RELATIONSHIPS BETWEEN SELF-CONCEPT OF ARITHMETIC ABILITY AND ARITHMETIC ACHIEVEMENT IN A SELECTED GROUP OF SIXTH GRADE STUDENTS

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EDWARD J. HAYES

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This is to certify that the

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ABSTRACT

RELATIONSHIPS BETWEEN SELF-CONCEPT OF ARITHMETIC ABILITY AND ARITHMETIC ACHIEVEMENT IN A SELECTED GROUP OF SIXTH GRADE STUDENTS

by Edward J. Hayes

The Problem

The purpose of this study was to test the relationships between arithmetic self-concept and arithmetic achievement as indicated by the results of standardized achievement tests and by teacher evaluation of arithmetic competency in the on-going classroom milieu. Corollary to this purpose was the intent to study the independent variables included in this exploration in relation to arithmetic self-concept.

The Sample

The research population consisted of a group of 161 Sixth Grade students from which a research sample of 144 children, for whom full data was available, was used.

Pertinent literature was reviewed and cited within the study in terms of theoretical and practical aspects.

Methodology

The experimental design was based primarily on a Pearson Product Moment Coefficient of Correlation correlational analysis. The t-test and the Mann-Whitney U test were used to analyze significance of differences between research groups for variables within the study.

Results

A summary of the results obtained from this study follows:

1. Students with high arithmetic self-concept achieved significantly higher in arithmetic, in terms of standardized arithmetic achievement test results, than did children with low arithmetic self-concept: $U = 6.15$, $p = < .001$.

2. There was no significant difference between the arithmetic self-concept of girls and arithmetic self-concept of boys, though the arithmetic self-concepts of girls was higher than the arithmetic self-concept of boys: $t = .74$, $p = > .05$.

3. Students with high arithmetic self-concept obtained significantly higher teacher-assigned grades in arithmetic than students with low arithmetic self-concept: $U = 5.87$, $p = < .001$.

4. Girls received significantly higher grades in arithmetic than boys: $t = 1.90$, $p = < .05$.

5. There was a significant positive correlation between scholastic aptitude, as measured by the California

Short-Form Test of Mental Maturity, and arithmetic self-concept: *r* = .51, *p* = < .01.

6. There was a significant positive correlation between arithmetic achievement test results and arithmetic self-concept: *r* = .62, *p* = < .01.

7. There was a significant positive correlation between teacher-assigned arithmetic grades and arithmetic self-concept: *r* = .71, *p* = < .01.

8. There was a significant positive correlation between total academic grade point average and arithmetic self-concept: *r* = .68, *p* = < .01.

9. There was a low, though significant, positive correlation between mothers' educational level for students in the sample and arithmetic self-concept: *r* = .23, *p* = < .02.

10. There was no significant relationship between mothers' educational level for girls in the sample and arithmetic self-concept: *r* = .13, *p* = > .05.

11. There was a low, though significant, negative correlation between a composite social-status ranking for children in the sample and arithmetic self-concept: *r* = -.30, *p* = < .01.

12. There was no significant relationship between social-status ranking and arithmetic self-concept for boys: *r* = -.22, *p* = > .05.

13. There was a significant positive correlation between general self-concept of ability and arithmetic

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achievement as indicated by standardized achievement test scores: $r = .48$, $p = < .01$.

14. There was no significant difference between general self-concept of ability of boys and general self-concept of ability of girls in the sample: $t = .06$, $p = > .05$.

15. There was a moderately high significant positive correlation between general self-concept of ability and teacher-assigned arithmetic grades: $r = .61$, $p = < .01$.

16. There was a substantially high significant positive correlation between total grade point average for academic subjects and general self-concept of ability: $r = .67$, $p = < .01$.

17. There was a low, though significant, negative relationship between a composite family social-status ranking for children in the sample and general self-concept of ability: $r = -.32$, $p = < .01$.

18. There was no significant relationship between family social-status ranking and general self-concept of ability for boys: $r = -.20$, $p = > .05$.

Generalizations which might be made concerning the findings should be viewed within specified limitations inherent to the study, which include grade level, geographic, socio-economic and ethnic-cultural restraints. This study should be considered primarily explorative, but with some replicative implications.

The conclusions derived in the study have supported the operation

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operational hypotheses of the research, namely that arithmetic self-concept is significantly and positively related to arithmetic achievement as indicated by both arithmetic achievement test results and teacher-assigned arithmetic grades.

Though conclusions are tentative, the rationale for using a perceptual frame of reference within the framework of self-theory seems feasible for study of factors underlying learning. The findings are sufficient to justify further study in this context.

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Finally, to my wife Rose and my children Brian, Kathleen, Patrice, Karen, Kevin, Keith and Bruce I dedicate this work.

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Edward J. Hayes

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CHAPTER I

INTRODUCTION

Nature of the Problem

The technonomy of the twentieth century, characterized by dramatic advancements in science and mechanics, places a high premium on education for its people. It has been said that the proliferation of knowledge during the present era is such that technical skills essential to many contemporary industrial, scientific and investigative operations will be rendered obsolete in less than a decade. Demographers and planners estimate that approximately sixty per-cent of the people living at the end of this century will be employed in technically oriented positions that do not even exist today. Automation, already responsible for the elimination of more than 200,000 factory jobs annually, will leave the uneducated behind.

Clearly there is in prospect a mandate for expansion of our educational objectives. There is a need for improved and increased education for greater numbers of our people to enable them to adapt to the demands of the technical epoch into which we are inexorably moving. This need arises when noted educators such as Conant (35) suggest that only about fifteen to twenty-five per-cent of our high school youth can profit by high level education in mathematics, science and foreign languages.

Fundamental to technical adequacy is a competency in mathematics and basic to this is a good start in arithmetic. However, Brown (17), in a recent publication of the National Council of teachers of Mathematics, reveals that though school enrollments have increased over the years the per-cent of student time spent on study of mathematics has steadily declined. Price (104), in The Revolution in School Mathematics, writing about the impact of progress on mathematics in the school, indicates that too few students gain an adequate knowledge of mathematical concepts in school to prepare them for advanced technical training and education. As a consequence we are deprived of the technical personnel required to enable us to remain competetive with other leaders in technology throughout the world. According to Woodby (145), in contemporary America many essential technical positions go unfilled because of the dearth of trained manpower.

Recent enrollment figures in mathematics classes at the secondary levels do not reflect a cognizance of the need for more students trained in mathematical principles. The need is amplified by the warning that the student who does not take at least three years of high school mathematics is so handicapped that many fields of study are permanently closed to him when he reaches college.

That there is a shortage of mathematicians has been emphasized by Price (104:10), writing of the progress in mathematics and its implications for the schools. He writes:

> As a result of the revolution in mathematics there is an unprecedented demand for mathematicians and mathematics teachers -- it is impossible to foresee a time when there will be an adequate supply.

There is some reason that we are faced with this shortage of competent mathematicians at all occupational levels ranging from education to scientific operations and research. It is apparent that there is a need to investigate the reasons that students do not elect mathematical courses. To maximize the educational potentialities of our students and to provide our economy with the trained personnel necessary for implementation of our technical commitments the charge to explore the possible causes of student reluctance to elect mathematics courses appears imperative.

Investigation has been done into the cognitive areas of arithmetic learning, but little research has been made of the affective correlates of arithmetic competencies. Weaver and Gibb (141), writing in the Review of Educational Research, recommend examination of personality variables as possible influences on the development of difficulties in arithmetic (mathematical) growth.

The Problem

It is the purpose of this study to investigate the relationship between a measure of arithmetic self-concept and arithmetic achievement in a selected group of sixth grade students.

It is recognized by psychologists and educators that innate intellectual factors do delimit learning ability; however, during the course of individual psychological examination of children with learning problems it occurred to the writer that there is possibly an important relationship between the concept a learner holds of self-ability in arithmetic and potentialities in relation to arithmetic achievement.

The strategy is to explore, isolate and describe relationships among measures of arithmetic self-concept, general self-concept of ability, arithmetic aptitude, arithmetic achievement, teacher evaluations and student variables related to I.Q., sex, a designation of family social-status, and the educational level of the mother.

Research Objectives

Clinical, educational and social psychologists have, in recent years, attempted to explore the psychologically relevant configuration in which learning and behavior occurs through study of the self-concept in a variety of experimental designs.

The specific objectives of the research are:

1. To explore background information related to students' arithmetic self-concept which could be related to arithmetic achievement.

2. To investigate relationships among student responses on an arithmetic self-concept scale; scores on a group achievement test; scores on a group aptitude (I.Q.) test; teacher evaluations (current and cumulative) and rankings of family social-status.

3. To investigate differences in arithmetic achievement that may exist between students with high arithmetic self-concepts and students with low arithmetic self-concepts.

Theoretical Considerations

Theoretical direction for the present investigation evolves from the social psychology of Mead (92); the perceptual approach to individual behavior as delineated by Combs and Snygg (32), and the self-theory of Rogers (111).

A basic postulate is that the capacity for intelligent behavior is dependent upon the state of one's perceptual field. The self-concept of learning abilities is seen as a functionally facilitating or limiting factor in academic achievement since a poor self-attitude implies a lack of confidence that adversely affects general adjustment and proficiency in school.

A corollary proposition is that the self-concept functions as an integrating force in school achievement to the extent that a student will achieve at a level consistent with his perceptions of his ability to achieve. Much motivation for sound learning comes from the child's drive to enhance his self-concept through positive self-achievement, and to protect it by avoiding failure. An adequate self-concept is related to high academic achievement and an inadequate self-concept is related to low achievement.

The self-concept is learned, it is a product of experience and interaction with others in the social milieu; it is dynamic and is in continuous involvement with living and with learning at school.

Bases for these postulates will be established in Chapter II of this study.

Need for the Study

In education an understanding of the dynamics underlying achievement gains and/or deficits is important to educators at the theoretical, practical and administrative levels. There is research evidence supportive of the idea that the self-concept is an important factor in the determination of how children act, learn and function in life. The thesis presented in this study is that definitive knowledge of the affective influences operant in mathematical/arithmetic performance is essential to effective planning for individual differences that occur in children in the on-going teaching-learning process. There has been related research which examined relationships between self-concept and academic achievement, Brookover (16) and Weatherman (140). No study, however, has attempted an in-depth probe of the possible relationship between the arithmetic self-concept and measures of arithmetic achievement.

Definition of Terms

Self-concept is a personal perceptual framework that includes the individual's conscious attitudes and understandings of himself, his experiences and his capacities in relation to his surrounding world as motivation for behavior and learning.

Arithmetic is defined as the understanding of rules for combining two or more numbers. It is the art of computation and the application of this art.

Arithmetic self-concept refers to the individual's perception of his understanding of arithmetic functions; his expectations of future arithmetic capabilities; his appreciation of arithmetic as a socially relevant discipline; his interest in arithmetic as a tool for present and future economic existence, and his aspiration for future use of arithmetic (mathematic) skills.

Operationally the arithmetic self-concept refers to responses on items one through twenty-five on the arithmetic self-concept scale: an adequate arithmetic self-concept is equated with a score deviating above the median on the arithmetic self-concept scale.

General self-concept of ability refers to the student's perceptions of his ability to do school work and his attitudes toward the evaluative-competetive aspects of school.

Functionally the general self-concept of ability refers to the student's responses to the fifteen test items of the original Michigan State University Self-Concept of Ability Scale cited by Brookover and associates (16).

Academic aptitude refers to those competencies specifically related to academic success in terms of measured potentialities.

Functionally aptitude is defined as the student's score on a recently administered standardized test scale. The California Short-Form Test of Mental Maturity, Level 2, 1963 revision was the test used.

Arithmetic achievement is the level at which competency in arithmetic skills is empirically demonstrated by test scores. These scores were determined by performance on the arithmetic sub-tests of a group administered standardized achievement test taken by each child in the sample. The Stanford Achievement Test, Intermediate I Battery, 1964 revision was the achievement test used. The Arithmetic Applications sub-test score was designated as the score indicative of arithmetic achievement for general purposes.

Teacher evaluation is regarded as the letter grade conferred upon students from teacher perceptions of arithmetic competency in the on-going classroom activity.

Teacher evaluation is operationally defined as the marks listed for arithmetic achievement in the student's permanent school record for the quarterly marking period during which the arithmetic self-concept scale was administered; the final semester mark and a cumulative average of arithmetic marks received in grades three, four and five. The total grade point average for academic subjects in the sixth grade was also computed.

The Social-Status Index is a numerical designation representative of the socio-economic status of the families of the children included in the study.

Social-status is functionally defined as the composite of ratings made of socio-economic factors of families of children in the study in terms of parent education, father occupation, type of dwelling and residential area. The McGuire-White Measurement of Social Status was the instrument used to yield this designation.

Mothers' Education is the indication of the highest grade in school attended by the mothers of children in the sample.

Operationally the mothers' educational level was represented by the grade level of highest attendance listed in the permanent school record of their children.

Overview of the Study

In Chapter I, the introduction presents the rationale and the overall objectives of this study of the relationships between arithmetic self-concept and measures of arithmetic achievement and scholastic aptitude. Nature of the problem, statement of purpose, strategy, research objectives, theoretical considerations and need for the study are included in this section.

In Chapter II literature and research relevant to the problem is reviewed. Theoretical concepts and definitions pertaining to the self-concept, development of the self-concept, relation of the self-concept to learning, relation of affective characteristics to arithmetic achievement and the classroom implications of the self-concept are included in this section.

In Chapter III the research design and methodology are delineated. Prepatory activities, the population, and the sample are defined. Selection of the sample, selection of the variables, selection and description of the instruments are explained. Finally, procedures for collecting and analyzing the data are outlined in this section.

In Chapter IV contains the hypotheses and limitations of the study. The general hypotheses, operational hypotheses and limitation and scope of the study are defined in this section.

In Chapter V an analysis of the experimental results is made with appropriate tables to aid in the interpretation.

Chapter VI is a summary of the findings and conclusions; a discussion of the findings and recommendations are included in this section.

Summary

The general purpose of this study was to investigate the relationships that may exist between a student's arithmetic self-concept and measures of arithmetic achievement, scholastic aptitude and family social-status. The strategy was to explore, isolate and describe relationships between the dependent variable, arithmetic self-concept, and the independent variables of I.Q., sex, arithmetic achievement, teacher grades and designations of family social-status.

The principle hypothesis of this investigation was that there is a significant positive relationship between arithmetic self-concept and arithmetic achievement.

CHAPTER II

REVIEW OF THE LITERATURE

In recent years a number of research projects have been conducted to explore what aspects of the student's affective make-up operate in the learning process. Many of the current research projects reflect the growing interest of educational psychologists in the phenomenon of self-concept as an influence on behavior, and in particular the behavior underlying academic achievement. The involvement of educational psychologists in the investigation of characteristics of the self-concept represents a move from the psychotherapeutic emphasis and direction that characterized much of the early research into the dynamics of self-concept. In regard to this transition, Combs and Soper (33), comparing teachers' perceptions of the helping relation with views held by therapists, concluded that there are common characteristics in good helping relationships wherever they are found; and no appreciable differences exist between the percepts of teachers and the attitudes of therapists toward the helping relation.

For the purpose of the present investigation only those studies that are related to the development of self-concept and its role as a precursor of academic attitudes are reviewed.

Nature of the Self-Concept

After nearly half a century of relegation to virtual oblivion, self-theory has emerged with such vigor that one finds it threaded through the fabric of almost all current psychological thought. Patterson (100), tracing the development of Rogerian Self-Theory, comments that the self is today becoming of central importance in all theories of personality. In this regard, Arieti (5) sees the prominence accorded the self in modern psychological theory as testimony of the emergence of the psychology of personality as a field of scientific endeavor.

Self-theory, during the era that James (66:291) defined a man's self as the sum total of all that a man calls his own, was associated primarily with the laboratory and the lecture hall. In a more modern era the impetus was initially given to the development and expansion of a theoretical frame-work by clinical psychologists and psychotherapists. In contemporary times, self-theory is being adopted by a growing number of educators and psychologists. For instance, Combs and Snygg (32), Jersild (69), Rogers (111) and Symonds (128) have been the guiding lights in the development of ideas enunciated by Cooley (36), Lecky (82) and Mead (92); they have adapted constructs related to self-theory and, with numerous other colleagues, have added significantly to the practical body of knowledge of that theory.

Since a number of contemporary practioners and theorists in the fields of education and psychology have contributed materially to the accumulation of scientific knowledge relevant to self-theory there have been some semantic difficulties to overcome. There has been a tendency for writers to personalize concepts and refer to an idea they hold in common with others by an ideosyncratic term. In this respect, the terms ego and self are frequently used synonymously despite the distinction that Chien (28) and Smith (120) made between the two entities: they construe the ego as a motivational-cognitive structure built up around the self and working interdependently in reference to the self, but apart from awareness. Awareness is central to self-concept as defined by Combs and Snygg (32), Jersild (69) and Rogers (111).

Some of the terms compatible with self and used interchangeably in self-theory are: the proprium used by Allport (2); the phenomenological self of Snygg and Combs (32); the self-system delineated by Sullivan (126), and the self-regard of Wylie (147). The important consideration of these terms, despite their verbarian differences, is the implication that all represent an effort to understand the behavior of the individual from his own perceptions of his position in the environment in which he moves.

Self-concept is basic to self-theory and is that facet of personality that is, by definition, accessible to investigation. Self-concept has been defined in the following ways:

> Ausubel (6:273): The self-concept is an abstraction of the essential and distinguishing characteristics of the self that differentiates an individual's "self-hood" from the environment and from other selves. In the course of development various evaluative attitudes, values, aspirations, motives and obligations become associated with the self-concept.

> Combs and Snygg (32:127): The self-concept is an individual's attempt to reduce his self organization to its essence so that he may be able to perceive and manipulate it effectively; it is the generalization of self which aids in perceiving and dealing with self.

> DeLisle (43:7): The self-concept is the understanding which the individual has of himself in relation to his surrounding world as a motivating drive for his behavior.

> Dinkmeyer (41:183): The self-concept is really the individual's anticipation of his general acceptance or rejection in a given situation.

> Fink (53:58): The self-concept is the attitudes and feelings a person has regarding himself.

> Jersild (69:116): The self-concept is a composite of a person's thoughts and feelings, strivings and hopes, fears and fantasies, his view of what he is, what he has been, what he has become, and his attitudes pertaining to his worth.

> Raimy (105:155): The self-concept is the map which each person consults in order to understand himself, expecially during moments of crisis or strife. It is what a person believes about himself.

> Shostrom and Bremmer (116:138): The self-concept defines one's nature (I am), one's capacities (I can), one's values (I should or I shouldn't) and one's aspirations (I want to be).

> Thorne (134:110): Self-concept involves not only a continuing awareness of what one is in the present but also the record of what one has been in the past, and also what one would like to be in the future. Thus the self-concept consists of (a) memories and contexts stemming from past history, (b) conscious awareness of current mental states and (c) expectancies or imaginings concerning what one might be in the future.

The essence of these definitions is that self-concept is a constellation of one's conscious feelings and attitudes about himself in terms of four aspects ennumerated by Symonds (128): 1) how a person perceives himself; 2) what he thinks of himself; 3) how he values himself; 4) how he attempts through various actions to enhance or defend himself.

Self-theorists, such as Combs (29), Jersild (68), Mead (92), Raimy (105) and Rogers (111), postulate that self-concept is the conscious core of an individual's behavior that mediates behavior by serving as an intermediary between perceptions and behavior. There is research evidence to suggest that one behaves in ways which are consistent with his self-concept. For example, Lecky (82) found that what a person is able or unable to learn depends, to a large extent at least, upon how he has learned to define himself. In this respect, the relevancy of self-concept to the understanding of inceptive, typical and on-going behavior seems crucial -- particularly in terms of student performance.

Combs and Snygg (32) indicate that self-concept is a useful structure for studying the individual since it can be interpreted as a convenient approximation of the personality because it represents the most stable, important and characteristic self-perceptions of the individual. The self-concept is a shorthand description of the innumerable discrete perceptions of self an individual possesses.

Brownfain (19), in his doctoral study of the stability of self-concept, concluded that self-concept is an important point of reference for any evaluation a person makes of himself and thus is servicable to the work of understanding and predicting behavior. Benjamins (11), in an investigation involving 48 high school students as subjects and designed to relate reactions in terms of self-conceptualization to measurable behavior, showed that behavioral reactions related to external influences on changing self-conceptualization can indeed be associated with measurable components of the self-picture.

To Combs (29) the perceptual field is an organization continuously changed and modified by the perceptions occuring within it; Maslow (87) associates this phenomenon with the constant striving to self-actualization -- to express and to achieve potentialities. Carlson (25) and Engel (49), in separate longitudinal investigations of stability and change in self-concepts of adolescents, concluded that self-concept is a relatively stable dimension of the self that is related to the level of self-esteem. High self-esteem, according to their findings, is associated with adequate school related social adjustment.

Lazarus (80), in his book about psychological adjustment, writing of the conscious factors that influence personality growth and adjustment cites the self-concept as an important factor in understanding individual behavior. He perceives self-concept, as a representation of an individual's understanding of present behavior, as an important construct through which those interested in understanding human behavior can gain valuable insights. Such data, he suggests, can be gained through a self-report technique used to measure aspects of human personality related to interests and attitudes.

Development of the Self-Concept

Self-concept does not emerge, as Venus was supposed to have, full grown; it is a genetic structure that develops through a process of social interaction mediated by maturational factors. Mead (92), in this regard, theorized that though the self is not present at birth because of its social nature very early experiences play an important role in its development. Anderson (4) relates, due to the relative helplessness of an infant, the first year of life is vital to the development of the self-concept. Ausuble (6) also posits that social, indogenous and perceptual processes established in early life experiences have an important influence in ultimate personality development which includes the self-concept. Symonds (130), writing of the origins of personality, relates that even in the first year the mental processes of the infant are concerned with the reactions of others toward him and out of these reactions of others he builds his concept of himself. With regard to the impact of early experiences on the growth pattern, self-theory indicates that later stages of development are naturally dependent upon the beginning phases of self since early experiences do delimit the possibilities of later ones.

The self-concept of each individual is unique and is a synthesis of the experiences and social interactions he incurs during the course of his life. Kelley (73), writing about the fully-functioning self, states that the self consists, at least in part, of the accumulated experiential background, or backlog, of the individual. Writers such as Combs and Snygg (32), Dinkmeyer (41) and Lecky (82) tell us that the way an individual is treated by parents and significant others in his life is an important determinant in the development of the self-concept since the introjection of the values of others plays a significant role in the unfolding of the self. In respect to its development, however, Hilgard (64) suggests that the self-concept is not an unfolding of an inevitable pattern.

Sarbin (114), analyzing the psychological genesis of the self, has schematized its development this way:

Stage: S1. Somatic self (undifferentiated); age one month.
S2. Receptor-effector self (differentiated-vocal); age three-to-four months.
S3. Primitive construed self (differentiated to others); age six months.
S4. Introjecting-extrojecting self (responds to commands); age ten-to-fourteen months.
S5. Social self(use of I, me, mine, etc.); age twenty-four months.

Davids and Lawton (39), studying interrelationships among a child's self-concept and the child's concept of the mother in a group of normal pre-adolescents and a group of hospitalized emotionally disturbed children, deduced that results lent empirical support to the theoretical convictions that mother-child relations play a crucial role in the formation of the child's self-concept. Medinnus (93), investigating self-acceptance in a group of college freshmen, found that self-acceptance is related to perception of maternal attitudes. His findings indicate that the mother exerts a greater influence than the father on the child's personality development because of the child's identification with the mother: the findings obtained for both boys and girls. Pertinent to this influence of mothers, Drucker and Remmers (45), in an exploration of the environmental determinants or correlates of adjustment through analysis of attitudinal responses of 1000 seventh and eighth graders to the _SRA Youth Inventory_, concluded that the level of education of the mother was significant in relation to adjustment or lack of adjustment as indicated by the Basic Difficulties items on the _Youth Inventory_: $p = .01$.

Helper (63), studying indicants of parent reward as impinging upon children's self-descriptive behavior, also cites parental influences as an important factor in the shaping of the self-concept. Using a sample of 53 children at the seventh and eighth grade levels he tested the degree of correlation between parental reward for emulation of like-sex parent and the child's self-concept. From the results Helper concluded that parental reward is positively correlated with self-concept modeling: $r = .40$.

Ausubel (6), Dinkmeyer (41) and Prescott (103) perceive the schools as significant in producing feelings about the self. Since self-concept is a product of experiences, what happens to the child during the time spent in school becomes an important factor, particularly since the school is a place where the child is constantly comparing himself with others. Concerning this, Swift (127), evaluating the effects of early group experiences in nursery school, relates that peer influences operate in the development of self-concept during very early school-oriented experiences. The way children react toward him and the way other children perceive him influences a child's own perception of himself as a social person. Bandura and Huston (7), working with 48 nursery school children in an investigation to demonstrate that children learn a good deal of social behavior imitatively, inferred from results of their study that children do display a good deal of social learning of an imitative sort; nurturance on the part of the model facilitated such imitative learning in the study. Pertinent to the school-related influences affecting growth of the self-concept, Kipnis (75), studying the relationship between interpersonal perception and the process of changing self-concepts concluded that the relationships between a subject's perception of his friends and changes in self-concept indicated strongly that interpersonal percepts and self-perceptions are closely related: $\underline{p} = .01$.

The self-concept is not static -- changes in the self-concept do occur and can be associated with maturation, social experience and learning. Beck (10) theorizes that though by the age of five or six attitudes toward self and others have taken shape they are amenable to change; and in this vein, Rogers (113) writes that under certain psychological conditions needed reorganization and restructuring of the self can be facilitated. Changes in self-concept can be effected through enabling one to alter his perception of self, his abilities and the values which he holds by establishment of an atmosphere conducive to such change. The relative plasticity of self-concept is a construct of child development that should have pertinency, according to Symonds (128), for parents and teachers in relation to their roles in shaping children's self-concepts. In this context Symonds (128:110) has written:

> Children respond not only to what is said to them and about them but also to the attitudes, gestures, and subtle shades of expression that indicate how parents and teachers feel. Indeed, these more subtle expressions may be taken by the child as representing the parent's true attitude toward him.

Illuminating this point made by Symonds, Bower (15) has suggested that the psychological processes of children are subject to neither moral or logical restrictions.

Most self-theorists, including Jersild (69), Mead (92) and Rogers (111) underscore the importance of social interaction on development of self-concept. Indeed, Combs (30) has stated that no-one can evolve into anything remotely resembling humanness without interaction and intercourse with others and the environment.

Relation of the Self-Concept to Learning

The self-concept, because it is fundamental to the understanding of behavior, is an important principle to the analysis of the affective antecedents of learning since, according to Combs and Snygg (32), the capacity for intelligent behavior and the development of abilities are rooted in the self-concept. Lane (77), in a book on the education of human beings, perceived feelings and attitudes as basic determiners of a learning experience; and Dinkmeyer and Dreikur (42), writing about the encouragement process in learning, suggested that what the child decides to do depends largely on his own concepts, his perceptions of himself and others and his method of finding a place for himself. Relative to this Lecky (82:178), in his compact but cogent book on self-consistency, wrote:

> Academic difficulties and social maladjustments are both conceived as due to resistance arising from the subject's conception of himself. If a student shows resistance toward a certain type of material, this means from his point of view it would be inconsistent for him to learn it.

Amplifying this proposition, Dinkmeyer (41:184), in a book about the self written in the contextual framework of child development, suggests that self-concept serves to integrate and differentiate experiences; he has written:

> The self permits the child to act, to adjust, to do more than merely respond to specific stimuli.

Murphy (97:75) further states in relation to self-concept and learning:

> The self is dependent upon attributes or traits, things that one can do, things that are acceptable or unacceptable to others, things that win status or prestige in a group.

Jersild (70) has observed that the ability to learn is grounded in the individual's perception of his capacity to learn, and Rogers (111) adds that an individual's attitude toward learning is related to his personal adjustment. Allport (3) gives substance to this postulate in his thesis that learning is affected by self-awareness in terms of attention, judgement, memory, motivation, aspirational level, productivity and personality traits; Ausubel (6) regards such temperamental and personality characteristics as facilitative to problem solving techniques. It has been suggested that poor self-attitudes imply a lack of confidence that adversely affects general adjustment to the environment and proficiency in school. Silverman (118), studying the relationship of self-esteem to responsiveness to success and failure in which he was attempting to establish that high self-esteem subjects show little response to self-devaluating stimuli, concluded that there is a tendency for both high and low self-esteem subjects to limit their cognitive input to information which is congruent with their self-image.

In a research project nuclear to the study of the academic relevancy of self-concept, Wattenberg (139), in research with kindergarten children devised to determine whether the association between self-concept and academic achievement had its origin in self-concept being causal to achievement, or if, by contrast, the experience of academic success or failure played a part in the formation of self-concept, concluded that as early as kindergarten self-concept phenomena are antecedent to and predictive of academic accomplishment -- at least in reading.

Symonds (129) has stated that failure is intimately related to concept of self because it is a function of the level of aspiration which is an expression of self-appraisal. Bruck and Bodwin (20), examining this aspect of the association between self-concept and academic achievement in 60 children referred to a child guidance clinic, found that a positive significant relationship exists between educational disability and immature self-concept as measured by the Self-Concept Scale of the Machover DAP Test: $r = .60$. Borislow (13), in a study designed to investigate the importance of self-evaluation as a non-intellectual factor in scholastic achievement in a group of 197 college students, reached the conclusion that students who underachieve scholastically have a poorer conception of themselves as students than do achievers: $p = .01$. In the same vein, Dabbs (38), working with 88 college psychology students and investigating the process underlying defensive resistance to attitude change, found that high and low self-esteem subjects differ in their characteristic mode of adjustment: either they actively approach and attempt to cope with their environment, or they react to it in a passive, noncoping manner. Rath (107), in a study of the relationships between self-concept and achievement in a group of college freshmen, decided that those who achieve, as well as those who do not, do so as a result of the needs of their own self-system.

Fink (53), studying the relationship between self-concept and achievement, concluded that a relationship does in fact exist between adequate self-concept and level of academic achievement. His conclusions appeared to be unquestionable for boys, but less definite for girls: p for boys= .01; p for girls= .10.

In relation to the impact of self-concept on academic achievement or underachievement, Jackson and Strattner (67) offer the tenet that a person with a positive attitude toward a subject learns more readily than a person with a negative attitude because the former possesses a more stable and elaborated perspective into which to fit new material. In respect to this observation, Coopersmith (37) found that a personal conviction of adequacy provides the prerequisites for effective focussing of efforts even in stress-laden situations. Also in regard to this concept, Delisle (43) indicates that a significant aspect of the feeling about the self relates to the ability to achieve in competition with others.

Brookover and associates (16), in a longitudinal study, determined that self-concept of ability is significantly related to school achievement of seventh grade boys and girls: r was .57 for both boys and girls in the study. Haarer (58), in a similar research project, but limited to delinquent and nondelinquent boys, obtained corresponding results in reference to the relationship between general self-concept of ability and classroom achievement.

Washburn (138) submits that it becomes important to consider personality factors such as self-concept along with academic achievement as a predictor of long-range academic successes. Jersild (70:113) underlines this sentiment about the learner with this counsel:

> If he is convinced he is stupid, this conviction is likely to close many avenues of life to him (the student) that might in reality be open.

<u>Relation of Affective Characteristics to Arithmetic Achievement</u>

Even though innate cognitive characteristics related primarily to intellectual abilities such as perception, language skills, intelligence and problem solving ability are acknowledged as a delimiting factors in learning potential, it is evident, from the study of learning problems, that there are other influences of a non-cognitive sort that affect academic learning; these affective factors appear to operate in all areas of school-related learning including arithmetic. Some affective characteristics related to attitudes and values have been cited in relation to general learning in previous sections of this chapter. An attempt will be made to illuminate affective foundations of arithmetic learning in this section.

Horrocks (65:441), in an assessment of behavioral cognates of arithmetic learning, indicates that readiness to learn and manipulate numbers is a function not only of the individual's stage of intellectual development, but also of his attitude toward numbers. Lerch (83), in this regard, in an article developed to show that arithmetic instruction can change attitudes toward arithmetic, submits that experiences in arithmetic classes play a significant role in the development of attitudes toward arithmetic; such attitudes are related to achievement in arithmetic, according to him. Concerning the inception of attitudes toward arithmetic, Smith (119), tracing prospective arithmetic teachers' attitudes toward arithmetic, learned that feelings toward arithmetic are developed at all stages of our arithmetic instructional curriculum. Attitudes toward arithmetic were developed in the majority of such students while they were in elementary school.

That non-cognitive characteristics play an important role in the development of arithmetic seems indicated by Harap (61) who, in a controlled experiment stratifying children according to I.Q., found that I.Q. variance played a relatively insignificant role in the learning of specific arithmetic tasks such as decimals: $p = .05$.

Bassham (9), studying relationships between pupil affective traits and achievement in arithmetic, found that attitudes and interests appear to act as catalysts in arithmetic achievement. In his sample of 159 pupils, over four times as many pupils with a poor attitude toward arithmetic were classified as .65 grades below expected achievement; almost three times as many high-attitude pupils overachieved .65 grades. As a corollary to his study he suggests that attempts to favorably influence interest in arithmetic should be centered on the modification of pupils' perception of subject material in relation to self by changing the perception or by changing the method of presentation. In relation to the development of arithmetic attitudes, Aiken (1), exploring the effects of attitudes on performance in mathematics, concluded that attitudes toward arithmetic are the result of experiences with parents and teachers.

Combs and Snygg (32) posit that since behavior is a function of perception the factors which govern perception will determine the nature and degree of ability which an individual possesses. And Cattell (26), writing about acquired motives and the learning process, tells us that attitudes tend to be organized in relation to the individual's self-concept. In this regard, Lindgren (85: 232) has written:

> If a child sees himself as a good reader, but an indifferent and hopeless cipherer, the time and trouble spent on getting him to practice arithmetic skills will be to no avail.

Combs and Snygg (32:57) suggest an explanation to his phenomenon:

> To the child, the learning of arithmetic -- or whatever -- may seem to have nothing whatsoever to do with the quest for self-enhancement.

Flora (55), writing about the things that cause children to avoid mathematics, counsels that there is an element of fear in a child's rejection of arithmetic rather than difficulties intrinsic to the curriculum. Wilson (143), explaining why children avoid mathematics, suggests that the fear of arithmetic is conditioned. Concerning this idea, McDermott (89), in a doctoral study of some factors that cause fear and dislike of arithmetic and mathematics, concluded that attitudes toward arithmetic are attributable to teacher influences, parental indoctrination or sibling conditioning.

Turlock (135), writing about emotional blocks in arithmetic, states that pupils who constantly fail mathematics have deflated egos and tend to develop attitudes of dislike and hostility toward mathematics. Brookover and associates (16), in a longitudinal study of self-concept of ability and academic achievement, obtained a significant correlation coefficient between arithmetic self-concept and arithmetic grades in junior high school students: $\underline{r}$= .57 for both boys and girls. Pertinent to this, it would appear that the argument whether boys or girls achieve significantly higher in arithmetic has hardly been resolved: writers such as Ausubel (6) and Gibbs (56) indicate that boys do better, so far as arithmetic achievement is concerned, than girls do at the elementary school level; Aiken (1), Weatherman (140) and Wozenkraft (146) counter that girls do better in arithmetic than boys do at the elementary school level.

Weaver and Gibb (141), in Review of Educational Research, recommend examination of personality variables as possible influences on the development of mathematical learning. Witty (144) provides a rationale for investigating the effects of attitudes on arithmetic achievement in his charge that when meaningful methods of teaching arithmetic are used, changes in arithmetic attitudes take place: negative attitudes, according to him, become positive and positive attitudes become enhanced. He indicates that significant changes in arithmetical computation and reasoning are associated with changes in arithmetic attitudes.

The importance of research in the field of mathematics is emphasised in the contention by Cairns (24) that capability in mathematics is essential for simply relating one's self to the environment in which he must live, work and find enjoyment and satisfaction in a science oriented society.

Implications of the Self-Concept for the Classroom

Despite the fact that such writers as Ausubel (6), Dinkmeyer (41) and Prescott (103) perceive the classroom atmosphere as significant in producing feelings about the self, few teachers are acquainted with self-theory, except at the intuitive level, because it is a construct relatively new to education and for the most part has not been a part of teacher training. Since self-concept is a product of experiences, what happens to the child during the time spent in school becomes an important factor in its development. Symonds (128) relates, in this context, that concepts of self are reflections of the attitudes expressed a person by others and sees this as an indication of the power that parents and teachers have in determining the kinds of selves that children will develop.

No social institution outside the family exerts more important influences on the development of self-concept than the school.

The self-concept is an important construct in respect to effective classroom operation, particularly when one takes cognizance of the point made by Ellis (48) that, due to the social aspects of self-evaluation, an individual is taught that because others dislike or disapprove of one when he fails to master something, he should accept this evaluation and make it his own.

Self-concept is susceptible to the competitive and evaluative aspects of education. Lighthalls (84), writing about the impact of anxiety in relation to thinking and forgetting, indicates that threats to self-concept such as censure or invidious comparison causes children to be preoccupied with fears of failure. In respect to the effect of anxiety on learning, Combs and Taylor (34), exploring the consequences of a mild degree of threat on rote learning in a group of 50 college students, inferred that even mild self-perceived threat can seriously affect the adequacy of learning behavior. They concluded that, if even a mild perception of threat can affect the adequacy of behavior, their findings represented a challenge that has far reaching implications for psychotherapy, education and social action.

The group dynamics inherent to classroom activities provide potent opportunities for influencing formation of self-concept. The importance of group forces as a social and educative determinant is suggested by findings in recent research projects by such investigators as Dittes (44), Kipnis (75), League and Jackson (81), Miyamoto (94) and Stotland and Cottrell (124).

Davidson and Lang (40), studying children's perceptions of teachers feelings in a group of 203 middle-school-aged children, found that teacher feelings, as the child internalizes them, have an effect on school adjustment. Staines (123), in his report of an experiment conducted abroad supportive of this point, concluded that teaching methods can be adapted so that definite changes in self can be planned and effected in the classroom: $p = .01$. According to Staines, the self can be deliberately produced by teaching methods. The inference derived from these findings is that it is essential that teachers communicate positive feelings to their students and thus not only strengthen self-appraisal but also stimulate academic growth.

Bostrom and associates (14) suggest one method of reinforcing desired attitudes in the learning process: in studying grades as reinforcing contingencies in altering learning behavior in a sample of 127 university students, they concluded that good grades serve to reinforce attitudinal changes of a desired sort in emotionally charged learning circumstances. In this same tenor and particularly relevant to arithmetic, Lerch (83) suggest that it would seem that, if desirable attitudes toward arithmetic are to be developed and undesirable attitudes are to be changed, arithmetic students should be assured of a certain measure of success.

That significant others play an important role in the determination of self-concept and in the alteration of self-concept has been suggested in several recent studies: Helper (63), demonstrating this idea, in an experiment applying reinforcement stimulus-response theoretical concepts with 50 boys, deduced that reward techniques can be an important method for shaping self-concept and encouraging learning when a significant model is used. He used the like-sex parent in a situation in which emulative behavior of a desired sort was promoted: $\underline{r}$= .40. Bandura and Kupers

(8), in an unrelated research project involving 160 elementary-school-aged children and designed to investigate the transmission of patterns of self-reinforcement, showed that the behavior of models is influential in shaping patterns of self-control. They found that the introjection of attitudes was facilitated when a positive, prestigious model was used and reward for imitation of desired attitudes was an integral part of the encouragement process. Videbeck (136) also concluded from an investigation of the effects of reaction of others on the development of self-concept that self-conceptions are learned and that evaluative reactions of others play a significant part in that learning process.

LaPere (78), reporting on an experiment involving a treatment group and a placebo group of ninth grade students in a counseling situation, indicates that self-concept can be improved with a collateral improvement in academic achievement through working with parents and significant others. Erickson (51) also, reporting on a study of the normative influences of parents and friends upon academic success, reinforces the idea that parents and teachers do exert an important influence on self-concept and learning behavior of students. Jourard and Remy (72) obtained substantiating results in a study of children's percepts of parent's attitudes in relation to self-concept.

An important consideration in respect to the amenability to change in self-concept is the tenet that there is some pliability to it, particularly during the school-age years. Piers and Harris (101), in an interim report on an on-going longitudinal study, indicate that there are fluctuations in self-concept between the third and tenth grades. Self-concepts of sixth grade children differ significantly from self-concepts of third and tenth grade students according to their findings: $p = .01$. Morse (96), also in a preliminary report of findings in a longitudinal study of self-concept conducted by the University of Michigan, relates that as a child progresses through school his confidence diminishes and self-regard decreases. He implies that teachers need knowledge of the child's self-concept for almost every decision he makes in the on-going classroom activities. Jordan (71:30) echoes this sentiment in these words:

> It seems to me that without a concept which enables me to think at least of a self that can whistle, with all the problems of control, direction, and creativity that this involves, I must teach more or less blindly.

Pertinent to the growth pattern inherent to self-concept, Erickson (50) proposes that the period of sexual latency is a period during which the child is most susceptible to school influences.

Since self-concept and academic achievement-adjustment appear intimately related, it would seem that teachers should be sensitive to Combs' (30) indictment that we re-

ject too many people in our schools with a resultant inadequacy of self-concept and diminution of coping mechanisms. Prescott (103:379) has this to say about the results of such rejection:

> An inadequate concept of self, so common in our culture, is crippling to the individual. When we see ourselves as inadequate we lose our "can-ness." There becomes less and less that we can do.

The consequence of an inadequate self-concept was illustrated by Lafferty (76), who, in a study of values that defeat learning, found that significantly more children who underachieve seem convinced that they cannot, be their own effort, alter the course of a failing experience: $p = .05$.

Despite the fact that Taylor (132) indicates that findings in his doctoral dissertation about consistency of self-concept show that persons with positive self-concepts are more numerous than persons with negative self-concepts, we patently have a charge to work toward adequacy of self-concept in our educational processes. Teachers sometimes may interfere with this objective and in this regard Montagu (95) gave voice to the enjoinment that, in relation to the development of self, teachers have a job to do on themselves before working on others. Kelley (73:13) reflects this feeling in these words:

> It is that the representatives of the school -- teachers and administrators -- often have their own ends to be served, not those of the learners. They act from their own fears, which cause them to dampen

> and delimit the expanding personalities of the young thus defeating the very purpose for their being.

The task suggested here, it should be pointed out, is not, according to self-theorists such as Combs (29) and Rogers (112), one of changing the student's behavior, but is one of creating a situation in which changes in perceptions will be encouraged and facilitated. Only as a child has the opportunity to have experiences which will alter his concepts about his schoolwork, his teacher, his peers and other significant models can the concept of self be changed.

With knowledge of self-concept educators could be more effective in the helping of children in school; without such knowledge, according to Allport (3), we would be unable to increase the breadth of learning and the transfer of effects. Perkins (102) states that the self can be used as a psychological construct that will enable teachers, counselors, parents and others to achieve with training deeper understanding and insights into the development and behavior of children.

In research of the literature related to self-concept and the learning process one sees important implications for the training of the teachers who will staff our classrooms in future years. Preservice and in-service training projects should, for instance, take cognizance of Staines' (123) findings that teaching methodology can be adapted to effect definite changes in the self: he showed that teachers can shape the self-concept through planned teaching experiences. Since changes in the self-picture are an inevitable consequence of learning in every classroom, whether the teacher is aware of them or not, school-related influences become an important consideration for educators -- particularly as Dinkmeyer (41), Rogers (111) and Symonds (130) apprise us that the more deeply attitudes are engrained in self-concept through individual percepts, the more difficult they are to change. Changes do occur, however, at every stage of the child's developmental sequence.

The conclusion would appear to be that the schools can best assure the development of children into non-threatened, socially adjusted individuals by enabling them to gain effective and healthy group identification, self-knowledge and self-acceptance.

Summary

The intent of this chapter has been to review the literature of self-theory with especial emphasis on self-concept as it is related to learning. A principle aim of this purpose is to present self-concept as a measurable complex of feelings that grows through social and school interactions and that is related to school achievement with particular reference to arithmetic achievement. An attempt has also been made to fit some affective and non-cognitive aspects of arithmetic learning into the framework related to elements of self-concept.

An evaluation of the literature indicates that the theoretical structure of self-theory is in a process of growth impelled by psychological and educational research. An attempt has been made to show the changing complexion of research into the construct of self-concept by educators, psychologists and sociologists. An inference made from the literature is that self-theorists, though moving toward agreement, are still confronted with semantic problems.

Recent empirical studies have demonstrated the pertinency of self-concept to academic achievement.

Accepting self-theory principles as discribed in this chapter, the hypothesis would appear to be that the learner's self-concept of his learning ability can be a facilitating or interfering factor in academic achievement -- including arithmetic achievement.

CHAPTER III

DESIGN AND METHODOLOGY

The design and methods used in this study are described under eight main headings: 1) Prepatory Activities; 2) Population; 3) Sample; 4) Selection of the Variables; 5) Selection and Description of the Instruments Used in this Study; 6) Procedures for Collecting Data; 7) Procedures for Analyzing the Data.

Prepatory Activities

In preparing for the present study a number of instruments theoretically designed to test the self-concept of children in relation to adjustment and/or academic achievement was studied. Among the scales studied were instruments developed and used by the following authors in school-related research with children: 1) Bowers (15); 2) Brookover (16); 3) Carlson (25); 4) Fitts (54); 5) Lafferty (76); 6) Ringness (108) and 7) Rogers (109). Some, because of the findings of Laxer (79) and Lipsett (86) that discrepancy scores add little to the knowledge of an individual, were arbitrarily rejected because of their design. Study of the design, format and intent of the scales led to the discard of others of the scales examined. The Michigan State

University Self-Concept of Ability Scale used by Brookover and associates (16) in a series of longitudinal studies conducted through the Office of Research and Publications, Michigan State University under the auspices of the Cooperative Research Program of the Office of Education, United States Department of Health, Education and Welfare, was selected as the self-concept scale most amenable to modification for the needs of the present study.

Permission to modify the Michigan State University Self-Concept of Ability Scale for needs inherent to this study was obtained from Dr. Wilbur Brookover, Principal Investigator, for Cooperative Research Project No. 845, "The Relationship of Self-Images to Achievement in Junior High School Subjects", conducted by the College of Education, Michigan State University.

A self-concept scale, or self-report depending upon one's orientation, was selected because Ausuble (6) and Rogers (111) relate that a self-report is frequently the only way of directly investigating the subjective life of human beings, their attitudes, beliefs, motives and perceptions. Jersild (68) has concluded that, in terms of self-concept, the child has more capacity for understanding himself than educators, or others, have ever realized. Further, Dubin (46) asserts that the framework of the self-image cannot be inferred from an outsiders observation.

The Population

This study was conducted in the Algonac, Michigan Community Schools during the 1965-1966 school year and was terminated in June, 1966. The Algonac Community Schools serve the Village of Algonac and Environs. The Village of Algonac has a present population of approximately 3200 citizens, but the school system serves an additional population in excess of 2000 residents of neighboring residential and rural communities. The population of the Village proper had remained relatively constant during the two decades following World War II, but the surrounding area has been extensively developed since that time, particularly during the 5 years immediately preceding the time of this study. The resort complexion of the area and its accessibility to the Detroit Metropolitan area with recent highway development and improvement programs contributed to this expansion.

The Village of Algonac is primarily a resort community situated on the St. Clair River, a linking body of water on the St. Lawrence Seaway route. The major industry is boat building; however, many of the wage-earners of the area commute daily to jobs in the industrial centers of the Detroit, Michigan Metropolitan complex.

The school population consists of approximately 1800 children in grades kindergarten through twelve. There are three public and one parochial elementary school; one intermediate school housing grades six through nine, and one three year high school recently constructed. The district serves as a center for a cooperative vocational education-special education program. The curriculum is considered fairly representative of the type found in most urban school systems of comparable size in the United States. The elementary curriculum includes: teaching of basic social skills; teaching of fundamental reading, writing, spelling and arithmetic skills; education for general science, social studies (history, geography and civics), health, safety, physical education, art education and music education. There is a planned and implemented articulation with and continuity between the curricula of the elementary, intermediate and high schools through the offices of a curriculum director.

Mentally retarded children are placed in special education programs operated in the cooperative program referred to above.

The Sample

The subjects for this study included the sixth grade population of the Algonac, Michigan Community Schools. There was a total of 167 students in the sixth grade at the end of the school year in June, 1966. Of the 167, test data was obtainable for 161 in part, and for 144 *en toto*. Transfers and absences during periods of testing accounted for the lack of data for some observations in the sample.

The children in the study were grouped into two sections through use of random numbers. The students were placed in groups to be taught on a team - teaching basis. One section was designated an experimental group and the other section a control group. The differences in approaches were largely semantic since the control group of approximately seventy students was taught in a block - time sequence with a team of two teachers sharing the instructional responsibilities; the experimental group, composed of approximately ninety-five students, was taught by a team of three teachers sharing teaching responsibility. From each team one teacher - member was assigned the task of teaching arithmetic. Thus, in this study, two teachers were involved in the teaching of arithmetic in the sixth grade.

A preliminary report indicates no significant difference between the groups so far as aptitude and achievement is concerned.

Table 3.1

Number of Children in Teaching Groups for Whom Partial Data Was Obtainable

N=161

	Group I (Time-Block)	Group II (Team Teaching)	Total
Boys	29	47	76
Girls	35	50	85
	64	97	161

Table 3.2

Number of Children in Teaching Groups

for Whom Total Data Was Obtainable

N=144

	Group I (Time-Block)	Group II (Team-Teaching)	Total
Boys	24	42	66
Girls	31	47	78
	55	89	144

A statistical analysis was made of the differences between means for the dependent and independent variables for the group of 161 and the group of 144. No significant differences were observed so the decision was made that the elemination of the 17 observations for which only partial data was obtainable would not affect results of the study. Analysis was made through use of Michigan State University Computer Laboratory MDSTAT Routine (Calculation of basic statistics when missing data is involved).

Results are shown in Table 3.3.

Table 3.3

Analysis of Difference between Means of Total Group and Means of Sample Group

Variable	Total Group Mean N=161	Sample Group Mean N=144	*t*-test	*p*
1. Family Social Status Rank	4.57	4.52	.33	NS
2. Mother's Educational Level	10.94	10.96	.07	NS
3. General Self-Concept	50.30	50.26	.05	NS
4. Arithmetic Computations	19.63	19.65	.02	NS
5. Arithmetic Concepts	17.08	17.25	.20	NS
6. Arithmetic Applications	20.69	20.74	.05	NS
7. Full Scale I.Q.	104.79	104.79	-0-	
8. Language I.Q.	103.97	103.97	-0-	
9. Non-Language I.Q.	104.97	104.97	-0-	
10. Number Values	7.51	7.51	-0-	
11. Number Problems	6.22	6.22	-0-	
12. Current Arithmetic Grade Average	7.61	7.63	.06	NS
13. Semester Arith. Grade Average	7.53	7.53	-0-	
14. Cumulative Arith. Grade Average	7.93	8.00	.23	NS
15. Total Grade Point Average	7.68	7.70	.06	NS
16. Arithmetic Self-Concept	88.94	89.18	.13	NS

The sixth grade was chosen for this study for several reasons: 1) in the present situation the sixth grade represented the only grade at the elementary level in which all children in one grade were concentrated in one area; 2) more important, the sixth grade is a period during which skill repetition and reinforcement is diminished -- drill is, to a large measure, discontinued in basic tool areas. 3) The sixth grade represents a transitional level between elementary and secondary school programs.

The group of sixth graders used in this study were selected to avoid curricular difficulties that might arise because of the arithmetic variable in terms of instructional methodology related to "modern math". "Modern math" had not yet been introduced into the curriculum of the Algonac Community Schools.

Selection of the Variables

The variables included in this study were chosen for practical as well as theoretical reasons: relationship of the dependent variable to the independent variables as indicated by related research, and the accessibility of data related to the specific variables. Factors that have been associated with academic achievement and child growth and development were selected.

Research cited in Chapter II suggests that there are several factors that appear to be related to academic achievement of children. The variables used in this study were: 1) general self-concept of ability; 2) arithmetic self-concept; 3) sex of the child; 4) educational level of the mother; 5) family socio-economic ranking; 6) intelligence quotient; 7) academic achievement in terms of standardized achievement test scores, and 8) teacher evaluation

of arithmetic competency. These variables were defined in Chapter I.

Selection and Description of the Instruments Used

1. General Self-Concept of Ability was measured by the Michigan State University Self-Concept of Ability Scale in its original form. The scale consists of fifteen items measuring a student's perception of his present and anticipated school ability, and of his feelings toward the evaluative - competitive aspects of school. The scale was selected for its established reliability and validity in terms of measuring attitude toward school desired for this study.

2. Arithmetic Self-Concept was measured by an extension of the Michigan State University Self-Concept of Ability - Specific. The arithmetic self-concept scale included eight test items related to specific subject ability (arithmetic) from the original model augmented with seventeen questions designed to measure additional arithmetic attitudes in accordance with theoretical formulations of Dutton (47). The arithmetic self-concept scale was devised to measure the students' perception of his understanding of arithmetic functions; his relative competence in manipulation of arithmetic functions; his expectations of future arithmetic capabilities; his appreciation of arithmetic as a socially relevant discipline; his interest in arithmetic as a tool for modern existence; and his aspirations for future use of arithmetic skills. The scale consists of

twenty-five items.

The scale was developed to measure conceptual and attitudinal components of the self as delineated by Jersild (69:116). Validity and reliability tests were made on the instrument prior to use in the present research.

3. The family socio-economic ranking was determined through use of the McGuire-White Measurement of Social Status. The instrument provides an index of social-status through an averaging of rankings assessed for each family in the study on the basis of parent education, father occupation, type of family dwelling and area in which the family lives. The social-status ranking was obtained with the cooperation of Mr. Russell Christie, the school principal, who has an intimate knowledge of the community and of the residents of the community. Areas of the community were visited to assess dwellings and residential areas.

4. Intelligence Quotient was obtained for children in the sample during the regular school testing program. The California Short Form Test of Mental Maturity is designed to yield an I.Q. that correlates highly with I.Q. scores on the full scale California Test of Mental Maturity. A language intelligence quotient, a non-language intelligence quotient and a full-scale intelligence quotient are yielded by the test. The aptitude tests were administered by classroom teachers, under the direction of the Guidance Director, at the termination of the fifth grade

as the children were preparing to enter the sixth grade.

The California Short Form Test of Mental Maturity, Form S, Level II, 1963 revision was used.

5. Academic achievement scores in arithmetic concepts, arithmetic computations and arithmetic applications sub-tests were obtained from results of testing with the Stanford Achievement Test, Form W, Intermediate II, Complete Battery: 1964 revision. Raw scores were used for this study since converted scores would provide no additional pertinent detail in terms of relative scores. The achievement battery was administered by the school principal under the direction of the Guidance Director. Testing was done during three morning sessions and to the total sixth grade population in joint session to control for test variations as much as possible.

6. Teacher evaluations were obtained for each child in the study for the marking period and semester during which the achievement tests and the self-concept scales were administered. Grades were obtained from the permanent school record. A cumulative grade point average for third, fourth and fifth grades were obtained for all children in the research sample through research of the permanent school records.

To investigate possible differences that could arise in teacher appraisals, the two arithmetic teachers assigned to sixth grade arithmetic instruction were asked to respond to a questionaire modeled on the arithmetic self-concept scale, and designed to yield a self-concept of arithmetic teaching ability.

Because of the small number involved, statistical analyses of results were infeasible.

Both teachers were male; both teachers had taught elementary school classes four years; both teachers had taught arithmetic at the sixth grade level for four years; both teachers had participated in two methods courses in teaching of arithmetic since beginning to teach arithmetic. The teacher in Group I, the control group, differed from the teacher in Group II, the experimental group, in that he had a minor in mathematics at the undergraduate level, and the teacher in Group II had less than a minor in Mathematics. The teacher in Group I scored somewhat higher on the self-concept scale, but differed from the teacher in Group II only in that he ranked his satisfaction with his professional training higher in regards to mathematics preparation than did the teacher in Group II; and he expressed a preference for teaching mathematics over other sixth grade subjects which the teacher in Group II did not share. The teacher in Group II reported he enjoyed teaching arithmetic only so much as he enjoyed teaching other sixth grade subjects. Oddly, the teacher in Group II ranked himself as one of the best in the teaching or arithmetic while the teacher in Group I ranked himself only above average in the

teaching of mathematics.

Results indicated that teacher grades could be accepted at face value in terms of classroom arithmetic achievement, and that teacher differences would not affect results significantly.

7. The educational level for mothers of each child in the study were obtained from the permanent school records. The permanent school records indicate the highest level of elementary school, secondary school or institution of higher learning attended by the mother of each child in the study.

8. A total grade point average for all academic subject areas at the sixth grade level were computed for each child in the study. The final sixth grade marks for each academic subject area were obtained from research of the cumulative school record of each child in the study.

Provisions were made in the data collection to analyze the above information on the basis of sex differences as well as on a total group basis. Girls were expected to have higher arithmetic self-concepts than boys have.

Procedures for Collection of Data

In the final month of the fifth grade the subjects were administered the *California Short Form Test of Mental Maturity, Form S, Level II, 1963 revision* as part of the school testing program. The tests were administered by the classroom teachers under the supervision of the Director of Guidance Services of the Coordinated Educational Program mentioned above. In the last month of the sixth grade, June 1966, the Stanford Achievement Test, Form W, Intermediate II, 1964 revision, Complete Battery was administered to the total sixth grade group in joint sessions in the assembly hall by the Intermediate School Principal under the supervision of the Director of Guidance Services. Testing was done during three morning sessions under closely controlled conditions. Four days after administrating the achievement battery, the Michigan State University General Self-Concept of Ability Scale and the arithmetic self-concept scale were administered to the children in the research samples by the author. Testing conditions were closely controlled, directions were explicit and the testing conditions involved were the same for each group.

The language, non-language and full I.Q. scores were obtained from the California Short Form Mental Maturity Test, as were the number values and number problems sub-test results of the non-language portion of the test. The arithmetic computations, arithmetic concepts and arithmetic applications sub-test scores were used from the Stanford Achievement Test battery.

Procedures for Analyzing the Data

The analysis of data in this present study was done in these phases:

The Pearson Product Moment correlational analysis of the data to investigate relationships between the dependent and independent variables was used.

The formula appears below.

$$rij = \frac{\sum_{t=1}^{N} (X_{it}-\overline{X}_i)\ (X_{jt}-\overline{X}_j)}{\sqrt{\sum_{t=1}^{N} (X_{it}-\overline{X}_i)^2}\ \sqrt{\sum_{t=1}^{N} (X_{jt}-\overline{X}_j)^2}}$$

McNemar (91) and Guilford (57) cite these assumptions an necessary to the use of coefficients of correlation in establishing relationships between two variables:

1. The measurements must be represented in at least an equal interval scale (it must be possible to use the operations of arithmetic on the scores, i.e. adding, dividing, finding means, etc.).
2. The population must be bivariate and normal.
3. The observations should be normally distributed.
4. The observations must be homoscedastic (dispersions must be approximately equal and symmetrical).
5. The regression of scores must be linear.

Normal distribution is not always necessary so long as the distribution is symmetrical and unimodal.

Since the population and data in the present study satisfy these requirements a correlational analysis was utilized.

The .05 level of confidence was arbitrarily designated the level of significance associated with rejection

of the null hypotheses.

The significance of difference in arithmetic achievement between students with high arithmetic self-concept scores and students with low arithmetic self-concept scores were tested by the Mann-Whitney U-Test as described by Siegel (117:121). The formula appears below:

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{(n_1)\ (n_2)\ (n_1+n_2+1)}{12}}}$$

The upper and lower quartiles scores of the arithmetic self-concept distribution were used to show differences in arithmetic achievement. Students with I.Q. scores $\pm$ two standard deviations from the mean were excluded from the sample for this analysis. Since the distribution would not be considered normal a non-parametric test was selected.

Siegel (117) considers the Mann-Whitney U-Test one of the most powerful of the non parametric tests, and sees it as a most useful alternative to the parametric t-test when the t-test assumptions do not hold.

The .01 level of confidence was established as the level of significance associated with rejection of the null hypothesis.

The t-test as described by Walker and Lev (137:156) was used to analyze differences between girls' arithmetic self-concept and boys' arithmetic self-concept. The formula is shown below:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2 \frac{N_1 + N_2}{N_1 N_2}}}$$

The .05 level of confidence was chosen for accepting or rejecting the null hypothesis.

An additional study of the data was made through use of the Coefficient of Multiple Correlation, as described by Guilford (57:390), to analyze the amount of relationship between the dependent variable arithmetic self-concept and the independent variables in this study. It was selected to test the relative contributions of the independent variables to arithmetic self-concept.

A Coefficient of Multiple Correlation was also used to analyze the degree of relationship between test items in the arithmetic self-concept scale and arithmetic achievement as indicated by achievement test scores of the arithmetic applications sub-test of the Stanford Achievement Test. It was desired to test the relative contributions of the test items to arithmetic achievement.

.05 was designated as the minimum level of significance.

Summary

The sample selected for this study included the sixth grade population of the Algonac, Michigan Community Schools.

An instrument was developed to test the arithmetic self-concept of elementary aged children after prepatory investigation of self-concept scales used in similar studies. The arithmetic self-concept scale was administered to all students in the population from which the sample was drawn. Related achievement, aptitude and socio-economic data were obtained for children in the sample.

A design based on correlational analysis and a test of differences between means was used to study statistical significances among measures of arithmetic self-concept, academic achievement and scholastic aptitude. Relationships of the arithmetic self-concept to variables of academic achievement, scholastic aptitude and rankings of family socio-economic level were investigated. The .05 level of confidence was selected to indicate acceptance or rejection of the null hypotheses.

CHAPTER IV

HYPOTHESES AND LIMITATIONS OF THE STUDY

On the basis of theoretical formulations and research findings discussed in Chapter II of this study the following hypotheses are made concerning the relationships between arithmetic self-concept and measures of student aptitude, achievement and socio-economic status:

General Hypothesis

Stated in general terms the fundamental hypothesis of the present study is: there is a significant positive relationship between arithmetic self-concept and arithmetic achievement.

Operational Hypotheses Related to the Arithmetic Self-Concept

H:1 There is no significant difference in arithmetic achievement as measured by scores on a standardized achievement test between those students with high arithmetic self-concept and students with low arithmetic self-concept as indicated by scores on the arithmetic self-concept scale.

H:2 There is no significant difference in arithmetic achievement as indicated by teacher grades for arithmetic performance in the on-going classroom instructional situation between students with high arithmetic self-concept and students with low arithmetic self-concept as indicated by scores on the arithmetic self-concept scale.

H:3 There is no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls when scores on the arithmetic self-concept scale are used as the criterion.

H:4 There is no significant relationship between scores on the measure of arithmetic self-concept and scores on a measure of scholastic aptitude (I.Q. scores).

H:5 There is no significant relationship between scores on the measure of arithmetic self-concept and scores on the arithmetic sub-tests of the Stanford Achievement Test.

H:6 There is no significant relationship between scores on the measure of arithmetic self-concept and arithmetic grades. (Individual correlation coefficients will be computed for current, semester and cumulative arithmetic grades.)

H:7 There is no significant relationship between scores on the measure of arithmetic self-concept and the Sixth Grade total grade point average for all academic areas.

H:8 There is no significant relationship between student's scores on the measure of arithmetic self-concept and their mother's educational level.

H:9 There is no significant relationship between student's scores on the measure of arithmetic self-concept and ranking of their family social-status as indicated by criteria delineated in the McGuire-White Measure of Social Status.

Hypotheses Related to the General Self-Concept of Ability

H:10 There is no significant relationship between scores on the measure of general self-concept of ability and scores on the arithmetic sub-tests of the Stanford Achievement Test.

H:11 There is no significant relationship between scores on the measure of general self-concept of ability and arithmetic grades. (Individual correlation coefficients will be computed for current, semester and cumulative arithmetic grades.)

H:12 There is no significant relationship between scores on the measure of general self-concept of ability and the Sixth Grade total grade point average for all academic areas.

H:13 There is no significant relationship between student's scores on the measure of general self-concept of ability and ranking of their family social-status as indicated by criteria delineated in the McGuire-White Measure of Social-Status.

The confidence level for these hypotheses was set at the .05 level of significance.

Limitations and Scope of the Study

The scope of the present study is limited to considerations pertaining to arithmetic self-concept and its relationships with arithmetic achievement, academic aptitude, teacher evaluations and personal-social variables. Other variables that were not included in the present study may contribute to the relationships studied, conjecturally speaking.

The sample, considered fairly representative, consisted of a sixth grade population of an all-Caucasian elementary school situated in a semi-rural community in Lower Michigan.

Since instruments measuring self-concept are, at best, approximations, an additional limitation should be considered; namely, that it is advisable to consider the present exploration within the restriction implied by the construction of research instruments.

Summary

In this chapter the general hypothesis, the operational hypotheses and the limitations and scope of the study have been detailed. The operational hypotheses have been stated in the null form in each case. The scope of the study is circumscribed by the considerations pertaining to arithmetic self-concept and its relationship with measures of arithmetic achievement, scholastic aptitude and personal-social variables included in the study.

CHAPTER V

ANALYSIS OF THE RESEARCH DATA

Chapter V is a report of the analysis of the research data based upon the methodological and statistical procedures outlined in Chapter III. The analysis of the data is presented in two parts: first, relationships between arithmetic self-concept and arithmetic achievement; second, the coefficients of correlation between self-concept of general ability and arithmetic achievement. Analysis was predicated on the assumption that the independent variables of sex, socio-economic status, mother's education, self-concept of general ability, intelligence quotient, arithmetic achievement and arithmetic grades are related to the arithmetic self-concept. The confidence level for this study was established at the .05 level of significance.

Analyses were made for the total group and for boys and girls within the group.

The statistical data for the correlational analysis were computed from programs developed by the Michigan State University Computer Laboratory after data was coded on I.B.M. cards.

Arithmetic Self-Concept Data

In an effort to accurately analyze differences between the high arithmetic self-concept group and the low arithmetic self-concept group in terms of arithmetic achievement those students with extreme I.Q. scores in high and low ranges were eliminated from the sample for this analysis. It was theorized that the I.Q. factor could skew results, so those students whose I.Q. scores varied more than two standard deviations from the mean were not used in the test of the first two hypotheses of this study.

Table 5:1 below shows the means for the upper and lower quartile divisions of the total sample, for males and for females.

Table 5:1

Means of I.Q. scores, Arithmetic Self-Concept, Arithmetic Achievement and Arithmetic Grades According to Upper and Lower Quartile Levels

	Up Total N=35	Quart Boys N=16	Div Girls N=19	Low Total N=35	Quart Boys N=15	Div Girls N=20
Intel Quot	123.31	123.06	123.52	87.88	88.26	87.60
Arith Sf Con	103.74	103.25	104.16	79.03	76.67	80.80
Arith Achieve	29.80	29.38	30.60	15.20	13.67	16.35
Arith Grade	10.06	9.13	10.79	5.74	5.20	6.15

N=70

The first major hypothesis tested was: There is no significant difference in arithmetic achievement, as measured by scores on a standardized achievement test, between those students with high arithmetic self-concept and students with low arithmetic self-concept as indicated by responses on the arithmetic self-concept scale.

Table 5:2 below indicates the Mann-Whitney U-Test results of analysis of data related to H:1.

Table 5:2

Data Comparing Arithmetic Achievement for Upper and for Lower Quartile Divisions of Arithmetic Self-Concept Scores

Subjects	Mean Up-Quart N=35	Mean Low-Quart N=35	*z* score	*p*
Full Group	29.80	15.20	6.15	p=<.001*
Boys	29.38	13.67	3.88	p=<.001*
Girls	30.60	16.35	4.64	p=<.001*

* two-tailed test
N=70

The data indicated that there was a significant difference in level of arithmetic achievement between students with high arithmetic self-concept scores and students with low arithmetic self-concept scores, as indicated by scores on a standardized achievement test, when arithmetic self-concept scores from the upper and lower quartile divisions were used as the criterion. Differences for total group, for boys and for girls were found to be significant beyond the .001 confidence level when a two-tailed test was used.

The results were anticipated in terms of theoretical principles evolved from research of self-concept literature with particular reference to findings by Brookover and associates (16).

H:1 was rejected on the basis of research data derived in this investigation. The findings, however, do not preclude the possibility that individual students may achieve in arithmetic at a level at variance with their arithmetic self-concept score.

The second major hypothesis suggested that there was no significant difference in arithmetic achievement, as indicated by teacher-assigned grades for arithmetic performance in the on-going classroom instructional situation, between students with high arithmetic self-concept scores and students with low arithmetic self-concept scores as indicated by responses on the arithmetic self-concept scale.

Table 5:3 below indicates the results of analysis of data relevant to H:2 in terms of Mann-Whitney U-Test results.

Table 5:3

Data Comparing Arithmetic Grades for Upper and Lower Quartile Divisions of Arithmetic Self-Concept Scores

Subjects	Mean Up-Quart	Mean Low-Quart	z scores	p
Full Group	10.06	5.74	5.87	p=<.001*
Boys	9.13	5.20	3.05	p=<.001*
Girls	10.79	6.15	3.60	p=<.001*

* two-tailed test
N=70

Analysis of the data shows that there was a significant difference in arithmetic grades between students with high arithmetic self-concept scores and students with low arithmetic self-concept scores, as indicated by teacher-

assigned arithmetic grades, when arithmetic self-concept scores from the upper and lower quartile ranges are used as the criterion. Results of a two-tailed test of significance of differences suggest that there is a high degree of difference for the total group, for boys within the group and for girls within the group used in the present study. The differences are significant beyond the .001 confidence level.

H:2 was rejected on the basis of data intrinsic to this study. Again, the data pertained to statistical relationships and group differences, not to individual cases.

Hypothesis number three speculated that there was no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls when scores on the arithmetic self-concept scale are used as the criterion.

Table 5:4 below indicates results of statistical analysis of data pertinent to suppositions in H:3. (An F-ratio-test was used to establish homogeneity of variance before the t-test analysis was undertaken: $F = 1.11$, $p = > .05$.)

Table 5:4

Data Comparing the arithmetic Self-Concepts of Boys with the Arithmetic Self-Concepts of Girls

Scale	Mean Boys N=66	Mean Girls N=78	*t*-test	*p*
Arith Self-Concept	88.14	90.06	.70	p=>.05*
Gen Self-Conc of Ability	50.30	50.23	.87	p=>.05*

* two-tailed test
N=144

Statistical results indicated that there was no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls; there was no significant difference between the self-concept of general ability of girls and the self-concept of general ability of boys. Differences were not significant at the .05 confidence level.

Findings in this analysis, though not entirely consistent with expectations predicated on findings by Brookover (16) and Weatherman (140), do suggest that girls have higher arithmetic self-concept scores than do boys.

H:3 was supported; however, *t*-test analysis of arithmetic achievement computed independently from objectives of the present study show that there was also no clear-cut difference in arithmetic achievement between boys and girls in this study. Independent *t*-test analyses do suggest that girls received higher teacher-assigned grades than did boys in this study.

Table 5:5 shows results of *t*-test analyses of differences between arithmetic achievement test scores for boys and for girls; Table 5:6 depicts results of *t*-test analyses of differences between teacher-assigned grades for boys and for girls.

Table 5:5

Data Comparing the Arithmetic Achievement Test Scores of Boys and the Arithmetic Achievement Test Scores of Girls

Scale	Mean Boys N=66	Mean Girls N=78	*t*-test	*p*
Arith Comp	17.68	21.31	2.85	p=<.02*
Arith Conc	17.62	16.94	.60	p=>.05*
Arith Appl	21.00	20.51	.34	p=>.05*

* two-tailed test
N=144

Table 5:6

Data Comparing the Assigned Arithmetic Grades of Boys and the Assigned Arithmetic Grades of Girls

Grade	Mean Boys N=66	Mean Girls N=78	*t*-test	*p*
Cur Arith Gr	7.09	8.08	2.02	p=<.05*
Sem Arith Gr	6.98	7.99	3.06	p=<.01*
Cum Arith Gr	7.59	8.35	1.72	p=>.05*

* two-tailed test
N=144

Results suggest that there was a significant difference between arithmetic computations scores for boys and for girls; girls scored significantly higher on this subtest than boys did in this study: the significance level was beyond .02. There was no significant difference between scores on the arithmetic concepts and the arithmetic applications sub-tests of the standardized achievement tests, however. Differences were not significant at the .05 level; boys achieved somewhat higher than girls on the arithmetic concepts and arithmetic applications sub-test. Findings show that there was a significant differences between current teacher-assigned grades for boys and for girls in the study. The differences are significant beyond the .05 level. There also was a significant difference between semester teacher-assigned grades for boys and girls in the study. The differences were significant beyond the .01 level. There was no significant difference between cumulative teacher-assigned grades for boys and for girls. Differences were not significant at the .05 level; girls had higher mean grades on a current, semester and cumulative basis than boys.

Table 5:7 through table 5:18 contain coefficients of correlation and analyses of differences between coefficients of correlation for the various groups involved in the present study. The statistical analyses included in these tables are pertinent to questions essential to hypotheses four through thirteen.

Table 5:7

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Total Population N=161		
Variable	rho	p (two-tailed test)
Student's Sex	.06	p=>.05*
Family Social-Status	-.30	p=<.01
Mother's Education	.23	p=<.02
General Self-Concept of Ability	.70	p=<.01
Arithmetic Computations Sub-test	.62	p=<.01
Arithmetic Concepts Sub-test	.61	p=<.01
Arithmetic Applications Sub-test	.59	p=<.01
Full Scale Intelligence Quotient	.51	p=<.01
Language Intelligence Quotient	.43	p=<.01
Non-Language Intelligence Quotient	.49	p=<.01
Number Values Sub-test	.45	p=<.01
Number Problems Sub-test	.47	p=<.01
Current Arithmetic Grade	.71	p=<.01
Semester Arithmetic Grade	.72	p=<.01
Cumulative Arithmetic Grade	.67	p=<.01
Total Academic Grade Point Average	.68	p=<.01

* Not Significant at .05 level

Table 5:8

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Sample Group N=144 Variable	rho	p (two-tailed test)
Student's Sex	.06	p=>.05*
Family Social-Status	-.30	p=<.02
Mother's Education	.23	p=<.05
General Self-Concept of Ability	.71	p=<.01
Arithmetic Computations Sub-test	.62	p=<.01
Arithmetic Concepts Sub-test	.61	p=<.01
Arithmetic Applications Sub-test	.59	p=<.01
Full Scale Intelligence Quotient	.51	p=<.01
Language Intelligence Quotient	.43	p=<.01
Non-Language Intelligence Quotient	.49	p=<.01
Number Values Sub-test	.45	p=<.01
Number Problems Sub-test	.46	p=<.01
Current Arithmetic Grade	.71	p=<.01
Semester Arithmetic Grade	.72	p=<.01
Cumulative Arithmetic Grade	.67	p=<.01
Total Academic Grade Point Average	.68	p=<.01

* Not significant at .05 level

Table 5:9

Differences Between Coefficients of Correlation for Arithmetic Self-Concept and Specific Variables Examined in This Study for Sixth Grade Population and for Sample Group from Population

Variables Correlated with Arithmetic Self-Concept	Pop rho N=161	Samp rho N=144	z-test	p
Student's Sex	.06	.06	-0-	-
Family Social-Status	-.30	-.30	-0-	-
Mother's Education	.23	.23	-0-	-
General Self-Concept of Ability	.70	.71	.018	>.05*
Arithmetic Computations Sub-test	.62	.62	-0-	-
Arithmetic Concepts Sub-test	.61	.61	-0-	-
Arithmetic Applications Sub-test	.59	.59	-0-	-
Full Scale Intelligence Quotient	.51	.51	-0-	-
Language Intelligence Quotient	.43	.43	-0-	-
Non-language Intelligence Quotient	.49	.49	-0-	-
Number Values Sub-test	.45	.45	-0-	-
Number Problems Sub-test	.47	.46	.009	>.05*
Current Arithmetic Grade	.71	.71	-0-	-
Semester Arithmetic Grade	.72	.72	-0-	-
Cumulative Arithmetic Grade	.67	.67	-0-	-
Total Academic Grade Point Average	.68	.68	-0-	-

* Not significant at .05 level

Table 5:10

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Boys in Study N=66		
Variable	rho	p (two-tailed test)
Family Social-Status	-.22	p=>.05*
Mother's Education	.32	p=<.01
General Self-Concept of Ability	.72	p=<.01
Arithmetic Computations Sub-test	.56	p=<.01
Arithmetic Concepts Sub-test	.56	p=<.01
Arithmetic Applications Sub-test	.55	p=<.01
Full Scale Intelligence Quotient	.47	p=<.01
Language Intelligence Quotient	.37	p=<.01
Non-Language Intelligence Quotient	.48	p=<.01
Number Values Sub-test	.39	p=<.01
Number Problems Sub-test	.30	p=<.01
Current Arithmetic Grade	.71	p=<.01
Semester Arithmetic Grade	.70	p=<.01
Cumulative Arithmetic Grade	.63	p=<.01
Total Academic Grade Point Average	.66	p=<.01

* Not significant at .05 level

Table 5:11

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Girls in Study N=78		
Variable	rho	p (two-tailed test)
Family Social-Status	-.35	p=<.01
Mother's Education	.13	p=>.05*
General Self-Concept of Ability	.70	p=<.01
Arithmetic Computations Sub-test	.67	p=<.01
Arithmetic Concepts Sub-test	.65	p=<.01
Arithmetic Applications Sub-test	.63	p=<.01
Full Scale Intelligence Quotient	.54	p=<.01
Language Intelligence Quotient	.49	p=<.01
Non-Language Intelligence Quotient	.49	p=<.01
Number Values Sub-test	.49	p=<.01
Number Problems Sub-test	.57	p=<.01
Current Arithmetic Grade	.72	p=<.01
Semester Arithmetic Grade	.73	p=<.01
Cumulative Arithmetic Grade	.69	p=<.01
Total Academic Grade Point Average	.70	p=<.01

* Not significant at .05 level

Table 5:12

Differences Between Coefficients of Correlation for Arithmetic Self-Concept and Specific Variables Examined in This Study for Boys and for Girls in Sample

Variables Correlated with Arithmetic Self-Concept	Boys rho N=66	Girls rho N=78	z-test	p
Family Social-Status	-.22	-.35	.88	>.05*
Mother's Education	.32	.13	1.17	>.05*
General Self-Concept of Ability	.72	.70	.24	>.05*
Arithmetic Computations Sub-test	.56	.67	1.06	>.05*
Arithmetic Concepts Sub-test	.56	.65	.88	>.05*
Arithmetic Applications Sub-test	.55	.63	.70	>.05*
Full Scale Intelligence Quotient	.47	.54	.52	>.05*
Language Intelligence Quotient	.37	.49	.88	>.05*
Non-Language Intelligence Quotient	.48	.48	-0-	-
Number Values Sub-test	.39	.49	.76	>.05*
Number Problems Sub-test	.30	.57	1.61	>.05*
Current Arithmetic Grade	.71	.72	.24	>.05*
Semester Arithmetic Grade	.70	.73	.35	>.05*
Cumulative Arithmetic Grade	.63	.69	.64	>.05*
Total Academic Grade Point Average	.66	.66	-0-	-

* Not significant at .05 level

Table 5:13

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Group I N=55		
Variables	rho	p (two-tailed test)
Student's Sex	.06	p=>.05*
Family Social-Status	-.37	p=<.01
Mother's Education	.34	p=<.01
General Self-Concept of Ability	.79	p=<.01
Arithmetic Computations Sub-test	.57	p=<.01
Arithmetic Concepts Sub-test	.66	p=<.01
Arithmetic Applications Sub-test	.63	p=<.01
Full Scale Intelligence Quotient	.47	p=<.01
Language Intelligence Quotient	.41	p=<.01
Non-Language Intelligence Quotient	.38	p=<.01
Number Values Sub-test	.31	p=<.02
Number Problems Sub-test	.40	p=<.01
Current Arithmetic Grade	.73	p=<.01
Semester Arithmetic Grade	.75	p=<.01
Cumulative Arithmetic Grade	.71	p=<.01
Total Academic Grade Point Average	.77	p=<.01

* Not significant at .05 level

Table 5:14

Correlations Between Arithmetic Self-Concept and Specific Variables Examined in This Study

Correlation Coefficients for Group II N=89 Variable	rho	p (two-tailed test)
Student's Sex	.04	p=>.05*
Family Social-Status	-.26	p=<.05
Mother's Education	.19	p=>.05*
General Self-Concept of Ability	.66	p=<.01
Arithmetic Computations Sub-test	.68	p=<.01
Arithmetic Concepts Sub-test	.59	p=<.01
Arithmetic Applications Sub-test	.59	p=<.01
Full Scale Intelligence Quotient	.53	p=<.01
Language Intelligence Quotient	.44	p=<.01
Non-Language Intelligence Quotient	.55	p=<.01
Number Values Sub-test	.51	p=<.01
Number Problems Sub-test	.51	p=<.01
Current Arithmetic Grade	.71	p=<.01
Semester Arithmetic Grade	.72	p=<.01
Cumulative Arithmetic Grade	.64	p=<.01
Total Academic Grade Point Average	.62	p=<.01

* Not significant at .05 level

Table 5:15

Differences Between Coefficients of Correlation for Arithmetic Self-Concept and Specific Variables Examined in This Study for Group I and for Group II in Sample

Variable Correlated with Arithmetic Self-Concept	Gr I rho N=55	Gr II rho N=89	z-test	p
Student's Sex	.06	.04	.12	>.05*
Family Social-Status	-.37	-.26	.35	>.05*
Mother's Education	.34	.19	.93	>.05*
General Self-Concept of Ability	.79	.66	.16	>.05*
Arithmetic Computations Sub-test	.57	.68	.10	>.05*
Arithmetic Concepts Sub-test	.66	.59	.64	>.05*
Arithmetic Applications Sub-test	.63	.59	.35	>.05*
Full Scale Intelligence Quotient	.47	.53	.46	>.05*
Language Intelligence Quotient	.41	.44	.11	>.05*
Non-Language Intelligence Quotient	.38	.55	1.22	>.05*
Number Values Sub-test	.31	.51	1.40	>.05*
Number Problems Sub-test	.40	.51	.81	>.05*
Current Arithmetic Grade	.73	.71	.23	>.05*
Semester Arithmetic Grade	.75	.72	.35	>.05*
Cumulative Arithmetic Grade	.71	.64	.76	>.05*
Total Academic Grade Point Average	.77	.62	1.69	>.05*

* Not significant at .05 level

Table 5:16

Correlations Between General Self-Concept of Ability and Specific Variables Examined in This Study

Variable	Total Pop rho N=161	Samp Pop rho N=144	Boys rho N=66	Girls rho N=78
Student's Sex	.02*	.01*	-0-	-0-
Mother's Education	.26***	.24**	.30***	.18*
Family Social-Status	-.30***	-.32***	-.20***	-.42***
Arithmetic Computations Sub-test	.49***	.48***	.49***	.50***
Arithmetic Concepts Sub-test	.46***	.46***	.43***	.48***
Arithmetic Applications Sub-test	.42***	.42***	.39***	.44***
Full Scale Intelligence Quotient	.40***	.40***	.40***	.40***
Language Intelligence Quotient	.38***	.38***	.36***	.40***
Non-Language Intelligence Quotient	.35***	.35***	.37***	.33***
Current Arithmetic Grade	.61***	.61***	.62***	.62***
Semester Arithmetic Grade	.63***	.62***	.64***	.63***
Cumulative Arithmetic Grade	.55***	.55***	.59***	.53***
Total Academic Grade Point Average	.66***	.67***	.72***	.66***
Arithmetic Self-Concept	.72***	.71***	.72***	.70***

* Not significant at .05 level
** Significant at or beyond the .02 level
*** Significant at or beyond the .01 level

Table 5:17

Differences Between Coefficients of Correlation for General Self-Concept of Ability and Specific Variables Examined in This Study for Total Group and Sample Group

Variable	Total Pop rho N=161	Samp Pop rho N=144	z-test	p (two-tail test)
Student's Sex	.02*	-.01*	.09	>.05*
Family Social-Status	-.30**	-.32**	.13	>.05*
Mother's Education	.26**	.24**	.27	>.05*
Arithmetic Computations Sub-test	.49**	.48**	.13	>.05*
Arithmetic Concepts Sub-test	.46**	.46**	-0-	-
Arithmetic Applications Sub-test	.42**	.42**	-0-	-
Full Scale Intelligence Quotient	.40**	.40**	-0-	-
Language Intelligence Quotient	.38**	.38**	-0-	-
Non-Language Intelligence Quotient	.35**	.35**	-0-	-
Current Arithmetic Grade	.61**	.61**	-0-	-
Semester Arithmetic Grade	.63**	.62**	.09	>.05*
Cumulative Arithmetic Grade	.55**	.55**	-0-	-
Total Academic Grade Point Average	.66**	.67**	.13	>.05*
Arithmetic Self-Concept	.72**	.71**	.13	>.05*

* Not significant at .05 level
** Significant at or beyond .01 level

Table 5:18

Differences Between Coefficients of Correlation for General Self-Concept of Ability and Specific Variables Examined in This Study for Boys and Girls in Sample

Variable	Boys Samp rho N=66	Girls Samp rho N=78	z-test	p (two-tail test)
Family Social-Status	-.20*	-.42**	1.50	>.05*
Mother's Education	.31*	.18*	.80	>.05*
Arithmetic Computations Sub-test	.49**	.50**	.06	>.05*
Arithmetic Concepts Sub-test	.43**	.48**	.36	>.05*
Arithmetic Applications Sub-test	.39**	.44**	.36	>.05*
Full Scale Intelligence Quotient	.40**	.40**	-0-	-
Language Intelligence Quotient	.36**	.40**	.24	>.05*
Non-Language Intelligence Quotient	.37**	.33**	.30	>.05*
Current Arithmetic Grade	.62**	.62**	-0-	-
Semester Arithmetic Grade	.63**	.63**	-0-	-
Cumulative Arithmetic Grade	.59**	.53**	.54	>.05*
Total Academic Grade Point Average	.72**	.66**	.71	>.05*
Arithmetic Self-Concept	.72**	.70**	.24	>.05*

* Not significant at .05 level
** Significant at or beyond .01 level

In hypothesis number four it was hypothesized that there was no significant relationship between scores on the measure of arithmetic self-concept and scores on a measure of scholastic aptitude (I.Q. scores).

Data obtained in this study as indicated in Table 5:19 below dictate an inference that there was a relationship between arithmetic self-concept scores and scores on an intelligence quotient scale.

Table 5:19

Correlations between the Arithmetic Self-Concept and Scholastic Aptitude as Measured by the California Short-Form Test of Mental Maturity

CMM	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Full Scale I.Q.	.57*	.47*	.54*
Language I.Q.	.43*	.37*	.48*
Non-Language I.Q.	.49*	.48*	.49*

N=144
*p=<.01 (two-tailed test)

The relevancy of interaction of the I.Q.--arithmetic self-concept scale was indicated here. The results suggested a substantially significant positive relationship between I.Q. and arithmetic self-concept. The relationships were significant beyond the .01 level: rhos were somewhat higher for girls than for boys. Results were anticipated in reference to findings by Ringness (108) that academic self-ratings are related to I.Q. levels.

H:4 was rejected since it appeared that I.Q. and arithmetic self-concept were significantly related for the sample in this study. Full scale I.Q. scores and Non-Language I.Q. scores were more highly correlated with arithmetic self-concept than Language I.Q. scores were.

The fifth hypothesis stated: There is no significant relationship between scores on the measure of arithmetic self-concept and scores on the arithmetic sub-tests of the Stanford Achievement Test.

The correlations between arithmetic self-concept scores and scores on arithmetic sub-test of the standardized achievement test shown in Table 5:20 suggested that there was a positive relationship between arithmetic self-concept scores and scores on arithmetic sub-tests of a standardized achievement test in this study.

Table 5:20

Correlations Between Arithmetic Self-Concept and Arithmetic Achievement on Standardized Arithmetic Achievement Tests

Arithmetic Sub-tests	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Arithmetic Comp	.62*	.56*	.67*
Arithmetic Conc	.61*	.56*	.65*
Arithmetic Appl	.59*	.55*	.63*

N=144
*$p = < .01$ (two-tailed test)

Research findings in this study indicated that students' abilities to use arithmetic functions as demonstrated by standardized achievement test results were substantially and positively related to the arithmetic self-concept.

H:5 was rejected since results showed statistically significant positive relationships between arithmetic self-concept and arithmetic achievement tests. The relationships were significant beyond the .01 level. As in the previous analysis the correlations were higher for girls than for boys, but not a significant level. Though not predicted the differences were expected in terms of a thesis by Ausubel (6) that boys, because they possess less derived status than do girls in our culture, tend to set higher levels of aspiration than girls do.

Hypothesis number six predicted that there was no significant relationship between scores on the measure of arithmetic self-concept and teacher-assigned arithmetic grades.

Correlations between arithmetic self-concept and teacher-assigned arithmetic grades for this study are shown in Table 5:21.

Table 5:21

Correlations Between Arithmetic Self-Concept and Teacher-Assigned Arithmetic Grades

Marking period Arith Grade	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Current Arithmetic Grade	.71*	.71*	.72*
Semester Arithmetic Grade	.72*	.70*	.73*
Cumulative Arithmetic Grade	.67*	.63*	.69*

N=144
*$p = < .01$ (two-tailed test)

The findings derived from analyses of data related to the assumptions of hypothesis number six demonstrate conclusively that there was a positive significant relationship between arithmetic self-concept and teacher designated arithmetic grades for students in this study. The correlations were markedly high between arithmetic self-concept and arithmetic grades. The relationships were significant beyond the .01 level. The relationships were somewhat higher for recent and immediate grades than for cumulative grades, but the differences were not significant.

The findings were anticipated in respect to theoretical precepts of Combs and Snygg (32) and Rogers (111) that one's experiences serve as a framework for the acquisition of self-concept and that self-concepts of children are responsive to new experiences; findings also are consistent with conclusions by Aiken and Dreger (1) that direct experiences in relation to mathematics contribute to math attitudes.

H:6 was rejected since it was apparent that there was a marked significant positive relationship between the arithmetic self-concept and arithmetic grades for students in this study.

In hypothesis number seven it was asserted that there was no significant relationship between scores on a measure of arithmetic self-concept and the Sixth Grade total grade point average for all academic areas.

Table 5:22 delineates the coefficients of correlation between arithmetic self-concept and total academic grade point average for students in this study.

Table 5:22

Correlations Between Arithmetic Self-Concept and Sixth Grade Total Academic Grade Point Average

	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Total Academic Grade Point Average N=144	.68*	.66*	.70*

*p=<.01 (two-tailed test)

The data indicated that there was a high positive relationship between arithmetic self-concept and total academic grade point average for the Sixth Grade subjects in this study. The relationships were significant beyond the .01 level. The relationship was somewhat higher for girls than for boys, but not at a significant level.

The findings were expected in terms of direction provided by Brookover (16) and Werdelin (142) that mathematical ability is one part of the total intellectual-academic field and therefore cannot be studied in isolation, but only in connection with other parts of the field.

H:7 was rejected since it was shown that there was a high positive significant relationship between arithmetic self-concept and total academic grade point average for subjects in this study.

It was hypothesized next that there was no significant relationship between students' scores on the measure of arithmetic self-concept and their mothers' educational level.

Coefficients of correlation for data derived from investigation of hypothesis number eight are depicted in Table 5:23 below.

Table 5:23

Correlations Between Arithmetic Self-Concept and Students' Mothers' Educational Levels

	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Students' Mothers' Educational Level	.23*	.32*	.13**

N=144
*p=<.02 (two-tailed test)
**p=>.05 (two-tailed test)

The findings suggested that there was a small positive relationship between arithmetic self-concept and the level of mothers' education for students in the present sample. The coefficients of correlation for the total sample and for boys in the sample were significant beyond the .02 level; the relationships for girls in the sample were not significant at the .05 level.

The findings were not expected in regard to theoretical directions provided by findings of Drucker and Remmers (45); they are consistent with conclusions by McDermott (89) that fathers exert more influence on the development of mathematical attitudes than do mothers, and inferences by Medinnus (93) that mother influences are higher for boys than for girls: Boys appear more dependent on parental perceived attitudes due to the sociological and economic impact in terms of achievement demands and general expectations.

H:8 was tentatively rejected for the total sample group and for boys in the sample; but was sustained for girls in the study herein reported, since the relationships between arithmetic self-concept and level of mothers' education were not significant at the .05 level for girls.

The assumption in hypothesis number nine was that there was no significant relationship between students' scores on the measure of arithmetic self-concept and ranking of their families' social-status as indicated by criteria included in the <u>McGuire-White Measure of Social Status</u>.

Results of investigation of data related to the association between arithmetic self-concept and family social-status of children included in the study are illustrated in Table 5:24.

Table 5:24

Correlations Between Arithmetic Self-Concept and A Measure of Family Socio-Economic Status

	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Family Social-Status	-.30*	-.22**	-.35*

N=144
*p=<.01 (two-tailed test)
**p=>.05 (two-tailed test)

The findings showed that there was a slight significant negative relationship between arithmetic self-concept and a measure of family socio-economic status for subjects in the total sample group and for girls in the sample group; the relationships for boys were not significant. The relationships for the total sample and for the girls were significant at the .05 level -- all coefficients of correlation were in a negative direction.

The findings were not expected in reference to previous findings by Brookover (16) and Passy (99). The negative relationships may be explained by deficiencies in the social status scale used in the study in terms of community makeup; however, Sherif and Sherif (115) advise that cases of discrepancy between actual group membership and psychological relatedness are not infrequent in the U.S. which is a good example of a highly differentiated society in which there are many individuals whose reference groups are not the groups with which they are actually associated in day-to-day living. Following this line of reasoning, Beck (10) theorizes that many children from homes with low economic-status have parents with middle-class identifications.

H:9 was tentatively rejected for the total sample group and for girls within the sample group, but not for boys in the sample group, since the *r* for boys does not attain the .05 level.

Hypotheses Related to the General Self-Concept of Ability

Hypothesis number ten, the first major hypothesis pertaining to the general self-concept of ability, stated that there was no significant relationship between scores on the measure of general self-concept of ability and the arithmetic sub-test of the Stanford Achievement Test.

Table 5:25 shows the coefficients of correlation between general self-concept of ability and arithmetic achievement sub-tests of the Stanford Achievement Test as computed from data obtained in the study.

Table 5:25

Correlations Between General Self-Concept of Ability and Arithmetic Achievement Sub-tests

Arithmetic Sub-tests	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Arithmetic Comp	.48*	.49*	.50*
Arithmetic Conc	.46*	.43*	.48*
Arithmetic Appl	.42*	.39*	.44*

N=144
*p= <.01 (two-tailed test)

Information derived from examination of data pertinent to this hypothesis indicated that there was a substantial positive relationship between general self-concept of ability and arithmetic achievement. As with other coefficients of correlation in the present project the relationships were higher for girls than for boys, but not at a significant level. The relationships were significant beyond the .01 level.

The findings were expected in relation to research direction provided by Brookover and associates (16).

H:10 was rejected since the evidence indicated that there was a moderately high, significant, positive relationship between the general self-concept of ability and arithmetic achievement as indicated by arithmetic sub-tests of an achievement scale for children in the study presently reported.

Hypothesis number eleven stated that there was no significant relationship between scores on the measure of general self-concept of ability and teacher-assigned arithmetic grades.

Correlational results of analysis of data involved in the relationships between general self-concept of ability and teacher-assigned arithmetic grades are shown in Table 5:26.

Table 5:26

Correlations Between General Self-Concept of Ability and Teacher-Assigned Grades

Marking period Arithmetic Grade	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Current Arithmetic Grade	.61*	.62*	.62*
Semester Arithmetic Grade	.62*	.64*	.63*
Cumulative Arithmetic Grade	.55*	.59*	.53*

N=144
*p=<.01 (two-tailed test)

Data obtained from analysis of hypothesis number eleven revealed that there was a moderately high, significant, positive relationship between the general self-concept of ability and teacher-assigned arithmetic grades for achievement in the on-going classroom situation for children in the study. The relationships were fairly constant for boys and for girls. Relationships were significant beyond the .01 level.

The results were anticipated in relation to research direction provided from conclusions formed by Brookover and associates (16).

H:11 was rejected because evidence suggested a substantially high, significant, positive relationship between scores on the measure of general self-concept of ability and teacher-assigned arithmetic grades representing academic achievement for subjects in the present study.

The twelfth hypothesis of the study averred that there was no significant relationship between scores on the measure of general self-concept of ability and the Sixth Grade total academic grade point average.

Table 5:27 illustrates the relationships between the general self-concept of ability and the total academic grade point average for subjects in the study.

Table 5:27

Correlations Between General Self-Concept of Ability and Total Academic Grade Point Average

	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Total Academic Grade Point Average	.67*	.72*	.66*

N=144
*p=<.01 (two-tailed test)

Results of the analysis of these data prompted the conclusion that there was a substantial-to-marked significant, positive relationship between the general self-concept of ability and total academic grade point average. As in the previous analyses the relationships were somewhat higher for boys than for girls, but not at a significant level. The relationships were significant beyond the .01 level.

The findings were expected in terms of research directions obtained from findings by Brookover, et al (16).

H:12 was rejected since the evidence related to hypothesis number twelve lead to the conclusion that there was a moderate-to-high correlation between general self-concept of ability and total academic grade point average for students in the study.

The final major hypothesis of the present research study was: There is no significant relationship between students' scores on the measure of general self-concept of ability and ranking of their families' social-status as indicated by criteria included in the McGuire-White Measure of Social Status.

Results of investigation of data related to the associations between general self-concept of ability and family social-status of children included in the study are illustrated in Table 5:28.

Table 5:28

Correlations Between General Self-Concept of Ability and A Measure of Family Socio-Economic Status

	Samp Grp rho N=144	Boys rho N=66	Girls rho N=78
Family Social-Status	-.30*	-.20**	-.42*

N=144
*p= <.01 (two-tailed test)
**p= >.05 (two-tailed test)

The findings show that there was a definite, though slight, significant negative relationship between general self-concept of ability and a measure of family socio-economic status for subjects in the total sample and for girls with the group. The relationships for boys were supportive of the hypothesis. The relationships -- negative in direction -- were significant beyond the .01 level for the total sample and for girls in the sample; for boys the relationships did not attain the .05 level.

The findings were contrary to expectations in reference to research directions suggested by findings of Brookover *et al* (16) and Passy (99).

H:13 was tentatively rejected for the total sample group and for girls within the group, but not for boys within the group. The coefficients of correlation between general concept of ability and family socio-economic status were in a negative direction.

Table 5:29 shows an analysis of differences between *r*'s among arithmetic self-concept and general self-concept

of ability and specific variables examined in this study for the sample group.

Analysis of the data that appears in Table 5:29 suggested that arithmetic self-concept correlated significantly higher with arithmetic sub-tests than the general self-concept of ability does. The correlations between arithmetic self-concept and the specific variables included in this study were generally higher than the correlations between general self-concept of ability and the same variables in this study; the higher correlations for arithmetic self-concept and variables in the study obtain particularly in reference to the arithmetic criteria. The differences are significant beyond the .02 level when the *Sign Test* is applied to the data.

Table 5:29

Differences Between Coefficients of Correlation Among Arithmetic Self-Concept and General Self-Concept of Ability and Specific Variables Examined in This Study for the Sample Group

Variables Examined in This Study	ASC rho N=144	GSCA rho N=144	z-test	p	Sign Test **
Mother's Education	.23	.24	.08	>.05	-
Family Social-Status	-.30	-.32	.17	>.05	-
Arithmetic Computations Sub-test	.62	.48	1.62	>.05	≠
Arithmetic Concepts Sub-test	.61	.46	1.79	<.05*	≠
Arithmetic Applications Sub-test	.59	.42	1.96	<.025*	≠
Full Scale Intelligence Quotient	.51	.40	1.19	>.05	≠
Language Intelligence Quotient	.43	.38	.50	>05	≠
Non-Language Intelligence Quotient	.49	.35	1.45	>05	≠
Current Arithmetic Grade	.71	.61	1.53	>05	≠
Semester Arithmetic Grade	.72	.62	1.53	>05	≠
Cumulative Arithmetic Grade	.67	.55	1.62	>05	≠
Total Academic Grade Point Average	.68	.67	.17	>.05	≠

N=144
*p=<.05 (two-tailed test)
**p=<.02 (Sign Test analysis)

Other Relevant Results

The multiple correlation analysis was used in the present investigation to study the degree of variation attributable to variables in the study.

Results of the multiple correlational analysis involving arithmetic self-concept and the independent variables included in this study are expressed in Table 5:30 and Table 5:31. Partial Correlations and Beta Weights are listed for the variables.

Table 5:30

Data of the Multiple Coefficients of Correlation Between the Arithmetic Self-Concept Scale and Independent Variables in the Study

R	R^2	$\bar{R}^2$	$\bar{R}$
.82	.67	.63	.79

N=144

The results indicated that there was a definite marked positive significant relationship between the arithmetic self-concept and variables included in this study. The multiple correlation obtained between the dependent and independent variables suggested that arithmetic self-concept had a predictive relationship.

More than two-thirds of the variance in the total arithmetic self-concept scores was accounted for in terms of the variance in the independent variables part scores; approximately thirty-three percent variance remained.

Table 5:31

Partial Correlation Coefficients and Beta Weights for the Arithmetic Self-Concept Scale and Independent Variables in the Study

Variable	Partial rho	Beta Weights
Student's Sex	.018	.012
Family Social-Status	.021	.015
Mother's Education	-.037	-.026
General Self-Concept of Ability	.471	.444
Arithmetic Computations Sub-test	.033	.036
Arithmetic Concepts Sub-test	.116	.155
Arithmetic Applications Sub-test	.017	.023
Full Scale Intelligence Quotient	.032	.251
Language Intelligence Quotient	-.044	-.197
Non-Language Intelligence Quotient	-.023	-.094
Number Values Sub-test	.062	.050
Number Problems Sub-test	.073	.061
Current Arithmetic Grade	.063	.108
Semester Arithmetic Grade	.098	.185
Cumulative Arithmetic Grade	.132	.145
Total Academic Grade Point Average	-.117	-.171

N=144

<u>Partial Correlation</u>: net correlation between two variables when the influence of one or more other variables on their relation has been eliminated or allowed for.

<u>Beta Weight</u>: the amount that each variable must be multiplied in order to make the multiple correlation with a criterion a minimum.

Examination of the regressions of the multiple correlation coefficient derived in the analysis indicated that the independent variables of General Self-Concept of Ability, the Semester Arithmetic Grade and the Arithmetic Concepts Sub-test of the Achievement test contributed significantly to the total arithmetic self-concept score; the partial correlations range from .44 for the General Self-Concept of Ability to .16 for the Arithmetic Concepts sub-test. The dimensions of Mother's Education, Language and Non-Language Intelligence Quotients and Total Academic Grade Point Average with negative partial correlations added little to the total arithmetic self-concept score. For this study, the results indicated that Student Sex, Non-Language Intelligence Quotient and Family Social-Status contributed least to the total arithmetic self-concept score.

The findings prompted the conclusion that the variables examined in this study contributed significantly to the arithmetic self-concept with the exceptions of those variables cited above.

Results of the multiple correlation examination involving the Arithmetic Applications Sub-test of the standardized achievement test and the components of the arithmetic Self-Concept Scale are depicted in Table 5:32 and Table 5:33. Partial Coefficients of Correlation and Beta Weights are listed for the variables.

Table 5:32

Data for the Multiple Coefficients of Correlation Between the Arithmetic Applications Sub-test and Components of the Arithmetic Self-Concept Scale

R	R2	$\bar{R}$2	$\bar{R}$
.709	.503	.411	.641

N=161

The results of the multiple correlational analysis suggested that there was a substantial relationship between the Arithmetic Applications Sub-test scores and component questions of the Arithmetic Self-Concept Scale. The multiple correlation obtained between the dependent and independent variables suggested that the Arithmetic Self-Concept had a predictive relationship with this test of arithmetic achievement.

Approximately fifty percent of the variance in the Arithmetic Applications Sub-test scores was accounted for in the variance in the component questions.

Examinations of the regressions of the multiple coefficient of correlation derived in the analysis indicated that the questions pertaining to parent attitude toward student arithmetic grades; student understanding of arithmetic compared with other school subjects; ability to do multiplication problems and students' estimates of future ranking in college class in arithmetic contributed little to the total Arithmetic Applications Sub-test scores; par-

Table 5:33

Partial Coefficients of Correlation and Beta Weights for the Arithmetic Self-Concept Component Questions and Arithmetic Applications Sub-test

Question Number	Partial rho	Beta Weights
1	.150	.227
2	.126	.214
3	.079	.094
4	.077	.080
5	.009	.011
6	-.123	-.114
7	.075	.096
8	.150	.184
9	-.173	-.215
10	-.005	-.006
11	-.202	-.210
12	.028	.029
13	.091	.081
14	.074	.076
15	-.199	-.269
16	.055	.065
17	-.103	-.092
18	.076	.085
19	-.001	-.001
20	.160	.189
21	.007	.008
22	.087	.119
23	-.029	-.037
24	-.020	-.018
25	.082	.107

N=161

tial correlations for these questions were in a negative direction. Questions relating to students' evaluation of personal arithmetic ability compared with close friends; students' impressions of the relative difficulty involved in learning arithmetic in comparison with other school subjects and student comparison of arithmetic grades with grades received in other school subjects appeared to contribute most highly to the total Arithmetic Applications Sub-test score for subjects in this study. The partial correlations for these questions ranged from .150 to .160.

The multiple coefficients of correlation yielded for this study indicated that, for the subjects in this study, the component questions of the Arithmetic Self-Concept have validity in relation to predicting arithmetic achievement.

Summary

The non-parametric Mann-Whitney U-Test was used to test the first two hypotheses of this study pertaining to the high versus low arithmetic self-concept in relation to arithmetic achievement. Mann-Whitney U-Test analyses indicated there were significant differences between arithmetic achievement levels for students with high arithmetic self-concept scores and students with low arithmetic self-concept scores.

Hypothesis number three related to the differences between the arithmetic self-concept of boys and the arithmetic self-concept of girls was tested by use of the *t*-test; *t*-test results showed no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls for subjects in this study.

Hypotheses related to the arithmetic self-concept and the general self-concept of ability and independent variables intrinsic to the study were tested through correlational analysis using the *Pearson Product Moment Coefficient of Correlation* formula. Results indicated significant relationships for all variables in the study except that related to student's sex. The correlations for family social-status were in a negative direction for both arithmetic self-concept and general self-concept of ability.

Multiple correlations indicated that the general self-concept of ability, semester arithmetic grades and arithmetic concepts sub-test scores contribute significantly to the total arithmetic self-concept score for subjects in this study. Multiple correlations also suggest that the arithmetic self-concept scale has validity in predicting arithmetic achievement for students in this study.

CHAPTER VI

SUMMARY, FINDINGS AND CONCLUSIONS: DISCUSSION AND RECOMMENDATIONS

The final chapter of this study is organized into six main divisions: 1) Restatement of the Problem; 2) Recap of Design and Procedures; 3) Summary of Findings; 4) Conclusions; 5) Discussion and 6) Recommendations.

Problem

The primary purpose of this study was to investigate the relationships between arithmetic self-concept and variables related to arithmetic achievement in a selected group of sixth grade students. Subordinate purposes were: 1) to identify the variables that contribute most to the arithmetic self-concept score; 2) to isolate the components of the arithmetic self-concept scale that are most closely related to arithmetic achievement as indicated by scores on the arithmetic applications sub-test of the *Stanford Achievement Test*.

An attempt was made to establish the self-concept as a measurable constellation of variables related, significantly, to the accumulated experiential background of the individual. The school, it is theorized, contributes to the development of the self-concept in reference to the interpersonal relationships developed with teachers and peers that impinge upon a child's perception of himself. The competitive aspects of school related experiences have a particular impact on the development of self-concept as does the evaluative aspects of educative procedure since it is built, in all its uniqueness for each individual, in relation to others. The importance of self-concept is suggested by the imputation by Hilgard (64) that all personality mechanisms imply a self-reference and such mechanisms are not understandable unless considered in the framework of one's concept of himself.

Design and Procedure

Children of the sixth grade classes in the Algonac, Michigan Community Schools served as subjects and pertinent data were collected during the last month of the fifth grade and the last month of the sixth grade. Data were collected on 161 sixth grade students for the study.

The independent variables investigated in relation to their possible connection with the development of arithmetic self-concept were: student's sex, mother's educational level, family socio-economic ranking, general self-concept of ability, arithmetic achievement test scores, teacher-assigned arithmetic grades and total academic grade point average for sixth grade subjects.

For each student in the study a ranking of family socio-economic status was obtained through use of the McGuire-White Measure of Social Status. The California Test of Mental Ability-Short Form and the Stanford Achievement Test were administered to students in the sample. Additional personal data for each child was obtained from a research of the cumulative records of children in the investigation.

Hypotheses numbers one, two and three were submitted to analysis using tests of differences between means: The Mann-Whitney U-Test was employed to measure the differences between means for the upper quartile and the lower quartile divisions of the arithmetic self-concept range for hypotheses one and two. The Mann-Whitney U-Test was selected for these tests since the observations were considered to be not normally distributed. The *t*-test was used to analyze the differences between means pertinent to assumptions in hypothesis number three. The remaining hypotheses were examined through use of correlational analysis: the Pearson Product Moment Coefficient of Correlation was the technique used through the BASTAT program of the Michigan State University Computer Laboratory.

In addition to the fundamental analyses of the major hypotheses, a multiple regression correlational analysis was made using the arithmetic self-concept as the dependent variable in the first *R*, and the arithmetic applications sub-test as the dependent variable in the second multiple correlation. The analyses were made through use of the LSDEL program of the Michigan State University Computer Laboratory.

The .05 level of confidence was established for rejecting the null-hypotheses.

Summary of the Findings

H:1 There is no significant difference in arithmetic achievement, as measured by scores on a standardized arithmetic achievement test, between those students with high arithmetic self-concept as indicated by scores on the arithmetic self-concept scale and students with low arithmetic self-concept as indicated by scores on the same scale.

Result: Hypothesis rejected. The findings indicated that there was a significant difference between achievement levels in arithmetic for children with high arithmetic self-concept and children with low arithmetic self-concept. The difference was significant beyond the .001 level.

H:2 There is no significant difference in arithmetic achievement, as indicated by teacher-assigned arithmetic grades, between students with high arithmetic self-concept and students with low arithmetic self-concept as indicated by scores on the arithmetic self-concept scale.

Result: Hypothesis rejected. The findings suggested that there was a significant difference between teacher-assigned grades in arithmetic for children with high arithmetic self-concept and children with low arithmetic self-concept. The difference was significant beyond the .001 level.

The findings from these two analyses give support to the thesis that arithmetic self-concept affects arithmetic achievement.

H:3 There is no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls when scores on the arithmetic self-concept scale are used as the criterion.

Result: Hypotheses accepted. Findings showed there was no significant difference between the arithmetic self-concept of girls and the arithmetic self-concept of boys. Though girls did, as a group, have higher arithmetic self-concept scores than boys; the differences were not significant at the .05 confidence level.

The findings did not sustain the expectation that boys would have higher arithmetic self-concept scores than girls because of psycho-social implications related to differences in derived status between boys and girls in the American society.

H:4 There is no significant relationship between scores on the measure of arithmetic self-concept and scores on a measure of scholastic aptitude (I.Q. score).

Result: Hypothesis rejected. Analysis of data demonstrated that there was a significant positive relationship between I.Q. and arithmetic self-concept. The relationships were higher for girls than for boys for total I.Q. scores, language I.Q. scores and for non-language I.Q. scores. The correlations were significant beyond the .01 level.

H:5 There is no significant relationship between scores on the measure of arithmetic self-concept and scores on the arithmetic sub-tests of the Stanford Achievement Test.

Result: Hypothesis rejected. Data indicated that there was a significant positive relationship between arithmetic self-concept and standardized arithmetic achievement test results. Again, the results were higher for girls than for boys for arithmetic computations, arithmetic concepts and arithmetic applications sub-tests. The correlations were significant beyond the .01 confidence level.

The findings suggest agreement with an idea by Brown (18) that the student's ability to learn arithmetic is associated with his attitude toward arithmetic; and of an observation by Brueckner (21) that arithmetic is not a general ability, that a high level of proficiency in one aspect is not a guarantee of a correspondingly high level in other areas of arithmetic competency.

H:6 There is no significant relationship between scores on the measure of arithmetic self-concept and teacher-assigned arithmetic grades.

Result: Hypothesis rejected. Findings indicated that there was a significant positive relationship between the arithmetic self-concept and teacher-assigned grades. The correlations were significant beyond the .01 level.

These findings would appear relevant to findings by Bostrom (14) that grades have a significant impact on learning behavior.

H:7 There is no significant relationship between the arithmetic self-concept and the Sixth Grade total academic grade point average.

Result: Hypothesis rejected. The data indicated that there was a significant positive relationship between the arithmetic self-concept and the Sixth Grade total academic grade point average. The correlations were significant beyond the .01 confidence level.

The results of this analysis would seem to be in agreement with thinking by Woodby (145) that success or measurable achievement in arithmetic has some correlation with achievement in other disciplines.

H:8 There is no significant relationship between students' scores on the measure of arithmetic self-concept and their mothers' educational level.

Result: Hypothesis rejected in part. Findings indicated that there was a significant positive relationship between the arithmetic self-concept and mother's level of education for the sample. The correlations for the total group and for boys within the group were significant be-

yond the .02 level; however, the correlation for girls within the group was not significant at the .05 level.

The findings here appear related to a conclusion by Medinnus (93) that mothers influence the self-concept of boys more than of girls because of inferred cultural demands related to school achievement and general expectations.

H:9 There is no significant relationship between students' scores on the measure of arithmetic self-concept and ranking of their families' social-status as indicated by criteria delineated in the McGuire-White Measure of Social Status.

Result: Hypothesis rejected in part. Data indicated that there was a significant negative relationship between the arithmetic self-concept and a ranking of family social-status. The correlation for the total group and for girls within the group were significant beyond the .01 confidence level; the correlation for boys within the group was not significant at the .05 level.

The findings may be indicative of weaknesses in the social-status scale, but appear to be also reflective of a surmise by both Beck (10) and Sherif (115) that cultural permeability causes many children from low economic status home to have middle-class identifications. Dubin and Dubin (46) too, minimize the influence of the home experiences on attitudes, suggesting that the nature of the child and his reaction to the psychological field are critical determinants in creation of the self-image.

H:10 There is no significant relationship between scores on the measure of general self-concept of ability and arithmetic achievement as measured by sub-tests of the <u>Stanford Achievement Test</u>.

Result: Hypothesis rejected. Findings indicated that there was a significant positive relationship between the general self-concept of ability and standardized arithmetic achievement test scores. The correlations were significant beyond the .01 confidence level and obtain for arithmetic computations, arithmetic concepts and arithmetic applications sub-tests.

H:11 There is no significant relationship between scores on the measure of general self-concept of ability and teacher-assigned arithmetic grades.

Result: Hypothesis rejected. The analysis of data indicated that there was a significant positive relationship between the general self-concept of ability and teacher-assigned grades. The correlations were significant beyond the .01 confidence level and held for the current, semester and cumulative arithmetic grades.

H:12 There is no significant relationship between scores on the measure of general self-concept of ability and the Sixth Grade total academic grade point average.

Result: Hypothesis rejected. The findings indicated

that there was a significant positive relationship between the general self-concept of ability and the Sixth Grade total academic grade point average. The correlations were significant beyond the .01 level.

The findings appear consistent with deductions by Borislow (13) that students who underachieve scholastically have a poorer conception of themselves as students than do achievers.

H:13 There is no significant relationship between students' scores on the measure of general self-concept of ability and rankings of their families' social-status as indicated by criteria delineated in the _McGuire-White Measure of Social Status_.

Result: Hypothesis rejected. The findings indicated that there was a significant, though negative, correlation between the general self-concept of ability and ranking of family social-status. The correlations were all significant beyond the .05 confidence level; the correlations for girls were slightly higher than the correlations for boys.

Conclusions

Literature related to the present study suggested that there would be a relationship between academic self-concept and academic achievement. The results of the study appear to lend empirical support to the theory that a relationship exists between the level of arithmetic self-concept and arithmetic achievement.

Of the thirteen null hypotheses in this study all but one were rejected: ten were unqualifiedly rejected; two were tentatively rejected, and one was sustained. In general, the null hypotheses set forth in this study were rejected at a substantial level (beyond the .05 confidence level). The three hypotheses related to mother's educational level and family social-status ranking, however, were only tentatively rejected: the findings related to family social-status were significant in a negative direction.

The findings for the total sample group and for boys and for girls within the sample group for this study were substantial and the correlations obtained at a high level of significance for arithmetic achievement as indicated by standardized achievement test results and by teacher-assigned arithmetic grades. For this study, the conclusion that there was no significant difference between the arithmetic self-concept of boys and the arithmetic self-concept of girls was warranted; similarly, there was no significant difference between the general self-concept of ability of girls and the general self-concept of boys. The conclusion that there was a difference between the arithmetic achievement of boys and the arithmetic achievement of girls was only tentatively supported. There was a difference, significant at the .02 level, for the arithmetic computations sub-test of the standardized achievement test; there was no significant difference for the arithmetic concept and arithmetic applications sub-tests. Sixth Grade girls appeared to receive somewhat higher grades in arithmetic than boys do: the difference was significant beyond the .05 level for current grades, but was not significant on a cumulative basis (marks over a three year period).

Other conclusions that were deduced from the findings were:

1. It appears that there was a significantly high positive relationship between scholastic aptitude and arithmetic self-concept. Self-concept, specifically arithmetic self-concept, appeared to vary with intelligence; sex did not appear to be a determiner for differences among children in this study. The correlation between aptitude and arithmetic self-concept, ranging between .43 and .51 as they do for this study, were somewhat higher for the *r*'s between I.Q. and general self-concept of ability which range between .35 and .40. In reference to these correlations, it might be pointed out that Jersild (68) suggests that one views himself more on an emotional basis than on an intellectual basis.

2. Students who achieved scholastically in arithmetic had higher arithmetic self-concepts than children who did not achieve scholastically in arithmetic. Relationships were somewhat higher for teacher-assigned grades than for standardized arithmetic achievement test scores. The cor-

relations between arithmetic self-concept and arithmetic achievement ranged between .59 for arithmetic self-concept and the arithmetic applications sub-test to .72 for arithmetic self-concept and the semester arithmetic grade.

Arithmetic self-concept appeared to be a good predictor of achievement in arithmetic for children in the study. Recent arithmetic grades seemed to be somewhat more important in the formation of the arithmetic self-concept than past arithmetic grades.

3. Students' arithmetic self-concept was positively related to the Sixth Grade total academic grade point average. The concept a student held of his arithmetic ability appeared at least partially contingent upon his concept of his general school ability when teacher-assigned grades are considered. The correlation between arithmetic self-concept and total academic grade point average was .68.

4. For boys the mothers' educational level appeared to have some impact on the arithmetic self-concept, but for girls at the Sixth Grade level the mothers' educational level did not appear to be a determining factor in the development of arithmetic self-concept. This conclusion was tentative since the correlations tended to be slight.

5. Family social-status ranking was negatively correlated with the arithmetic self-concept and with the general self-concept of ability, and did not appear to work a significant influence on scholastic achievement (_r_'s were

between -.20 and -.33). This conclusion was not anticipated since related literature and prior findings suggested that social-status would have a positive effect on self-concept.

6. The general self-concept of ability for children in this study was positively related to arithmetic self-concept and collaterally with arithmetic achievement in terms of both standardized achievement test scores and in terms of teacher assigned arithmetic grades. The correlations between general self-concept of ability and arithmetic achievement was somewhat higher for teacher-assigned grades than for standardized arithmetic achievement test scores. Correlations for arithmetic achievement test scores ranged between .40 and .46 while the $\underline{r}$'s for teacher-assigned grades were between .55 and .62.

7. The general self-concept of ability was markedly correlated with Sixth Grade total academic grade point average. The general self-concept appeared to be a good predictor of general academic ability for Sixth Grade children. The correlation was .71.

8. General self-concept of ability, arithmetic grades and arithmetic achievement scores contributed significantly to the arithmetic self-concept.

Discussion

This study should be considered an exploratory investigation with definite replicative possibilities. The study was conducted using observations from a sample selected from one grade level in a single school community. The research was designed to test hypotheses pertinent to relationships between arithmetic self-concept and arithmetic achievement inherent in the study.

Since the study was conducted in a single community with students from a designated grade level there are limitations intrinsic to findings of the study. No effort was made to establish the sample as representative of the general population.

In this investigation the focus has been on statistical relationships and group implications, and not on individual cases. The findings, therefore, do not preclude the possibility that individual students might achieve at levels not consistent with their arithmetic self-concept.

The conclusions derived from data in the study supported the hypothesis that there is a significant positive relationship between arithmetic self-concept and arithmetic achievement for sixth grade students. In this investigation, boys and girls with high arithmetic self-concept scored significantly higher in arithmetic achievement than boys and girls with low arithmetic self-concept. These relationships hold for the total group as well as for boys and girls within the group.

The findings were consistent with the literature which indicated that various factors underlie academic self-concept and student achievement is positively associated with perceptions of ability in specific academic areas, particularly arithmetic achievement. The present findings, though part of an exploratory study, sustained some findings derived from a series of studies related to general self-concept of ability by the College of Education, Michigan State University. The findings indicated that the Brookover Scale can be used at the upper elementary level as well as at the junior-senior high school levels.

The study results tended to show that the factors of ability, attitude and experience entered significantly into the picture of arithmetic achievement. In respect to this, it would appear that the school plays an important role in the formation of self-concept and that the competitive aspects of the learning climate, the sensitivity of children to reactions of peers and teachers in reference to successes and failures appear to be reflected in a child's self-regard. Correlations obtained in this study were somewhat higher than those secured in previous studies in terms of relationships between arithmetic self-concept and arithmetic achievement in reference to arithmetic achievement test scores and teacher-assigned arithmetic grades.

Findings in this study suggested that family socioeconomic ranking had a negligible effect on self-concept. There was evidence, also, that the level of mothers' education affected arithmetic self-concept of boys, but not of girls. These relationships, though statistically significant in a negative direction, were modest.

It was apparent, from findings in the study, that general self-concept of ability had a high correlation with general academic achievement, including arithmetic achievement.

In this study the coefficients of correlation between arithmetic achievement test scores and teacher-assigned arithmetic grades ranged from .60 for the r between the arithmetic concepts sub-test and the cumulative arithmetic grade to .78 for the r between the arithmetic computations sub-test and the current arithmetic grade, and so tended to lend credence to the postulate the school marks have some "face validity" as a measure of ability of children in arithmetic. In respect to these facts, the principal finding that arithmetic self-concept was positively and significantly related to teacher-assigned grades suggested that teacher-pupil relationships did affect pupil learning efficiency and so appeared to have implications for teacher education on a pre-service and in-service basis. There appeared to be suggestions for teachers in terms of the importance of grades on the formation the self-concept in the on-going classroom situation. The connotation derived would seem to be that grades have an important impact on the development of arithmetic self-concept. There seemed to be, furthermore, some inference to be drawn in terms of devising methods of studying particular elements of children's self-concept of ability in specific academic areas. It is suggested, in results of this study, that it may be feasible to develop self-concept scales for other specific academic areas to increase the body of knowledge of the motivating forces underlying achievement in those areas. A consequence of further study of the implications of self-concept in relation to academic achievement might be the encouragement of positive self-concept formation and the diminution of inadequate self-concept frequently generated in many school children because of the spectre of rejection implied in traditional reactions to failure in regard to school expectations.

It should be pointed out that conclusions of the present study were limited to the variables measured pertaining to arithmetic self-concept and its relationships with arithmetic achievement, academic achievement, scholastic aptitude, teacher evaluation and family related variables. Other variables not included in the study may contribute to the relationships studied. Generalizations of the findings should be made with caution since the sample, though considered fairly representative, did consist of only the Sixth Grade population of an all-Caucasian elementary school situated in a semi-rural north central community. Caution should be used, particularly, in the extrapolation of findings related to multiple regression coefficients of correlation in the study since these statistical results are especially sensitive to variations from group-to-group.

Recommendations for Further Study

On the basis of observations and inferences made during the conduct and evaluation of this study, the following recommendations are offered with the hope that more knowledge pertaining to the dynamics involved in the academic self-concept may be gathered:

1. In order to obtain more knowledge of the dynamics involved in the interplay between the arithmetic self-concept and the aspects of arithmetic achievement included in this study, the following questions are relevant for further study: In what group of pupils -- high, middle or low in arithmetic self-concept -- is the range of achievement differences most pronounced? May we safely predict that the range of differences will be less among the high arithmetic self-concept group than they will be in the average and low arithmetic self-concept groups? Will differences be greater for boys or for girls?

2. To help determine the usefulness of arithmetic self-concept scale as a predictor of arithmetic achievement it would be well to replicate reliability and validity studies following the design of this study with other populations. Replications with other populations is also desirable to discover whether results derived from this study obtain for other populations.

3. Replication of the study with a larger sample using full intelligence quotient batteries rather than the short-form battery may enhance findings.

4. Replication of the study using the same variables, but involving samples from different grade levels from third through eighth grade might be helpful in determining whether the relationships between arithmetic self-concept and arithmetic achievement persists, or vacillates, throughout the middle school years.

5. A follow-up study of the children involved in the present study as they complete seventh and eighth grade would provide a longitudinal evaluation of the constancy of the arithmetic self-concept and may enable evaluations of areas in which changes occur.

6. It would be well to conduct a study, along the design of the present study, with underachievers and overachievers in arithmetic to discover the relationships of arithmetic self-concept to the phenomena of underachievement and overachievement in arithmetic.

7. It would be well to conduct studies involving treatment effects related to manipulation and modification of the arithmetic self-concept to determine how such treatments affect the level of arithmetic achievement.

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APPENDIX A

The Pre-Test of the Arithmetic Self-Concept Scale

Introduction

Responses to preliminary scale items by a sample of sixth grade students randomly selected from the elementary school populations of three separate school communities, in the winter of 1965, provided fundamental data for refining the arithmetic self-concept scale.

The Pre-test Sample

Responses to the arithmetic self-concept scale and the self-concept of general ability scale were obtained for 116 sixth graders from the schools involved in the pre-test sample. Current marking period grades in arithmetic were also obtained for the students in the pre-test sample. The 116 students represented approximately one-half of the total sixth grade populations of the three school districts involved.

Statistical Analysis

The sample was divided into quartiles using arithmetic grades as the criterion; the upper quartile children whose grades were B or above; the lower quartile included observations whose grades were D or below. The significance of the difference between means of scores on the arithmetic self-concept scale for the upper and lower quartiles was analyzed through use of the non-parametric Mann-Whitney U-Test as outlined in Siegel (117).

A Coefficient of Reliability was obtained for the arithmetic self-concept scale of the Spearman-Brown Prophecy Formula detailed in Thorndike and Hagen (133).

Administration and Scoring

The combined scales totalling 41 items was administered to three sixth grade classes. Classes were selected from three different semi-rural school communities representing a cross-section of socio-economic levels.

The self-concept of general ability scale consisted of fifteen multiple choice questions devised to explore one's conception of one's ability to do well in school. The arithmetic self-concept scale included twenty-six multiple choice questions related to one's attitudes toward arithmetic. Student responses to the questions of the two scales were scored on a five point scale. Responses representing the low self-concept answer were weighted one and responses representing the high self-concept answers were weighted five.

Validity

Although validation of self-concept scales is difficult, scores obtained for the pre-test sample confirmed expectations that there would be a significant difference in achievement, represented by arithmetic grades, between children with high arithmetic self-concept scores and children with low arithmetic self-concept scores. A mean of 105 was obtained on the arithmetic self-concept scale for students with grades in the upper quartile of the sample compared with a mean of 77 for students whose arithmetic grades fell in the lower quartile as determined by teacher evaluations.

The Mann-Whitney U-Test was used to analyze differences because the scores could not be considered to be normally distributed since extremes in quartile ranges were used.

The results are shown in the table below:

Table I

Differences Between the Arithmetic Self-Concept Mean Scores for Upper and Lower Quartile Groups

Groups	N	AS-C Mean	z	p (one-tailed test)
Upper Quartile	36	105		
Lower Quartile	36	77	5.67	$<.0005$

N=72

The arithmetic self-concept scale was considered to have empirically demonstrated practical validity, at least in terms of arithmetic grades that reflect arithmetic status in the classroom for the pre-test sample.

Reliability

Reliability data for the arithmetic self-concept scale is given in Table II. The results represent the odd-even split-half reliability coefficient as computed through use of the Spearman-Brown Prophecy Formula.

$$r = \frac{2r_{\frac{1}{2}\frac{1}{2}}}{1+r_{\frac{1}{2}\frac{1}{2}}}$$

Table II

Reliability Coefficient for the Arithmetic Self-Concept Scale

	r	r_{11}	p
Arith. Self-Conc. Scale-Split-half	.60	.75	$<.001$

In relation to the findings, the arithmetic self-concept scale was considered to have reliability for the pre-test sample since $p = <.001$.

Pre-Test Results

The pre-test data were used to refine the pre-test instrument into an improved questionaire for the study of relationships between arithmetic self-concept and arithmetic achievement. Phrasing was brought more into line with sixth grade comprehension on the final questionaire than they were on the original instrument, and one question that showed little discrimination was eleminated on the revised scale.

APPENDIX B

Please print your name, birthdate, sex, school name and grade in the proper blanks below:

Name ____________________, __________________, ____________
Last First Middle

Birthdate ___________________ Boy ___ Girl ___ Age _____
Month Date Year

Name of School ____________________________ Grade ______

In the spaces below check the highest grade your mother completed in school:

1 2 3 4 5 6 7 8 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Grade School

1 2 3 4 ☐ ☐ ☐ ☐ Hi School

1 2 3 4 ☐ ☐ ☐ ☐ College

This questionaire is part of a study project designed to help us to understand what school students in your grade think of their school ability, especially in arithmetic, and of their future plans in life.

Please answer the questions as though you were describing <u>yourself</u> <u>to</u> <u>yourself</u>.

Answer each question just as honestly as you can. You should make the answers show how <u>you</u> really think about how well <u>you</u> are able to do in school and especially in arithmetic. Remember, there are no right or wrong answers as such -- only how <u>you</u> feel about the answers to the questions. The answers should <u>not</u> show how you would like them to be, but should show how they are to you now.

Read each question and the answers that follow it carefully. Select the answer that best tells how <u>you</u> feel about the question and place an "X" as the directions tell you.

Please read the directions for each part of the questionaire carefully before you answer. Each boy and girl is different and <u>you</u> should say what is true for <u>you</u>. So be sure to pick the answer that best shows how you feel or think about each question.

If you have any trouble, or if you have any questions about any word or statement raise your hand and someone will help you.

No one will be shown your answers. They will not be shown to your teacher and your answers will not affect your school marks in any way.

When you are told to start, follow the directions carefully and then begin. Take your time -- there is no hurry.

Place an "X" in the box in front of the statement that best answers each question for you. Answer all the questions. (You will have one "X" for each question).

1. How do you rate yourself in school ability compared with your close friends?

- [ ] a. I am the best
- [ ] b. I am above average
- [ ] c. I am average
- [ ] d. I am below average
- [ ] e. I am the poorest

2. How do you rate yourself in school ability compared with those in your class at school?

- [ ] a. I am among the best
- [ ] b. I am above average
- [ ] c. I am average
- [ ] d. I am below average
- [ ] e. I am the poorest

3. Where do you think you will rank in your high school graduating class?

- [ ] a. Among the highest
- [ ] b. Above average
- [ ] c. Average
- [ ] d. Below average
- [ ] e. Among the lowest

4. Do you think you have the ability to complete college?

- [ ] a. Yes, certainly
- [ ] b. Yes, probably
- [ ] c. Not sure either way
- [ ] d. Probably not
- [ ] e. No

5. Where do you think you would rank in your class in college?

- [ ] a. Among the highest
- [ ] b. Above average
- [ ] c. Average
- [ ] d. Below average
- [ ] e. Among the lowest

6. In order to become a doctor, lawyer or college teacher work beyond four years of college is necessary. How likely do you think it is that you could complete work beyond four years of college?

- [ ] a. Very likely
- [ ] b. Somewhat likely
- [ ] c. Not sure either way
- [ ] d. Unlikely
- [ ] e. Most unlikely

7. Forget for a moment how others mark your work. In your own opinion, how good do you think your school work is?

- [ ] a. My work is excellent
- [ ] b. My work is good
- [ ] c. My work is average
- [ ] d. My work is below average
- [ ] e. My work is much below average

8. What kind of marks do you think you are able to get, if you work?

- [ ] a. Mostly A's
- [ ] b. Mostly B's
- [ ] c. Mostly C's
- [ ] d. Mostly D's
- [ ] e. Mostly E's

9. How important to you are the marks you get in school?

- [ ] a. Very important
- [ ] b. Important
- [ ] c. Not really important
- [ ] d. Doesn't matter to me at all

10. How important is it to you to be high in your class in marks?

- [ ] a. Very important
- [ ] b. Important
- [ ] c. Not really important
- [ ] d. Doesn't matter to me at all

11. How do you feel if you don't do as well in school as you know you can?

- [ ] a. I feel very badly
- [ ] b. I feel badly
- [ ] c. I don't feel especially badly
- [ ] d. It doesn't bother me at all

12. How important is it to you to do better than others in school?

- [ ] a. Very important
- [ ] b. Important
- [ ] c. Not really important
- [ ] d. Doesn't matter to me at all

13. Which statement best tells how you feel?

- [ ] a. I like to get better marks than everyone else
- [ ] b. I like to get better marks than almost everyone else
- [ ] c. I like to get about the same marks as everyone else
- [ ] d. I don't care about any special marks

14. In your schoolwork do you try to do better than others?

- [ ] a. All of the time
- [ ] b. Most of the time
- [ ] c. Once in awhile
- [ ] d. Never

15. How important to you are good marks compared with other things you get out of school?

- [ ] a. Good marks are most important things in school
- [ ] b. Good marks are among the important things in school
- [ ] c. Some other things in school are more important
- [ ] d. Good marks don't matter to me at all

Put an "X" in the box under the statement which best answers the question for you. (You will have an "X" for each line.)

1. How do you rate your ability in arithmetic compared with the ability of your close friends?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

2. How do you rate your ability in arithmetic compared with those in your class at school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

3. Where do you think you would rank in your high school graduating class in arithmetic?

Among the lowest	Below average	Average	Above average	Among the highest
☐	☐	☐	☐	☐

4. Do you think you have the ability to do college work in arithmetic?

No	Probably not	Not sure either way	Yes, probably	Yes, certainly
☐	☐	☐	☐	☐

5. Where do you think you would rank in a college class in arithmetic?

Among the lowest	Below average	Average	Above average	Among the highest
☐	☐	☐	☐	☐

6. How likely do you think it is that you could complete advanced work beyond college in mathematics?

Most unlikely	Unlikely	Not sure either way	Somewhat likely	Very likely
☐	☐	☐	☐	☐

7. Forget for the moment, how others mark your work. In your own opinion how good do you think your work is in arithmetic?

My work is much below average	My work is below average	My work is average	My work is good	My work is excellent

8. What kind of marks do you think you are capable of getting in arithmetic?

Mostly E's	Mostly D's	Mostly C's	Mostly B's	Mostly A's

9. How do you rate your ability to do word problems in arithmetic compared with others in your class in school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best

10. How well do you feel you are able to understand arithmetic compared with other school subjects you study?

Not well at all	Poorly	Well enough	Fairly well	Very well indeed

11. Do you think arithmetic is as difficult to learn as other subjects you study in school?

It is the most difficult	It is quite difficult	It is no more difficult than others	It is not difficult	It is one of the easiest

12. How do you rank arithmetic in practical everyday usefulness compared with other school subjects you study?

It is the least useful	It is not very useful	About the same as others	It is very useful	It is the most useful

13. How often do you think of arithmetic problems outside of school?

Never	Very seldom	Occasionally	Very often	Quite often
☐	☐	☐	☐	☐

14. How do you rate the study of arithmetic compared with other school subjects, such as language or social studies, that you study in school?

It is the least important	It is not important	About the same as other subjects	It is important	It is the most important
☐	☐	☐	☐	☐

15. How do you rank your ability to do long division problems compared with others in your class at school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

16. How sure of yourself do you feel in the solving of arithmetic problems compared with work in other subjects you study in school?

Very unsure of myself	Not sure of myself	About the same as other subjects	I am sure of myself	I am very sure of myself
☐	☐	☐	☐	☐

17. If you had a choice, how much time would you want to spend studying arithmetic in school?

Much less time than at present	Less time than at present	About the same as at present	More time than at present	Much more time than at present
☐	☐	☐	☐	☐

18. How well do you rank your ability to do long addition problems in arithmetic compared with others in your class at school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best

19. What marks do you think your parents would say you are capable of getting in arithmetic?

Mostly E's	Mostly D's	Mostly C's	Mostly B's	Mostly A's

20. How do your marks in arithmetic compare with marks you receive in other school subjects you study?

They are among the poorest	They are below average	They are average	They are above average	They are among the best

21. How do you rank your ability to do long multiplication problems in arithmetic compared with others in your class?

I am among the poorest	I am below average	I am average	I am above average	I am among the best

22. What marks do you think your teacher would say you are capable of getting in arithmetic?

Mostly E's	Mostly D's	Mostly C's	Mostly B's	Mostly A's

23. How do you rank your ability to do difficult subtraction problems in arithmetic compared with others in your class in school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best

24. Do you think that the study of arithmetic is as important for future living for you as much as other subjects you study in school are important?

It is the least important subject	It is not as important as other subjects	It is about as important as other subjects	It is somewhat more important than other subjects	It is the most important subject
☐	☐	☐	☐	☐

25. How do you rank your ability to do work involving fractions in arithmetic compared with others in your class in school?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

Thank you for your help

APPENDIX C

Name______________________________________

How many years have you taught school?_______years.

Have you had occasion to teach arithmetic before?________
yes no

How long have you taught arithmetic?_______years.

What is your professional training in mathematics? Have a major____; have a minor____; have less than a minor in mathematics____.

Approximately how many college courses have you had in mathematics?_____

How many courses in the teaching of mathematics?____. Have you taught any coursework in mathematics since beginning to teach mathematics____,____? How many courses?____.
yes no

Please place an "X" in the box under the statement which best describes how you feel about the statement.

1. How do you rank the importance of arithmetic to future living in comparison with other courses taught at this level of school?

It is the least important	It is not very important	It is about the same as others	It is among the most important	It is the most important
☐	☐	☐	☐	☐

2. How would you rank your understanding of arithmetic concepts and processes in comparison with other subject material you teach or have taught?

Among the poorest	Below average	Average	Above average	Among the best
☐	☐	☐	☐	☐

3. If you had your choice, how much time do you think should be devoted to the teaching of arithmetic at this grade level?

Much less time	Less time than at present	About the same amount of time	More time than at present	Much more time than at present
☐	☐	☐	☐	☐

4. How would you rank the rapport between you and your students in the teaching of arithmetic?

It is among the poorest	It is below average	It is average	It is above average	It is among the best
☐	☐	☐	☐	☐

5. How would you rank your professional training for teaching arithmetic?

Very poor	Poor	Adequate	Good	Very good
☐	☐	☐	☐	☐

6. How would you rank your personal sense of satisfaction in teaching arithmetic compared with other academic subjects taught at this grade level?

It is the least satisfying	It is not as satisfying as others	About as satisfy ing as others	Somewhat more satisfying than others	It is the most satisfying subject of all
☐	☐	☐	☐	☐

7. How do you think your students would rank you in terms of competency in teaching of arithmetic in comparison with the teaching of other subjects?

Among the poorest	Below average	Average	Above average	Among the best
☐	☐	☐	☐	☐

8. How would you rank your ability to teach arithmetic at this grade level?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

9. How well do you like teaching arithmetic in comparison with other school subjects you teach or have taught?

It is among the poorest	It is below average	About the same as others	It is above average	It is among the best
☐	☐	☐	☐	☐

10. How would you rank your ability to teach arithmetic in comparison with other teachers of arithmetic at this grade level?

I am among the poorest	I am below average	I am average	I am above average	I am among the best
☐	☐	☐	☐	☐

APPENDIX D

Stanford Achievement Test, Intermediate Battery, Form W

Norms and Population

The norms are derived from a nation-wide testing sampling, during February and March, 1963. A total of 264 school systems drawn from 50 states participated; 850,000 pupils were tested as part of this program. Public schools (integrated, segregated white, and segregated negro), private non-sectarian and private sectarian were included in the sample. The schools were selected from areas representing nine geographic locations proportioned to 1960 census reports.

Validity

Content or curricular validity was sought by examining appropriate courses of study and textbooks as a basis for determining the skills, knowledges, understandings, etc. to be measured, according to publishers. The purpose of Stanford Achievement Test is to provide dependable data concerning pupil achievement in important skills.

The content of the final forms of the test was selected from the total body of material tried out experimentally in such a way that the final tests conform to the original specifications with respect to content.

Reliability

The manual presents odd-even split half reliability coefficients using the Spearman-Brown and the Kuder-Richardson reliability coefficients. According to Bryan (22), reliability coefficients derived from the Spearman-Brown and the Kuder-Richardson formulas have a median of .88. Reliability *r*'s ranging from .88 to .90 indicate the test may appropriately be used to evaluate group differences in ability in various subject areas, for purposes of planning individualized instruction, grouping pupils for instructional purposes, determining and evaluating rate of progress, and evaluating achievement.

The reliability coefficients are based on a sample of 1000 cases drawn randomly from 76 school systems testing in all grades 1-9 in national standardization.

Bryan (22) says this about the arithmetic sub tests:

> In providing a measure of that phase of the traditional mathematics curriculum known by the general term "arithmetic", the *Stanford Achievement Test* continues to be outstanding among tests of its kind.

APPENDIX E

California Short-Form Test of Mental Maturity, 1963, S-Form, Level 2

Norms and Population

The 1963 revision of the *Short-Form* embodies a completely new scaling and norming from the 1957 *Short-Form*. A basic change in this connection is the use of chronological age groups for normative data and deviation units for all derived scores, except mental age. The 1963 revision of the *Short-Form* was scaled to the 1960 revision of the *Stanford-Binet*, *Form L-M*, to obtain the total I.Q. and corresponding mental age. A total of 38,793 cases from schools representing seven geographic regions of the United states was used for scaling and norming of the 1963 revision.

Validity

Norming and scaling involved testing procedures which included comparison with other intelligence or mental ability tests, comparison to the 1957 edition, articulation, and try-outs of norms in complete school systems, in addition to scaling of the *Short-Form* series to the *Stanford-Binet Intelligence Scale*. For the most part scaling and other data processing were concentrated on cases in the national age-

group population from just below the first percentile rank to just above the 99th percentile rank, i.e., I.Q.'s from 63 to 137 inclusive. The _California Short-Form Test of Mental Maturity_ is a one-period adaptation of the _California Test of Mental Maturity_. The _Short-Form_, 1963 Revision consists of seven test units, each representing a different mental exercise: The Non-Language Section consists of four units measuring mental capacities related to the recognition or logical analysis of abstract relationships. The Language Section consists of three units sampling the ability to comprehend verbal and numerical concepts and the extent and accuracy of recall. It provides information about the functional capacities that are basic to learning, problem-solving and responding to new situations. The _Short-Form_ serves both survey and analytical purposes for educators, counselors, psychologists and employers in a variety of testing situations.

Reliability

Stanley, quoting statistics included in the "Reliability Report" issued by the California Testing Bureau, writes in _Buros, Sixth Mental Measurements Yearbook_ (23) that reliability coefficients for the _Short-Form_ using the Kuder-Richardson formula range from .94 for the language portion, .89 for the non-language portion and .95 for the total I.Q. scores.

APPENDIX F

The Measurement of Social-Status: McGuire-White

Indices of social-status and family life style are described in this present paper and directions are given for their calculation. The status index approximates the position of a person with some frame of reference people employ to place one another.

Human behavior tends to vary some what according to status. The relationship between "what one feels, thinks and does" and "where one fits in," however, is not a direct one. Social roles are a functional aspect of status. Role behaviors appropriate to sex, age-grade, and social-status are learned according to place and through time. As a consequence of role experiences according to status systematic variations in cognitive discriminations, in cathetic attachments, and in value-apprehensions appear and persist unless changed to accompany a shift in status.

An index is useful in placing subjects in subclasses of sample populations for various kinds of behavior research. Comparisons can be made among the several sub-samples in an investigation to determine just what are the probable sources of variation in behavior. In broad terms, the sources of

variation can be looked upon as biological differences (age-sex), cultural patterns (life-styles...), social characteristics (status, roles), and psychological attributes (e.g. motives and attitudes).

The status indices described below are based upon questions commonly asked by people who are seeking to "place" one another. Each index depends upon a combination of ratings from three or more scales.

Index of Social-Status -- Short Form

O	Occupation	Rate 1 to 7 on OO Scale
E	Education	Rate 1 to 7 on ED Scale
A	Dwelling Area	Rate 1 to 7 on DA Scale

The Rating Scales
Dwelling Areas

1. Select residential area (or acres) of highest repute in the community. Such an area usually is set apart and does not exist in every community.

2. Status areas of high repute: homes vary in size but they are set upon well-kept grounds which afford some privacy; only a few highly-valued apartments.

3. Preferred residential areas where there are few if any pretentious homes but dwellings and grounds have a great deal of care; good apartment buildings.

4. Average residential neighborhoods with no deterior-tion; dwellings are relatively small and unpretentious but neat in appearance; "respectable" homes.

5. Dwelling areas which are beginning to deteriorate; some families "don't know how to take care of their place"; business or industry entering in outside of the neighborhood shopping center which characterized "3" or "4".

6. An area which has deteriorated considerably but is not a slum; "run-down" and the reputation is "low"; small businesses and industries are interspersed.

7. Slum area (or areas) of the community; neighborhood is in bad repute, although an occasional dwelling may be well-kept; other homes are "shacks".

Educational Attainment

---

1. Completed appropriate graduate work for a recognized profession at highest level; graduate of a generally recognized, high status four-year college.

2. Graduate from a four-year college, university or professional school with a recognized bachelor's degree, including four-year teacher colleges.

3. Attended college or university for two or more years; junior college graduate; teacher education from a normal school; R.N. from a nursing school.

4. Graduate from high school or completed equivalent secondary education; includes various kinds of "post-high" business education or trade school study.

5. Attended high school, completed grade nine, but did not graduate from high school; for persons born prior to 1900, grade eight completed.

6. Completed grade eight but did not attend beyond grade nine; for persons born prior to 1900, grades four to seven would be equivalent.

7. Left elementary or junior high school before completing grade eight; for persons born prior to 1900, no education or attendance to grade three.

OCCUPATIONS: LEVELS AND KINDS

	Professional	Proprietors	Businessmen	White collar	Blue collar	Service	Farm people
1.	Lawyer judge, engineer, professor, sch supt.	Lge bus.val at $100,000 or more--depending on community	Top executives -- Pres *et al.* of corp., bank or pub. utility	CPA; editor of newspaper or magazine; exec-sect of status organ.			Gentlemen farm or landowners who do not supervise directly their propt'y
2.	Hi school teacher, librarian and others with 4 yr degree	Business valued at $50,000 to $100,000	Asst. off. & dept mg., or supv. of some mfg agents	Accountant, insur. agt., real est., stock salesman; editor, writer			Land operators who supervise properties and have an active urban life
3.	Grade sch teacher, registered nurse, minister with	Business or equity value at $10,000 to $50,000	Mgr. of sm branch or buyers or salesmen of known mdse.	Bank clerk Auto slmn., Postal clk. RR or telg. agent	Small contr. who works at or supervises his jobs		Farm owners with hired help Operators of leased propt'y who superv.
4.		Business or equity valued at $2,000 to $5,000	Dime str. clks, groc. clks; telephone and beauty operators, *et al*		Aprtc. to skilled trd. repairmen, med. sk. wkr.	Policeman barbr., pr. nurse, brkn. *et al*	Tenants on good farms, former owners of farms who "hire" to others

4.		Business or equity valued at $5,000 to $10,000	Stenogr., bookeeper; ticket agent, sales people in dept. stores, et. al.	Foremen, Mstr. Carp., Electrician, RR Eng., et. al.	Police Captain, tailor, RR Condt'r watchmkr.	Small land-owner, oper. of rental property hiring "hands"
5.		Business or equity valued at $2,000 to $5,000	(Dime store clerks, Grocery clerks; tele-phone, and beauty opers.	Apprentice to skilled tradesman, repairman, med. sk. wkrs.	Policeman, barber, pract. nrs brakeman	Tenants on good farms, former owners of farms who "hire out"
6.		Business or equity valued at $2,000 or less	Semi-skilled factory and production workers; assistants to skilled tradesmen; warehousemen and watchmen		Taxi and truck drivers, waiters & waitresses gas stn atd.	Sharecroppers, established farm laborers, subsistence farmers
7.	"Reputed Lawbreakers"		Heavy labor; odd-job men; mine or mill hands, unskilled workers		Domestic help, bus-boy, scrub women, Jant'r helper	Migrant wkrs., "squatters-nesters"

According to the authors, it should be remembered that the indices of class-status or of life styles made by using the criteria intrinsic to the *McGuire-White Measurement of Social-Status* are only approximations, probably correct 80 or 90 percent of the time.

APPENDIX G

Matrix of Intercorrelations

1. Sex
2. Social Index
3. Mother's Education
4. General Self-Concept
5. Arithmetic Computations
6. Arithmetic Concepts
7. Arithmetic Applications
8. Full Scale I.Q.
9. Language I.Q.
10. Non-Language I.Q.
11. Number Values
12. Number Problems
13. Current Arithmetic Grade
14. Semester Arithmetic Grade
15. Cumulative Arithmetic Grade
16. Total Grade Point Average
17. Arithmetic Self-Concept

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.00																
2	-.03	1.00															
3	.13	-.44	1.00														
4	-.01	-.33	.24	1.00													
5	.23	-.36	.32	.48	1.00												
6	.05	-.27	.22	.46	.67	1.00											
7	.03	-.32	.28	.42	.73	.87	1.00										
8	.00	-.35	.30	.40	.55	.67	.65	1.00									
9	.05	-.33	.21	.38	.43	.59	.57	.92	1.00								
10	.07	-.32	.32	.35	.56	.62	.61	.91	.68	1.00							
11	.19	-.32	.23	.35	.46	.40	.44	.54	.40	.60	1.00						
12	.06	-.26	.24	.29	.49	.51	.55	.64	.58	.59	.52	1.00					
13	.16	-.40	.33	.61	.78	.71	.71	.54	.46	.53	.42	.55	1.00				
14	.18	-.38	.28	.62	.77	.67	.68	.55	.47	.52	.46	.55	.92	1.00			
15	.14	-.31	.25	.55	.72	.61	.66	.62	.55	.58	.49	.55	.76	.80	1.00		
16	.20	-.39	.31	.67	.73	.69	.67	.59	.54	.51	.44	.54	.83	.88	.77	1.00	
17	.06	-.30	.23	.71	.62	.60	.59	.51	.43	.49	.45	.46	.71	.72	.67	.68	1.00