</tr>
<tr>
<td>2</td>
<td>M 3.30</td>
<td>8.94</td>
<td>8.94</td>
<td>8.52</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>F 5.70</td>
<td>6.02</td>
<td>7.24</td>
<td>8.30</td>
<td>3.42</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>F 3.35</td>
<td>4.68</td>
<td>4.68</td>
<td>7.33</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M 6.90</td>
<td>8.83</td>
<td>8.83</td>
<td>8.30</td>
<td>3.30</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>F 7.10</td>
<td>8.65</td>
<td>8.65</td>
<td>8.30</td>
<td>3.30</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>F 6.78</td>
<td>8.00</td>
<td>8.00</td>
<td>8.76</td>
<td>3.40</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>M 4.07</td>
<td>7.60</td>
<td>7.60</td>
<td>7.76</td>
<td>2.67</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>M 6.93</td>
<td>5.83</td>
<td>5.83</td>
<td>7.31</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>F 6.90</td>
<td>2.95</td>
<td>5.84</td>
<td>5.99</td>
<td>2.70</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>F 8.58</td>
<td>6.00</td>
<td>8.64</td>
<td>8.52</td>
<td>3.83</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>F 7.38</td>
<td>7.72</td>
<td>7.72</td>
<td>8.52</td>
<td>3.83</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>M 5.43</td>
<td>7.65</td>
<td>7.65</td>
<td>7.25</td>
<td>3.38</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>M 3.43</td>
<td>9.06</td>
<td>3.53</td>
<td>6.40</td>
<td>1.71</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>F 4.20</td>
<td>3.02</td>
<td>3.32</td>
<td>3.17</td>
<td>2.83</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>M 8.65</td>
<td>6.46</td>
<td>6.60</td>
<td>7.63</td>
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Table D-3
Attitude Scores and Student Grades

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VITA

SANDRA LEE COWAN BLEVINS

Personal Data:
- Date of Birth: April 15, 1941
- Place of Birth: Morristown, Tennessee
- Marital Status: Married
- Husband: Raymond Dean Blevins, Ph. D., University of Tennessee, Professor of Anatomy and Physiology.
- Affiliations: Phi Kappa Phi Honor Society, Phi Delta Kappa, Kappa Delta Pi (education), Kappa Mu Epsilon (mathematics), National Council of Teachers of Mathematics, Athean Literary Society (awarded lifetime membership), King College, Bristol, Tennessee

Education:
- East Tennessee State University, Johnson City, Tennessee; mathematics, chemistry, B. S., 1962.
- University of Tennessee, Knoxville, Tennessee; mathematics, education, Master of Mathematics, 1970.
- East Tennessee State University, Johnson City, Tennessee; education, computer science, Ed. D., 1979.

Professional Experience:
- Teacher, mathematics and chemistry, Virginia High School; Bristol, Virginia, 1962-64.
- Teacher and departmental chairman, chemistry, Overton High School; Memphis, Tennessee, 1965-66.
- Teacher, mathematics, East Tennessee State University High School; Johnson City, 1974-75.
- Teacher, mathematics and science, Happy Valley High School, Elizabethton, Tennessee, current position.
Honors and Awards: East Tennessee State University, 1959-62:
Four Year Scholarship
Alumni Association Award, 1958-59
Lambda Chi Alpha Scholarship Award, 1958-59
Dean's List and Dean's Award
Who's Who in American Colleges and Universities

University of Tennessee, 1969-70:
National Science Foundation Fellowship Award
for Graduate Study

East Tennessee State University, 1976-79:
Doctoral Fellowship

Other:
President, King College Faculty Women, 1968-69
President, University School PTA, 1974-75

Travel, Holy Land and Switzerland, 1976.