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The Relative Contribution of Perceived Parental, Science Teacher, and Best Friend Evaluations of Science Ability on the Self Concept of Science Ability Held by Eighth Grade Females

Virginia Kemp Fish
Western Michigan University

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THE RELATIVE CONTRIBUTION OF PERCEIVED PARENTAL, SCIENCE TEACHER, AND BEST FRIEND EVALUATIONS OF SCIENCE ABILITY ON THE SELF CONCEPT OF SCIENCE ABILITY HELD BY EIGHTH GRADE FEMALES

by

Virginia Kemp Fish

A Dissertation Submitted to the Faculty of The Graduate College in partial fulfillment of the Degree of Doctor of Philosophy

Western Michigan University Kalamazoo, Michigan December 1978

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Virginia Kemp Fish
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WESTERN MICHIGAN UNIVERSITY, PH.D., 1978
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CHAPTER I
INTRODUCTION AND STATEMENT OF THE PROBLEM

The limited participation of women in science\(^1\) in this country is by now well-documented. A great deal of the research up to this point, however, has focused upon the woman who is already committed to science--either as a college student or as a practicing scientist (see Rossi, 1971; White, 1975; Perucci, 1970; for example).

Statement of the Problem

This research centers upon a point prior to adulthood in the life cycle, and examines the relative effect of the perceptions of parental, teacher, and peer evaluations of science ability upon the self-conception of science ability held by eighth grade females. Hopefully this will provide some insights in terms of the large, sociocultural milieu in attempting to account for the paucity of women scientists. The pertinent literature has shown that the conception females have of themselves in the realm of mathematics and science is part of a complex array of variables which has resulted in

\(^1\) For the purposes of this dissertation, science refers to the following fields: engineering, computer specialties, mathematics, and the earth, life, and physical sciences. The behavioral and social sciences are excluded.
relatively few women entering these fields. (For the area of mathematics see Kaminski, 1975; Fennema, 1974; 1978; Fennema & Sherman, 1977; for science see Erlick & LeBold, 1975; Kaminski, 1978; Bowe, 1977).

Additionally, the literature has shown that parents are in part responsible for their daughters not taking science/mathematics courses and/or considering careers in these areas (see Kaminski, 1975; 1978; Fox, 1976a). The intent of this research is to go beyond the role of parents and to examine the part played by teachers and friends as well in an attempt to sort out the relative importance of each in terms of perceived evaluations of science ability. Parents, teachers, and friends are assumed to function as significant others in the realm of science. Within the research design, therefore, the perceived evaluations of parents, teachers, and friends are the independent variables; the self-concept of science ability is the dependent variable.

Another facet of the research problem is to examine the effect of the variable of importance attached to doing well in science on the part of parents, teachers, and friends. The assumption has been made that the importance variable may function as an intervener between perceived parental, teacher, and friend evaluations and the resulting self-concept of science ability. Also, the importance variable is used as a control and the variable dichotomized into high and
low importance. The question posed, then, is whether the importance variable, used either as an intervenor or as a control, strengthens the relationship between parental, teacher, and friend evaluations and self-concept of science.

Additionally, the variables of race and socioeconomic position of eighth grade females are used as controls to see what differences can be noted with reference to the self-concept of science ability. While there is some evidence that minority parents are generally strongly motivated to gain educational and occupational opportunities for their children (Scanzoni, 1971; Herriott & St. John, 1966), little specific evidence is available with reference to the evaluations of significant others in the realm of science and eighth grade females. There is, in fact, a dearth of research on minority or white eighth grade females and the self-concept of science ability process. Also, while the assumption has sometimes been made that parental expectations differ by socioeconomic levels, two researchers (Brookover & Erickson, 1975) contend that social class differences have been greatly exaggerated and that most parents at all socioeconomic levels desire that their youngsters do well. Hopefully, this research can provide some insights as to how the race and socioeconomic variables function with reference to the self-concept of science ability among eighth grade females.

While the literature is perhaps vague in specifying precisely
how perceived evaluations of significant others became translated into the self-concepts youngsters hold of themselves, a whole host of variables would seem to be involved. Evaluations may implicitly or explicitly involve expectations and may also involve the importance attached to particular actions or behavior. Two concepts seem especially relevant to the evaluations process of significant others: that of self and that of role. The sociological literature, and more specifically the symbolic interaction literature, stresses the salience of those defined as significant others in the presentation and definition of self. While many definitions of self-concept are extant, the one employed here is "symbolic behavior in which the individual articulates a program of action for self as an object in relation to others" (Brookover, et al., 1967:8).

Articulating a program of action for self as an object in relation to others depends to some extent upon the particular role(s) that are relevant to the perceived evaluations and expectations held by one's significant others. In this research the term role is used to refer to a set of expectations which impinge upon a person occupying a particular position (e.g., that of female). These expectations define the appropriate behavior expected of that person. Role expectations include the shoulds as well as the should nots. The actual playing of a role refers to role performance or behavior. Parents, teachers, and friends, thus, may hold expectations regarding appropriate role
behavior for eighth grade females, and, in turn, may evaluate the actual role performance of these youngsters. These evaluations and expectations, in turn, affect the perception the youngsters have of themselves. As noted, perceived expectations of significant others may also involve the importance attached to particular actions or behavior. (Is it important to the parent that a daughter do well in science? Does she perceive this, and does this perception, in turn, affect her self-concept of science ability?)

Further, while perception of the evaluations of others may not necessarily be synonymous with the actual evaluations of others, nonetheless perceived evaluations are a crucial variable for understanding various kinds of decision making. Within this process, credibility of the other is an important factor (Brookover & Gottlieb, 1964; Brookover & Erickson, 1975; Miyamoto & Dornbusch, 1956).

Since appropriateness of behavior is defined by humans through the internalization of the evaluations and expectations of significant others, each person, including young females, develops a definition of appropriate behavior in each significant situation. As part of this process humans assess their competency to carry out the behaviors appropriate for a particular role. As young females define their ability in a role, a self-concept of ability, which functions as a threshold variable in terms of future performance, develops (Brookover, 1959; Brookover & Erickson, 1975). Brookover and his
associates, in their research (1967:8), have defined the self-concept of academic ability construct as: "behavior in which one indicates to self (publicly or privately) his ability to achieve in academic tasks as compared with others engaged in the same task."

This definition is relevant to the subject specific self-concept of science ability construct which is the concern of this dissertation. A self-concept of academic or of subject-specific abilities can be seen as evolving through a process of communication and interaction with parents, teachers, and friends on the part of eighth grade females, thus. A female student may believe that her teachers think she can and should learn English or geography, but that she will not be able to learn mathematics or science. Through the same interaction process, the female student may acquire a sense of the importance which others attach to a given role performance in her particular situation.

Both the theoretical and the empirical literature suggest that significant others are not necessarily the same from one situation or role to another. The significant others of a female playing the role of physics student are not likely to be the same as for that same person in the role of dancer or cross-country skier. In the area of general academic ability, Brookover and his associates note the importance of perceived parental evaluations (1962, 1965, 1967). One of the concerns of this dissertation is whether perceived
parental evaluations are also important in the subject-specific area of science and to assess the relative importance of perceived teacher and friend evaluations as well.

A curious phenomenon is noted in the literature with reference to the subject areas of mathematics and science. While both sexes perform at about the same level in mathematics and science in the lower grades, by the seventh and eighth grades the performance level of females begins to drop (Hilton & Berglund, 1974; Maccoby & Jacklin, 1974a; Kaminski, 1978, review of the literature). Youngsters are, of course, confronting and coping with many changes in their lives during the junior high years. The developmental researchers point to cognitive changes and the "stage of formal operations" (Piaget & Inhelder, 1969) as well as to the attempts to strive for an "identity" and to combine "personal desires with social demands" (Erikson, 1968). Concerns with gender-role\(^1\) appropriate behavior emerge as dating patterns occur. For some youngsters the process of thinking about or establishing a vocational career occurs. Also, youngsters at the junior high level have moved from the self-contained classroom of the elementary school to a system of specialized teachers for specific subjects including science.

\(^1\)In this research gender-role refers to the sociocultural patterned expectations surrounding what is considered appropriate for the male or the female role.
In examining the relative importance of the perceived evaluations of parents, teachers, and peers upon the self-conception of science ability held by eighth grade females, the following can be noted in attempting to sort out the variables: (1) Presumably, the parents of most eighth graders are the same ones that the youngsters had in elementary school. In this sense parents have remained stable; (2) While some friends may have changed, others are carried over into junior high. In this sense friends are not as stable as parents, but are more so than teachers; (3) Teachers are the least stable in the sense that, as noted, youngsters have moved from the elementary school self-contained classroom to a system of specialized teachers (such as a special science and a special mathematics teacher). Science teachers as experts may perceive some youngsters as stupid in science and others as bright in science. In the field of mathematics at least the literature notes that in some systems mathematics teachers are males, who may perceive females as stupid students. Conceivably female mathematics teachers may also perceive females as stupid students. Also, research indicates that some female students not doing well in mathematics note that they have received no encouragement from parents, peers, or teachers (Fennema & Sherman, 1977; Sells, 1976-77).

Up to the junior high age age the importance of parental evaluations can be noted. By the eighth grade, however, perhaps the
situation is changing with reference to specific areas such as science. Ordinarily, parents do not claim any particular expertise in science; a mystique may surround science as Osen (1974) contends does with mathematics.

Summary

The problem with which this dissertation is concerned is to examine the relative importance of perceived parental, teacher, and friend evaluations of science ability upon the self-concept of science ability held by eighth grade females. Additionally, the variable of importance attached to doing well in science is examined to see whether the evaluations-self-concept relationship is strengthened by using importance as a control or as an intervening variable.

The concepts of self and of role are highly relevant to the evaluation process in which the significant others of eighth grade females are engaged. Parents, teachers, and friends hold expectations and make evaluations which are communicated--explicitly or implicitly--to eighth grade females. These perceived expectations and evaluations, in turn, affect the self-conception held by these youngsters. Evidence indicates that the performance level of junior high females in mathematics and science begins to decline. Conceivably teachers play a crucial role in this realm as it is possible that parents do not generally see themselves as experts in the area of science.
Foci of the Problem

Introduction

This researcher perceives the problem to involve two areas of focus: (1) Theory; and (2) Methods. Both are discussed in this section.

Theoretical

The framework which undergirds the research effort stems from the symbolic interaction framework within the Meadian tradition as amplified and extended upon by John Kinch (1963) and more especially, Wilbur Brookover and his associates (1962, 1965, 1967); the latter have contributed theoretical insights and empirical data regarding the self-concept of ability construct. The self-concept of ability construct flows out of a more general model delineated by Brookover and Erickson (1975) in which the self-concept is seen not as a trait which one has or possesses, but as a defining behavioral process. Following Mead, self is viewed as process, not structure. Both Mead (1934) and Blumer (1969) stressed the salience of the meanings that are attached to the actions and evaluations of others (especially significant others in the person's social world). Females, for example, in organizing their own behavior, take into account the meanings attributed to that behavior (verbal and otherwise) as well as their perceptions of the way others view them. If females per-
ceive that they are evaluated by parents or teachers as not very bright in science, or if peers are perceived as viewing science as an unfeminine interest, this has important implications for a young female's self-concept of science ability. Conceivably, this could lead to not doing well in science or not taking science courses.

Role-taking is an important part of the perceived evaluation process as experienced by young females.

One set of hypotheses put forth in this research is based upon the proposition that the variable of importance acts as an intervening variable between perceived parental, teacher, and peer evaluations and self-concept of science ability. While empirical data to support these specific hypotheses are lacking, theoretical justification for including these for testing would seem to be implied in Brookover's (1959) social psychological conception of learning framework and the role requirements for self model of Brookover (1964) and Brookover and Erickson (1975). This framework entails a process whereby parents, teachers, and friends are perceived by a youngster as making evaluations regarding various aspects of the youngster's behavior. Additionally, the youngster internalizes a view of the importance of each role he/she plays which is based upon cues and the perceived evaluations of these significant others. This process seems especially relevant with reference to young females whose view of self emanates from the evaluations of others (Bardwick & Douvan, 1971;
Bern & Bern, 1974). Further, because of a socialization process which stresses dependency and passiveness, young females are perhaps especially attuned to cues from significant others. Conceivably, the evaluations of parents, teachers, and peers with reference to a young female's science ability might be perceived as not very high by her, but she might perceive that, nonetheless, doing well in science is important to them.

Brookover and his associates (1967) provide further insights by noting that behavior is a compliant act whereby humans attempt to satisfy the preferences of others in order to gain or maintain certain desired relationships. Importance may be viewed as one condition necessary for compliancy. A young female may learn from parents, teachers, or peers that they see her as being capable of getting A's or B's in science, but that getting those A's or B's is not important to them, and that her performance in science will have little effect upon the social relationships she values. On the other hand, getting those A's or B's may be seen as important to parents and teachers but not as important to friends. In this situation, cross-pressures may arise, and role conflict may emerge because of incongruent role expectations held by significant others.

Methods

The second focus of the problem, which is intertwined with the first, concerns the methods aspect. Four theoretical concerns of
symbolic interaction that have relevance for the research design can be underscored. First of all, the Meadian tradition emphasizes a concern with meanings and with verbal behavior as one kind of behavior. This research effort taps the dimension of verbal behavior. What respondents say is viewed as an appropriate area for study. Secondly, the focus within the symbolic interaction framework upon the self as an object and as process directs the researcher to examine behavior from the perspective of those being studied. Thirdly, the emphasis upon taking the role of the other means that the researcher must link the "symbols and meanings" of the respondents to the "social circles" and relationships that furnish those perspectives (Denzin, 1969). This research, thus, involves the perceived evaluations from the standpoint of the eighth grade female, not of those others involved (parents, teachers, peers). As noted, the dimension of perceived evaluations is crucial in understanding human behavior and decision making from the symbolic interaction perspective. Finally, the self-concept of science ability items utilized reflect a future completion of the act orientation consistent with the Meadian tradition. In utilizing five year longitudinal data Kaminski (1978) provides some support for the usefulness of the conditional self-concept of ability items as a predictor for taking advanced science classes three or four years after the eighth grade.

Since there is a paucity of research which has focused on the
self-concept of science ability among eighth grade females, there is scant empirical data upon which to draw. In their own research on eighth grade students, Brookover et al. (1962, 1965, 1967) note that there are often problems in sorting out the relative impact of parents, teachers, and friends on self-concept of general academic ability. Since parents, teachers, and friends often share the same perceived evaluations of youngsters, sorting out the relative influence of each may be difficult to discern (Brookover & Erickson, 1975). Additionally, the perceived evaluations of any one of the three sets of significant others may assume lesser or greater importance as youngsters move from junior high to high school. No conclusion seems warranted that parents or teachers or friends do not have any influence, however.

With reference to the variables in the dissertation, the following can be highlighted: (1) Each variable can have a simple as well as an additive effect in relationship to other variables; (2) One concern of this research is upon the relationship between each of the independent variables (parental, or teacher, or friend evaluations) and the dependent variable, self-concept of science ability; (3) The overall focus of the research effort is upon the cumulative effect of the independent variables upon the dependent variable.

A path model without controls as well as four variations of the path model controlling for the variables of race and socioeconomic
position of respondents seem particularly appropriate for noting both the direct and indirect effects of all variables upon the dependent variable as well as noting the cumulative effect of the independent variables upon the dependent variable. Longitudinal data are completely lacking in many areas of sociology. This research is fortunate, however, in being able to draw upon the insights and findings from the extensive longitudinal research done by Brookover and his associates (1962, 1965, 1967) both in the area of general academic self-concept and in subject-specific self-concept of ability. While the Brookover research was done in this country, cross-cultural validation studies have been done in Europe as well as in Asia (see Depew et al., n.d.).

Summary

Two foci of the research problem have been delineated: (1) Theory; and (2) Methods. The theoretical framework utilizes the symbolic interactionist perspective within the Meadian tradition with the additional self-concept of ability construct of Brookover and his associates. Self-concept is seen not as a trait one possesses but as a defining behavioral process. The social psychological conception of learning framework of Brookover seems to point to the relevance of the importance variable in the evaluation process of significant others.

The methods utilized focus on the verbal behavior of respondents.
and their perceived evaluations of significant others. Parental, teacher, and best friend evaluations are the independent variables; self-concept of science ability is the dependent variable. A path model with and without controls is an especially appropriate research tool as it enables the researcher to examine both the direct and indirect effects of all variables as well as the cumulative effect of the independent variables upon the dependent variable.

Females in Science

Introduction

Although the main thrust of this dissertation is not upon the current situation of females in science, some discussion of this topic is in order as the ramifications of the research extend beyond the confines of the research design itself. The paucity of female scientists is seen as the possible end result of a process which may begin at an earlier point in the life cycle. As the second chapter focuses more narrowly on the socialization process of females in the early years of their lives, the discussion of females in science is more appropriately placed within the first chapter rather than in the second.

The Situation

Recent data published by the National Academy of Sciences (1974) is illuminating. The percent of female doctoral scientists is particularly striking in several fields: engineering, 0.4%; physics
and earth sciences, 2.7%. Table 1.1 highlights the fact that although the overall participation rates are low, important variations across fields occur. Females tend to be better represented in the social and behavioral sciences. Table 1.2 gives some additional information and insights by listing percent of female scientists by field and highest degree. Except for the earth and marine sciences which stay relatively the same from masters to doctoral levels (2.3% and 2.6% respectively), all other areas of concern to this research suffer a decided drop, dramatic in some cases (e.g., mathematics goes from 15.2% to 5.9%; statistics from 15.8% to 5.4%). The paucity of females in the computer sciences at the doctoral level and in the atmospheric and space sciences at both levels is noteworthy.

Table 1.1

Percent of Doctoral Scientists/Engineers who are Women by Field--1973

<table>
<thead>
<tr>
<th>Field</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>0.4%</td>
</tr>
<tr>
<td>Physics</td>
<td>2.7%</td>
</tr>
<tr>
<td>Earth Sciences</td>
<td>2.7%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5.6%</td>
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<tr>
<td>Mathematics</td>
<td>6.3%</td>
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<tr>
<td>Social Sciences</td>
<td>10.9%</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>11.8%</td>
</tr>
<tr>
<td>Psychology</td>
<td>20.5%</td>
</tr>
</tbody>
</table>

Source: National Academy of Science, 1974
Table 1.2

Percent of Women Scientists by Field and Highest Degree, 1970

<table>
<thead>
<tr>
<th>Field</th>
<th>Ph. D. /D. Sc.</th>
<th>M. A./M. Sc.</th>
<th>Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL FIELDS</td>
<td>7.6</td>
<td>13.3</td>
<td>9.4</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5.9</td>
<td>15.2</td>
<td>11.4</td>
</tr>
<tr>
<td>Physics</td>
<td>2.1</td>
<td>5.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4.1</td>
<td>9.9</td>
<td>7.1</td>
</tr>
<tr>
<td>Earth &amp; Marine Science</td>
<td>2.6</td>
<td>2.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>9.9</td>
<td>19.8</td>
<td>12.9</td>
</tr>
<tr>
<td>Psychology</td>
<td>18.0</td>
<td>36.7</td>
<td>24.1</td>
</tr>
<tr>
<td>Sociology</td>
<td>14.1</td>
<td>30.3</td>
<td>22.6</td>
</tr>
<tr>
<td>Political Science</td>
<td>6.9</td>
<td>14.2</td>
<td>9.7</td>
</tr>
<tr>
<td>Anthropology</td>
<td>19.1</td>
<td>22.2</td>
<td>19.4</td>
</tr>
<tr>
<td>Economics</td>
<td>4.4</td>
<td>7.6</td>
<td>6.1</td>
</tr>
<tr>
<td>Linguistics</td>
<td>18.6</td>
<td>31.4</td>
<td>23.5</td>
</tr>
<tr>
<td>Atmospheric &amp; Space Sciences</td>
<td>1.7</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>1.2</td>
<td>9.2</td>
<td>11.2</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>0.3</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Statistics</td>
<td>5.4</td>
<td>15.8</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Both tables dramatically illustrate the underrepresentation of females in science. Additionally, research among engineering and science graduates of a large midwestern university noted that female careerists were less likely to be in high supervisory positions than were their male counterparts. Further, their salaries were lower than males although the researcher (Perucci, 1970) points to two mitigating factors: (1) More females are in educational, academic settings than in industry where salaries are generally higher; (2) A smaller proportion of females are in engineering where salaries are usually larger than in some of the other science areas. Finally, some evidence indicates that females are more likely to gravitate to positions within science which require less investment in training and in which females exemplify in their behavior characteristics often associated with the traditional female role--obedience, conscientiousness, deference, and a preference for working with people rather than things (Helson, 1975).

A basic issue now emerging among many social scientists about the continuing underrepresentation of females in the sciences concerns the relative explanatory power of variables. Until recently, innate differences were commonly given to explain the differential performance levels of males and females in various mathematics and science achievement and aptitude tests. Recently, attention has shifted to various sociocultural variables. Apparently a variety
of factors interact to discourage females from considering a scientific career. Some of these barriers are overt; others are covert. These include the following: (1) A socialization process in which dependence and passivity are implicitly and explicitly encouraged and in which success as measured by an objective visible achievement may be perceived as antithetical to femininity (Bardwick & Douvan, 1971; Komarovsky, 1946 and 1953); (2) A lower self-concept of ability among females even when they are doing well (Holter, 1970; Wylie, 1961 and 1963); (3) A higher evaluation of males by both sexes (McKee & Sherriffs, 1957 and 1959); (4) A perception of mathematics and science by females as male domains (Ernest, 1975; Fox, 1976a; Ruina, 1973); (5) A reinforcement and perpetuation of gender-role stereotypes in the schools—teachers, books, curricular materials—(Jay & Schminke, 1975; Trecker, 1974; Howe, 1971; Good et al., 1973); and finally (6) Non-support or perception of non-support by significant others (Hawley, 1972; Bem & Bem, 1974; Kaminski, 1975; Baumrind, 1972).

Summary

In this chapter the researcher has analyzed and discussed the main focus of this research: the relative effect of perceived parental, teacher, and friend evaluations of science ability on the self-concept of science ability held by eighth grade females. While some research exists to support the importance of parental evaluations in the realm
of science, this research seeks to extend the boundaries by examining the role of teachers and friends as well. Up to this point in time, little research exists which focuses on the self-concept of science ability among eighth grade females. Race and socioeconomic position as well as the variable of importance are used as control variables. The symbolic interaction framework, which stresses the importance of the perceived evaluations of significant others in one's resulting self-concept, is the context within which this problem is examined. As the performance level of eighth grade females in mathematics and science seems to decline, various factors which may be involved are briefly discussed.

The problem has two foci: (1) Theoretical; and (2) Research Methods. The research, hopefully, will provide some insights for reducing disparities that exist between males and females in science.

The next chapter discusses the theoretical framework utilized as well as an extensive review of the literature.
CHAPTER II

THEORETICAL FRAMEWORK AND REVIEW OF THE LITERATURE

This chapter examines some potentially useful theoretical frameworks and amplifies that of symbolic interactionism which seems particularly appropriate and useful for the research concerns. Additionally, a review of the appropriate literature is presented within the following categories: the general socialization process; gender-role socialization; the role of parents, teachers, and friends in this process, and the relative effect of their perceived evaluations; self-concept of females; mathematical/science self-concept and perception of these fields as male domains; career interests/awareness, especially as related to stereotyping. The review of the literature highlights not only the importance of the concept of self in the decision-making process but also that females early in life perceive themselves as a devalued group and the possible consequent implications this has for entering fields such as science.

Possible Frameworks

Numerous considerations enter into the process of choosing a theoretical framework which seems useful and appropriate to the researcher. The following are germane: What view of the human
world is presented? Does one framework explain more material more fruitfully in terms of the researcher's main concerns? Are the concepts emphasized compatible with the major focus of the research effort?

Four frameworks--role theory, ethnomethodology, structural-functionalism, and cognitive dissonance--are discussed as potentially useful frameworks for this dissertation. In addition, the symbolic interaction framework which is utilized in this study is discussed with reference to its strengths for the research concerns. It is difficult to present any theory as a unidimensional phenomenon since each has branches or off-shoots representing somewhat divergent perspectives or emphases. In many cases different frameworks utilize some of the same concepts, but one perspective may emphasize these concepts to a greater extent.

**Role Theory**

While role theory and symbolic interaction bear some resemblances in that each is concerned with the interaction of humans and the relationship between the individual and society, there are differences in emphasis which make role theory less compatible than symbolic interaction with the concerns of this research effort. In role theory individuals are seen as players in the theatre. When human action is seen as occurring in a theatre, interaction is likely to be viewed as highly structured by the script, directors, other
actors, and the audience. The social world is viewed as a network of variously interrelated positions or statuses within which individuals enact roles. For each position various kinds of expectations about how incumbents are to behave can be discerned.

Three general classes of expectations appear to "typify role theory's vision of the world": (1) Expectations from the script. These involve norms specifying how individuals ought to behave under a variety of conditions; (2) Expectations from other players. These refer to demands emitted by other players in an interaction situation; and (3) Expectations from the audience. Audiences provide a frame of reference that circumscribes the behavior of actors in various statuses (J. Turner, 1978).

The "point of articulation" between society and the individual is denoted by the concept of role and involves individuals who are incumbents of positions or statuses employing self and role-playing capacities to adjust to various kinds of expectations. Three basic conceptualizations of roles can be discerned: (1) Prescribed Roles: conceptual emphasis is placed upon the expectations of individuals in statuses; the social world is assumed to be composed of relatively clear-cut expectations; (2) Subjective Roles: conceptual emphasis in this instance is placed upon the interpersonal style of individuals who interpret and then adjust to expectations; and (3) Enacted Roles: conceptual emphasis is placed upon overt behavior; the social world
is viewed as a network of interrelated behaviors (Deutsch & Krauss, 1965; J. Turner, 1978).

While the conceptualization of self within role theory roughly parallels Mead's portrayal of mind and self, concern appears to be with the way humans conform to what is expected of them by virtue of occupying a particular status. From this conceptualization the individual is assumed to be not so much a creative role entrepreneur who tries to change and alter social structure through varied and unique responses, but rather a pragmatic performer who attempts to cope with and adjust to a variety of expectations inhering in the social structure. Role theory, thus, does not emphasize the "creative consequences" of mind and self for the construction and reconstruction of society to the extent the symbolic interaction framework does (J. Turner, 1978). The social world, thus, is seen as "excessively circumscribed" by the expectation structure. The emphasis upon the controlling power of one's immediate social environment--past and present--reflects, therefore, a doctrine of "limited social determinism" (Biddle & Thomas, 1966).

One useful distinction made by role theorists that has implications for the concerns of this dissertation has to do with the concept of multiple roles and the fact that each human occupies many statuses and is bound by the various role expectations of these statuses. Eighth grade females, for example, play the roles of daughter,
friend, students, and, more particularly, science student. Role theorists, further, point to the possibility of either intra role-conflict or inter role-conflict developing. Eighth grade females may experience role-conflict because of contradictory expectations held by significant others. Teachers or parents may consider it important to do well in science while friends may not. Significant others may be perceived as evaluating the science ability of young females very differently. This may give rise to confusion and to role conflict (Sarbin, 1968; Deutsch & Krauss, 1965).

While providing some useful insights, role theory seems less useful overall than some other frameworks for this dissertation. For one thing, role theory emphasizes a structured and determinate view of human interaction, with humans following the script. The contention has been made that their structure point of view "removes the 'self' from interaction" while assuming that "structural and psychological" variables "cause" humans to act in relatively "fixed and predictable" ways (Lindesmith, et al., 1975). The Meadian perspective which emphasizes an indeterminate completion of the act view of human interaction seems more appropriate for the research concerns. Secondly, while role theorists recognize and acknowledge the concept of role-taking, this concept does not assume as prominent a place within role theory as it does in some other frameworks. Since perceived evaluations are germane to the research enterprise
and the evaluation process involves the process of role-taking, other frameworks which accord role-taking high priority are more useful to this study. Thirdly, while role theorists acknowledge the existence of a concept of self, emphasis is not placed upon a self-concept as a fluid, dynamic process in decision-making. Finally, while the concept of reference persons (significant others) is included in role theory, no clear recognition of the part played by these others in the self-conception process is discussed.

While role theory is of some use, its overall view of the social world is of a highly structured one in which such concepts as definitions of the situation and subjective reality are given only minimal attention, if any, in terms of human interaction and decision-making. Role theory's view of the human world and the fact that it explains less material, less fruitfully for this study make it not as useful as other frameworks.

Ethnomethodology.

Compatible with the symbolic interaction perspective is the framework of ethnomethodology. While some theorists (Meltzer et al., 1975) discuss ethnomethodology as one branch of symbolic interaction, more frequently theorists discuss it as a perspective in its own right (J. Turner, 1978; Mullins, 1973; Lindesmith et al., 1975; Ritzer, 1973). Ethnomethodology draws from and extends upon the concerns of interactionists such as Herbert Blumer and
Erving Goffman as well as drawing upon the insights of the European phenomenologists Edmund Husserl and Alfred Schutz. The leading progenitor in this country has been Harold Garfinkel (1967).

Ethnomethodology proposes an analysis of the routine, taken-for-granted expectations that members of any social order regularly accept. The abiding concern of the framework is with the everyday, taken-for-granted meanings and the organization of these meanings into routine patterns of interaction (Denzin, 1969). One researcher (Schur, 1971:115) refers to ethnomethodology as developing a "micro-sociology of meaning." Ethnomethodology focuses on the ongoing process of "reality construction" that is constantly emerging from the activity of actors in carrying out their everyday life. Further, it is in the accounts (actors' explanations of their actions) of these actors that the "experience and maintenance of social structure" is revealed (Ritzer, 1973).

The meaning of the word ethnomethodology—a study of the methods used by folk or people—provides a clue to the conceptual emphasis of the perspective. For the ethnomethodologist, thus, emphasis is upon the methods employed by those under study in "creating, maintaining, and altering their presumption that a social order, forcing certain kinds of behavior, actually exists 'out there' in the 'real world'." Research by ethnomethodologists, therefore, focuses on the process or methods for constructing a reality,
rather than on the substance or content of the reality itself (J. Turner, 1978:410).

While both ethnomethodologists and symbolic interactionists emphasize the process of interaction and how actors create common meanings in dealing with each other, there is a difference in emphases between the two frameworks. For one thing, symbolic interactionists emphasize and are concerned with the relations between individual conduct and forms of social organization. Their concern is with how selves emerge out of social structure and social situations (Denzin, 1969). Additionally, although Blumer's interactionism stresses the process of creating meanings, it acknowledges the existence of an external social order. Ethnomethodology, on the other hand, suspends or "brackets" the issue of whether or not there is an external world of norms, values, and beliefs. Instead, ethnomethodology concentrates on how interaction creates among actors a sense of a factual world out there. Ethnomethodology, in other words, maintains that social order, including all symbols and meanings, exists, not only precariously, but has no existence at all independent of the members' "accounting and describing practices" (Ritzer, 1973). In extending upon both the perspectives of interactionism and phenomenology, ethnomethodology, then, begins to posit a different vision of the social world and an alternative orientation for understanding the Hobbesian problem of how social organization is created,
maintained, and changed (J. Turner, 1978).

Ethnomethodology bears similarities to the Meadian tradition in positing an "active voluntaristic" conception of humans in which they "manipulate and mold" norms in accordance with their activity. Humans, additionally, are viewed as in a state of "becoming." While ethnomethodology then bears some commonalities with symbolic interaction in terms of concerns and conceptions, its major focus upon the process or methods for constructing a reality, rather than upon the content or substance of the reality itself, makes it a less useful perspective than other frameworks for this dissertation.

The emphasis in this study is upon the substance or content of such concepts as conception of self, role-taking, perceived evaluations, and significant others. Although the concept of self within the ethnomethodological tradition is congruent with the Meadian one, the concept of self remains peripheral to the major concerns of ethnomethodologists. Thus, although the view of the human world as presented by ethnomethodologists is somewhat compatible with the focus of this study, the symbolic interaction framework explains more material more fruitfully in terms of the research questions.

**Structural-Functionalism**

To the extent that both symbolic interaction and ethnomethodology posit a link between the individual and social structure that rests on the role of symbols and common meanings, they share a good
deal in common with the structural-functional perspective. It is especially difficult to discuss structural-functionalism as a theory since there are so many branches and variations. The discussion here is not meant to be an all encompassing presentation of structural-functionalism, but rather to focus on that branch that has concerned itself with the concept of roles.

The structural or institutional perspective links the concept of role with institutional terms like status, position, and office. Anthropologists and sociologists have utilized this perspective, emphasizing interrelated roles, such as those embodied in occupational structures, age grading, and kinship systems. The rules and norms governing these role systems are among the chief matters of concern as are the interrelationships of institutions. Sociologists who have made contributions in this realm include Talcott Parsons and Robert Merton. While the structural or institutional approach to roles and related concepts shares many common concerns and terms with role theory, the structural approach is often seen as more macro oriented in contrast to the micro approach of role theory (Lindesmith et al., 1975).

Merton (1965) in particular has discussed the concepts of status and role, and has gone on from there to elaborate upon the concepts of a role-set, multiple roles, and role conflict. By role-set Merton (1965:369) means "that complement of role relationships which
persons have by virtue of occupying a particular social status."

Eighth grade females are involved—as are all humans—as a multiplicity of role sets. As daughters, they are involved in a family role-set; as students, in a school role-set; as friends, in a friendship network. Additionally, as noted in the discussion of role theory, all humans play a multiplicity of roles, and this fact creates the possibility of role conflict arising.

Merton's discussion of social mechanisms for the articulation of roles in role-sets is particularly insightful and contains many implications for the concerns of this dissertation. In particular Merton points to the (1) Differing intensity of role-involvement among those in a role set; (2) Differential distribution of power among those in a role set; and (3) The mechanism of social support by others in similar social statuses who may face similar problems or difficulties. In a friendship network of eighth grade females there may be a differing intensity of role involvement on the part of the youngsters. To some young females, it may not greatly matter that friends view doing well in science as unimportant. To other youngsters this may indeed be a matter of concern. In a school setting, it may not matter to a young female that a teacher places high importance on the youngster's doing well in science.

Likewise the distribution of power in the family or school of the young female may place her in a position of seeing herself as
relatively powerless. Finally, the matter of social support from those with similar problems can be noted. If a youngster has a low self-concept of science ability and/or sees parents as evaluating her poorly, support may be obtained from some of her friends who are also experiencing these problems.

While the structural or institutional perspective provides valuable insights as just discussed with reference to part of the dissertation problem, the overall concerns are not as compatible with the overall concerns of the research endeavor as are those of symbolic interaction. The concepts of role-taking and of self and the conditional aspects of behavior and decision-making are not addressed at all. Some theorists in fact contend that structural-functionalists ignore that "humans have selves" (Ritzer, 1973). Thus, structural-functionalism explains less material less fruitfully for the concerns of this study and does not address itself to many of the concepts germane to this endeavor.

Cognitive Dissonance

Although there have been many varieties of cognitive dissonance theories, one of the best known is that proposed by Leon Festinger (1957). All varieties have asserted that humans attempt to "perceive, cognize, or evaluate" the various aspects of their environment and of themselves in such a way that the "behavioral implications of their perceptions" shall not be contradictory. The
essential principle is toward cognitive consistency or balance. Festinger's theory differs from other variations in two respects: (1) It has stimulated abundant research; and (2) It places unique emphasis upon the consequences of decisions (Deutsch & Krauss, 1965).

Festinger (1957:31) summarizes the core of the theory:

1. There may exist dissonant or "non-fitting relations" among cognitive elements.
2. The existence of dissonance gives rise to pressures to reduce the dissonance and to avoid increases in dissonance.
3. Manifestations of the operation of these pressures include behavior changes, changes of cognition, and circumspect exposure to new information and new opinions.

Elements are identified as cognitions, i.e., the things humans know about themselves; their behavior; and their environment. Cognitions are used to refer to any knowledge, opinion, or belief about oneself or about one's behavior and one's environment. Dissonance between cognitive elements is said to exist if not--x follows from y. If x follows from y, the relationship is defined as consonant (Festinger, 1957). In other words, if humans are aware of various things that are not psychologically consistent with one another, humans will strive for consistency among these objects in a variety of ways.
Dissonance, Festinger (1957) suggested, can arise from several sources including what he termed cultural mores. The latter term refers to the culture's defining what is consonant and what is not. Dissonance arising from the cultural mores would seem especially appropriate for the concerns of this dissertation. As noted in the review of the literature, doing well in science or being interested in a scientific career on the part of females may be perceived as unfeminine interest in our society. While Festinger asserted that dissonance is an inevitable consequence of decisions, modifications of the theory have suggested that commitment is a factor as to whether cognitive dissonance is experienced (Shaw & Costanzo, 1970).

Additionally, Lindesmith et al (1975:106-107) have noted that in complex situations, there are many influences beside sheer dissonance that need to be taken into account. Further:

In a complex pluralistic world that is poorly understood persons are simultaneously involved in many kinds of situations or roles so that dissonance is often not noticed or is disregarded by them. Dissonances are often multiple and so numerous as to become unmanageable. Often, perhaps, we simply note dissonance and live with it without bothering about it, especially if the groups to which we belong support us. Recognized inconsistency may be neutralized by compartmentalization . . . .

Clearly cognitive dissonance has relevance for the concerns of this study. The evaluations of any or all of one's significant others as seen by oneself may be different from one's evaluations of self. A situation difficult to resolve may arise. The incongruent cells in
the research design in which low parental or teacher or friend evaluations exist, along with a high self-concept of science ability on the part of the respondent (or the converse situation), point to the possibility of cognitive dissonance. Also, the evaluations of particular significant others as seen by young females may be incongruent with the evaluations of other significant others (teachers and friends may be seen as evaluating the youngster's science abilities differently).

Since behavior is a compliant act in which one may try to please significant others, ways to resolve the potential conflict will be attempted. In some cases, inconsistency may be neutralized by compartmentalization (Lindesmith, 1975); or, if commitment is low, cognitive dissonance may not arise. Thus, if an eighth grader's commitment to doing well in science is low, it may not matter whether her significant others attach value to doing well or not.

Since the theory of cognitive dissonance does not present a general theory of human behavior but rather focuses on a restricted range, its usefulness is limited for the purposes of this study. The insights of cognitive dissonance with reference to part of the research problem are of value. However, the concepts of interaction, role-taking, self and significant others which are germane to the research effort, are not addressed. Thus, the incomplete nature of cognitive dissonance for the purposes of this dissertation make it less than satisfactory as an overall framework.
Symbolic Interaction

The symbolic interaction framework seems the most compatible with the overall concerns of this dissertation. The basic concepts utilized in the research, those of interaction, of self, of roles and role-taking, and of significant others are also a basic and integral part of the symbolic interaction perspective.

Although the concept of interaction is a general one and widely used in everyday conversations, symbolic interactionists have built a whole framework around the concept. Very simply, the term refers to "the way people act toward or communicate with each other as individuals or groups within social contexts" (Lindesmith et al., 1975:17). Underscoring the fluid, dynamic, constructed nature of human interaction is to see humans as players or participants in a game (J. Turner, 1978; Wallace, 1969). From this perspective interaction is seen as "interactants working out their relationships" (Blumer, 1969). The constructed nature of interaction points up the fact that humans respond to the intentions of others, i.e., to the future, intended behavior of others, not merely to their present actions (Manis & Meltzer, 1967). The latter point of view seems especially compatible with the foci of this study.

The notion of interaction as a tentative process, a process of continuously testing the conception one has of the role of the other, points up the importance of role-taking in the interaction process and as the mechanism through which interaction takes place. Role-tak-
ing is germane to the concerns of this research as role-taking is a necessary part of the process of ascertaining the perceived evaluations of others toward one's self.

Ralph Turner (1962:23) notes that:

The idea of role-taking shifts emphasis away from the simple process of enacting a prescribed role to devising a performance on the basis of an inputed other-role. The actor is not the occupant of a position for which there is a neat set of rules—a culture or set of norms—but a person who must act in the perspective supplied in part by his relationship to others whose actions reflect roles that he must identify. Since the role of alter can only be inferred rather than directly known by ego, testing inferences about the role of alter is a continuing element in interaction. Hence the tentative character of the individual's own role definition and performance is never wholly suspended.

Additionally, the emphasis upon the concept of self within the symbolic interactionist tradition is compatible with the concerns of this research. It is through role-taking and through language that a self arises, and one is able to view self as an object like other objects in one's social world. Also, the role of significant others in the conception of self is recognized and stressed. Further, how humans define the situation and the notion of subjective reality are compatible with the research goals. The fact that humans are seen as creating their own world highlights that while the perceived evaluations of others may not be congruent with the actual evaluations of others, perceived evaluations are, nonetheless, crucial in decision-making (Manis & Meltzer, 1967; Blumer, 1969; Kinch, 1963). Cooley's notion of the "looking-glass self" (1967) highlights the importance
of one's "imagined judgments" of others. The research of Brookover and associates (1962, 1965, 1967) provides empirical support for the importance of the perceived evaluations of significant others.

The Meadian emphasis upon the self as multidimensional (Mead, 1934) points up the many roles humans play and the accompanying dimensions of self. As noted, role theory encompasses the notion of multiple roles and role conflict. In contrast with role theory, the emphasis within symbolic interaction is somewhat different, however, because of the interactionists' overriding concern with the concept of self. Allied with the notion of a multiplicity of selves is the emphasis upon the acting units and the way they orient themselves to each other. Acting units are related to Mead's concept of the generalized other and the view of human interaction as a game in which the participants engage in "strategic adjustments and readjustments" of players in a game (J. Turner, 1978).

The following are seen as the especial strengths of the symbolic interaction framework which make it a particularly useful perspective for the purposes of this dissertation: (1) A general emphasis upon and recognition of the relevance of concepts compatible with this study, i.e., the concepts of symbolic interaction, self, role-taking, and significant others; (2) The emphasis given to what is seen as the crucial process of role-taking in the interaction process; (3) A recognition of the constructed nature of social reality in which sub-
jective reality, while not necessarily congruent with objective reality, is nonetheless crucial in human decision-making and the resulting behavior; (4) A recognition of the salience of those defined as significant others in the definition and presentation of self; (5) A view of humans as active creatures who play a part in constructing their own world; (6) A recognition of human interaction as a tentative process in which role-taking is an integral part.

The symbolic interaction perspective, thus, presents a view of the human world that is compatible with the research focus; explains more material more fruitfully in terms of the main concerns of this study; and finally, emphasizes concepts compatible with the research endeavor.

Summary

This section has briefly discussed and highlighted five frameworks--role theory, ethnomethodology, structural-functionalism, cognitive dissonance, and symbolic interaction--which are potentially useful frameworks for this dissertation. As the symbolic interaction framework seems to be the most useful, fruitful, and compatible with the major foci of the research, this perspective is used.

The next section examines the symbolic interactionist framework in more detail.
Theoretical Framework

In 1937 Herbert Blumer coined the phrase symbolic interactionism. "In an off-hand way . . . the term somehow caught on and is now in general use" (Blumer, 1937:1). It has come into prominence as a label for a relatively distinct approach to the study of human conduct and human group life. The approach embodies the works and thoughts of a diverse group of scholars including G. H. Mead, Charles Cooley, John Dewey, W. I. Thomas, Robert Park, William James, and Florian Znaniecki.

The theoretical thrust of this approach is contained in a relatively small set of assumptions. Human societies are viewed as interactive concerns that are shaped, produced, and maintained by those interacting individuals. Humans are viewed in active processual terms, and are seen as capable of engaging in self-reflexive behavior, i.e., they are able to take their own and others' points of view and to enter actively into the process of organizing their own interactions. The meaning of objects arises, not out of any intrinsic meaning, but from the behavior directed toward those objects. The process of defining objects is ever-changing, subject to redefinitions, realignments, relocations. The definition of the object must be consensual for conduct toward any object to be meaningful (Blumer, 1969; Denzin, 1970; Lindesmith et al., 1975).

Implicit in the foregoing discussion is the assumption that human
behavior is observable and self-directed at two distinct levels: the interactional (or behavioral) and the symbolic. Additionally, the point should be underlined that symbolic interaction refers to the "peculiar and distinctive character" of interaction as it takes place between humans in that they interpret, perceive, define or monitor the actions of others instead of merely reacting to them (Blumer, 1969). The meanings attached are therefore of primary significance. The meanings attached to science as unfeminine and as an inappropriate female activity take on tremendous significance in terms of self-concept and evaluations by others.

Implied throughout is that human interaction is mediated by the use of symbols, by interpretation, and by ascertaining the meaning of one another's actions. Humans, in other words, respond to interpreted stimuli (Blumer, 1969; Denzin, 1970). In a discussion and appraisal of Mead, Blumer (1969:78-82) notes that Mead's analysis of symbolic interaction presupposes the following: (1) Human society is made up of individuals with selves, and thus humans can be the object of their own actions; (2) Individual action is a construction and not a release, being built up by the individual through noting and interpreting features of the situation in which the person acts; and (3) Group or collective action consists of the aligning of individual actions, brought about by the individual's interpreting or taking into account the actions of others. (The
young female in the research problem interprets or takes into account the actions of parents, teachers, and best friends.)

Basic to Mead's framework and to these concerns is the concept of self. Although many definitions and conceptions have been proposed by a variety of scholars, this dissertation will embody one consistent with the Meadian tradition. Very generally, Mead saw the self as process, not structure. To have a self in Mead's framework simply means that the individual may act socially toward self just as the person does toward others, i.e., one can praise, blame, punish self. Mead saw society as existing prior to the self and as the context within which selves arise. The mechanism whereby one is able to view self as an object is through role-taking. This is done by attempting to assess the standpoint of others and acting toward one's self from that position.

Additionally, it is through language (significant symbols) that children acquire the meanings and definitions of those around them. Taking the role of the other and language are, therefore, mandatory factors in the genesis of self. The roles a person takes in this process involve several stages: from that of discrete individuals (the play stage); through that of discrete organized groups (the game stage) to that of the abstract community (the generalized other). The latter is the completing stage of the self in which the child, in the course of association with others, builds up a general-
ized standpoint from which to view oneself and one's own behavior. The self-conscious behaving individual thus takes or assumes the organized social attitudes of the given group or community (or some section thereof) to which the person belongs. Prior to the play stage is the preparatory stage in which incipient role-taking occurs. In the play stage itself, although the child first begins to take activity toward self, there is—as yet—no unitary standpoint from which to view self (Mead, 1934; Blumer, 1969; Meltzer, 1967).

Mead further notes two analytically distinguishable phases of the self: the "I" and the "me." The "I" represents the impulsive tendency of the individual; the initial, unorganized, spontaneous aspect of human experience; the "me," the unincorporated other within the individual. It comprises, thus, the organized set of attitudes and definitions, expectations, and understandings common to the group. Mead contended that every act begins in the form of an "I" and usually ends in the form of the "me." While the "I" gives propulsion, the "me" gives direction to the act. The "I," thus, offers the potential for new, creative activity while the "me" disposes the individual both to goal-directed activity and conformity (Mead, 1934; Meltzer, 1967). One final point: Mead, contrary to some scholars, perceived the self as a multidimensional, not a unitary, phenomenon. He notes the following:

We carry on a whole series of different relationships to different people. We are one thing to one man and
another thing to another. There are parts of the self which exist only for the self in relationship to itself. We divide ourselves up in all sorts of different selves with relationship to our acquaintances . . . . There are all sorts of different selves answering to all sorts of different social reactions (1934:142).

One attempt to tap the various dimensions of self and their salience for an individual was the pioneering work of Manford Kuhn and the Twenty Statements Test (TST). (See Kuhn & McPartland, 1954) The TST was developed by Kuhn as part of his endeavor to transform the concepts of symbolic interactionism into variables that might be utilized to generate and test empirical propositions.

Other persons obviously play an important role in how humans perceive themselves. Humans are continually engaged in the process of role-taking in which some minimal attempt is made to assess the standpoint of others (Couch, 1970). Those whose attitudes, opinions, beliefs, are of particular salience to us have been variously termed reference groups, significant other(s), and orientational other. (The latter term was used by Kuhn, 1964b, but its usage has been minimal.) The reference group concept has been considerably expanded and elaborated upon to include negative and multiple as well as positive reference groups. This dissertation utilizes the concept of significant other; it is used to "identify real or imaginary persons who influence our beliefs about ourselves and our world" (Brookover & Erickson, 1975:301). Technically, significant others may be of two types: those important to people in their occupancy.
of specific roles and statuses and those of general importance to
them as people (Denzin, 1970:92).

Intertwined with the concept of significant others and their per-
ception of others is Cooley's notion of the "looking glass self" (1967:
217):

As we see our face, figure, and dress in the glass, and are interested in them because they are ours and pleased or otherwise with them according as they do or do not answer to what we should like them to be; so in imagination we perceive in another's mind some thought of our appearance, manners, aims, deeds, character, friends, and so on, and are variously affected by it.

A self-idea of this sort seems to have three principal elements: the imagination of our appearance to the other person; the imagination of his judgment of that appearance, and some sort of self-feeling, such as pride or mortification. The comparison with a looking glass hardly suggests the second element, the imagined judgment, which is quite essential.

One attempt to formalize the self-concept in the Meadian tradi-
tion has been done by Kinch who defines self-concept as "that organ-
ization of qualities that the individual attributes to himself" (1963:
481). The individual's conception of self emerges from social
interaction, and, in turn, guides or influences the behavior of that individual. Utilizing the variables of self-concept, perceived re-
ponses of others, actual responses of others, and the resulting
behavior, Kinch posits three postulates. From these it is logically possible to deduce three additional ones. In toto, they are as follows:
1. The individual's self-concept is based on his perception of the way others are responding to him.

2. The individual's self-concept functions to direct his behavior.

3. The individual's perception of the responses of others toward him reflects the actual responses of others toward him.

4. The way the individual perceives the responses of others toward him will influence his behavior.

5. The actual responses of others to the individual will determine the way he sees himself (his self-concept).

6. The actual responses of others toward the individual will affect the behavior of the individual (1963:481-482).

One dimension which Kinch and other symbolic interactionists point to is that of perceived evaluations or definitions of the situation of others. Although these are not necessarily or always synonymous with the actual evaluation of others, they are crucial in understanding human behavior and decision-making. Credibility of the other is an important aspect of this process (see Brookover & Erickson, 1975; Kaminski, 1975, 1978; Miyamoto & Dornbusch, 1956). As noted, human behavior is viewed as a dynamic, fluid, ongoing process in which humans act out plans of action, and in the process new or emergent forms of meaning and action appear. In this sense symbolic interaction is a "negotiated, emergent, and often unpredictable
production" (Lindesmith et al., 1975:4). In the Meadian framework
the concept of the act simply encompasses the total process involved
in human activity and points up both the covert and overt aspects of
human action.

Flowing from this is the perspective that sees the self-concept
not as a static trait but as a defining behavioral process; as action,
activity in a state of becoming. The framework is utilized in the
self-concept of ability items in this research, in which the orientation
is of the future (completion of the act). Implicit in this view is the
possibility of changing or modifying one's self-concept. This latter
point has important implications for this research effort as many
females see themselves and are perceived by others as stupid in
this area, and many males and females perceive the fields of math-
ematics and science as male domains (Fox, 1976a; see Brookover,
1959; and Brookover et al., 1965 for research focused upon modify-
ing a person's ability to learn by a change in self-concept).

In order to relate this theoretical formulation more specific-
ally to the research endeavor, a discussion of the theoretical insights
of Brookover and Erickson (1975) in which the self-conceptualizing
behavior of a student is divided for analytical purposes into four
major role categories has been included. The theoretical insights
of Brookover and Erickson build upon the framework of the early
symbolic interactionists. The four major role categories include:
role requirements for self; self-concept of ability to carry out role requirements; the instrumental and intrinsic values to self to carry out role requirements. Each dimension is discussed separately.

1. Role requirements for self: a) in the specific role in question; b) in more general roles in the setting; and finally c) in other roles currently engaged in or anticipated. The specific role might be that of science student as it relates to the more general role of student as it relates to the other roles of female, daughter, sister, best friend. Role requirements for self involve a complex array of expectations related--as noted previously--to how the person perceives self and the perceived evaluations of others, especially significant others. Some evidence indicates that females are more dependent than males upon the perceived assessment of others in evaluating self (Couch, 1955; Kaminski, 1975).

2. Self-concept of ability to carry out role requirements. Since appropriateness of behavior is defined by each person through the internalization of the expectations of significant others, humans develop a definition of appropriate behavior for self in each significant situation. Humans, in other words, assess their competency to carry out the behaviors appropriate for a particular role. As humans define their ability in a role, a self-concept of ability develops. Further, the latter functions as a threshold variable, i.e., before humans will attempt to carry out certain role behaviors, they must
assume some probability that they will be successful to some minimal level. If they have a high degree of confidence in their ability to accomplish role tasks, then their self-concept of ability is not functioning to impede their efforts and may well enhance those efforts. Simply having a high self-concept of ability does not necessarily mean that a student, for example, will be a high achiever. Unless the belief is present, however, that one is able to be a high achiever, the person will not try to be one. Thus, the utility of referring to the self-concept of ability as a functionally limiting threshold condition. Self-concept of ability, then, is viewed as a necessary but not sufficient condition for the emergence of plans to carry out role activities (Brookover, 1959; Brookover et al., 1964; Bilby et al, n.d.).

(3) The instrumental value to self of role performance. This kind of self-assessment includes a person's cognitions or assessments of the rewards and costs to self associated with a given performance and weighs the costs or rewards associated with the act. The costs and rewards may be in terms of social approval, achieving and maintaining desired relationships with others, or monetary rewards. Many young females see little instrumental value attached to taking science or mathematics courses as these areas are seen as male domains (Fox, 1976a). Further, career plans for many females do not encompass the masculine fields of mathematics,
chemistry, or physics. If females are interested in becoming a computer specialist or a marine biologist, the social costs may be seen as too high a price to pay. A further factor compounding the situation is that gender-role stereotyping commonly attributes instrumental values to males and expressive values to females (Baumrind, 1972).

(4) The intrinsic value to self of role performance. This refers to a person's cognitions or assessments of the worth, pleasure, or value involved in the act itself regardless of any pay off from others (any social or economic consequences, i.e.). The emphasis with this dimension of self-conceptualizing behavior is upon the value placed upon a particular role. The internalized importance of each role a human plays is involved in this dimension in contrast to the instrumental rewards and costs associated with role behavior. Conceivably, operationalizing the concept of intrinsic worth might be difficult. Obviously, the intrinsic and instrumental decisions are intertwined; conceivably, a change in one could modify or bring about a change in the other.

Finally, the following can be noted with reference to the self-concept: ¹

¹As noted, self-concept has been defined in a number of ways. While the researcher will discuss some research on a general self-concept, the major focus of this dissertation is upon role-specific self-evaluations (science ability) rather than upon a general self-esteem measure.
define themselves is subject to change. Changing the self-concept females have in the science and mathematics realm is, in fact, the specific focus of some of the planned intervention studies now being carried out (see Fox, 1976b); b) Self-conceptions regarding any task may vary from one situation to another or even from day-to-day. Nonetheless, there is a stability; some cognitions about self are more resistant to change than others; c) What humans believe about themselves does not necessarily have to fit with the objective facts. A young female may believe (or may have received the message) that she is stupid in physics or calculus, and, thus, is not likely to enroll in a class with that offering. It is, thus, on the basis of the assumptions about self in relation to the environment that humans take certain postures toward the world. These assumptions about self provide a frame of reference for anticipating and evaluating new experiences (Brookover & Erickson, 1975).

Of relevance to the concept of self are the concepts of learning and of ability. Learning can simply be thought of as the acquisition of new behavioral patterns. Consistent with this is the point of view that youngsters learn what they perceive they are able to learn, and that self-perception is acquired during interaction with significant others who hold expectations of the student as learner (Brookover & Erickson, 1975; Brookover et al., 1962). Intertwined with this are various cultural perspectives on ability. The variations in
student role expectations and the evaluations of students' ability to learn produce tremendous differences in the specific definitions of appropriate behavior for individual students. The considerable variation in student learning that does result is, therefore, often the outcome of social differences and the interactions these social differences produce, and not simply of variations in genetically structured capacities. Frequently, however, variations in level of learning and ability to learn are attributed to genetic differences which are thought to produce a fixed intelligence. The position taken in this study is that although there may be differences in heredity, such differences are largely irrelevant in explaining variations in the learning of most human activities.

Additionally, learning ability is viewed, not as a fixed, unchangeable trait (the latter is a very pervasive assumption), but as subject to modification. The contention is not that conditions can be created to make a genius out of somebody, but rather that people may come to be perceived and may perceive themselves as stupid or morons via the processes of labeling and of perceived and actual evaluations (Brookover & Erickson, 1975; for an extended discussion and review of the literature of the ability/IQ controversy see Bowles and Gintis, 1972-73 and Gartner et al., 1974).

Out of the symbolic interaction tradition has emerged the labeling perspective which has relevance for this research. This
school focuses upon the processual aspects of human interaction and the manner in which (or whether) someone engaging in certain behavior comes to be perceived and labeled by others as deviant. These others may include parents, teachers, friends. Parents presumably engage in the labeling process daily in interaction with their children; the latter may be labeled as sweet, athletic, hard-to-handle, good in science, poor readers, funny clowns, etc.

Likewise, teachers make similar kinds of assessments; in some cases teachers' and parents' labels may be mutually reinforcing. A parent may set the scene by bringing a child to school the first day and announcing that "You'll have trouble with this one." Recently Rist (1973:241ff) has called attention to the effect of social class variables on teacher expectations (middle-class students can learn; lower-class, can't; white schools are good; black are bad). Teachers as well as parents hold particular kinds of expectations toward young females. If these youngsters love physics and wish to become an engineer, they may be labeled as deviants (unfeminine) and viewed with dismay, anger, or alarm.

Summary

The symbolic interaction perspective sees human interaction as a dynamic, ongoing process in which humans function both as actors and as reactors. The framework points to language and to taking the role of the other as basic to the development of a self
and to its completing stage (the generalized other). The self, likewise, is viewed as a dynamic, multidimensional phenomenon, with two analytically distinguishable phases, the "I" and the "me." The perceived evaluations/expectations of those defined as significant others are particularly salient to one's concept of self (either generally or in a particular area). Complementing this are two further aspects: (1) the labeling process in which labels are affixed by parents, teachers, friends (and others as well); (2) the "looking glass self" in which humans see reflected back the evaluations and expectations of others. Self-conceptualizing behavior involves various role categories and dimensions, including a self-concept of ability which functions as a threshold variable.

Review of the Literature

The Socialization Process

The following quotation should be viewed as a backdrop to a discussion of the socialization process for females in which the learning of appropriate gender-role attitudes and behavior takes place:

Science is an intellectual profession which demands high achievement, and aspiration toward intellectual goals. Science demands originality, a questioning of authority, an eagerness to examine the "taken for granted." Thus it places a high premium on independence in thinking, autonomy, setting goals for oneself, and a willingness to work in isolation. What characteristics in a child's early environmental milieu, what attitudes and values espoused

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by the family, would predispose him (sic) to such activity? (Eiduson & Beckman, 1973:67).

As the socialization process itself is discussed, it will become increasingly clear that females are indeed not socialized nor encouraged to display a questioning of authority, independence of thinking, autonomy, an eagerness to examine the taken for granted. The socialization process, rather, prepares females to play a subordinate role in the society and rewards and encourages passivity, helplessness, and being nice. Researchers have noted that if females are to become scientists, many changes in the socialization process will be necessary: the development of instrumental competence and self-reliance instead of "pleasing feminine submission"; encourage in girls, not "unthinking conformity," but "alert intelligence" that asks why and rejects the easy answers (Baumrind, 1972; Rossi, 1971). Finally, Rossi (1971:625) notes that "a childhood model of the quiet, good, sweet girl will not produce many women scientists, scholars, doctors, or engineers."

The process itself. By definition the concept of socialization entails learning in contrast to the concept of maturation which involves the unfolding of the potentialities of the organism. From the societal perspective, socialization is the means by which social and cultural continuity are attained. From the standpoint of individuals, the socialization process focuses upon their development as social beings and participants in the society. Socialization, as a dynamic
ongoing process, entails a continuing interaction between individuals and those who seek to influence them; this interaction undergoes many phases and changes (Clausen, 1968a). The sociological perspective stresses the role of sociocultural variables in this process. With reference to appropriate gender-role behavior, Money's research (1965) on hermaphrodites in which assignment of sex seems to be the overriding variable lends credence to this orientation.

Money notes that a fair number of babies are born each year whose sex is difficult to determine with certainty. Some infants appear to be male but are biologically female, while others appear to be female but are biologically male. Money and his colleagues have spent over 20 years following the life histories of some of these babies. In some cases an infant was assigned one sex at birth and was later found to belong biologically (genetically, gonadally, hormonally) to the opposite sex. In virtually all cases the assignment of sex and, thus, of rearing proved dominant. Babies who were biologically male but socialized as females followed a typical feminine pattern of development while the reverse was true for those babies who were biologically female but socialized as males.

Weitzman (1975) in a review of the socialization literature contends that: (1) the effectiveness of the socialization process has probably been overestimated; women are assumed by members of the society to internalize the feminine role completely; (2) the
literature incorrectly treats the pressures on women as unidimensional. She notes that without denying the pressures on females to conform to the feminine role, females are socialized in an ambivalent fashion. While they are rewarded for typical feminine behavior, they may also be rewarded for some types of masculine behavior. This happens because what is labeled masculine behavior is generally highly regarded and rewarded in our society. Although they may not be able to verbalize this very well or even consciously recognize it, girls learn early in life that females occupy a subordinate position and are a devalued group.

The socialization process begins soon after birth when a pink blanket is pinned on a girl baby and a blue on a boy baby. Differences in handling and in voice tone occur depending upon whether the infant is perceived as a male or as a female. Cultural assumptions about what is natural for boys and for girls may be so deeply internalized that parents treat their children in a differential manner without even being aware that they are reinforcing gender-role appropriate behavior. This process occurs, of course, before the child is even aware of gender-role identity. (Goldberg & Lewis, 1969; Kogan & Lewis, 1965; Moss, 1967; Komarovsky, 1953; Weitzman, 1975).

By a very early age (around six) many children have learned to distinguish between what males and females, boys and girls do; what kinds of behavior are appropriate for each; express appropriate role
preferences for self; and behave in accordance with gender-role standards. In a review of the literature Weitzman (1975) notes that while there are discussions of the harsh restrictions placed upon boys, the equally harsh restrictions (but of a different kind) placed upon girls are ignored for the most part.

For one thing, girls are given fewer opportunities for independent action and at a later age than their brothers. While boys are punished more frequently by physical means than are girls, nonetheless, the range of allowable behavior seems to be greater for boys. The greatest sex difference in socialization patterns appears to be in the realm of aggression. While aggression is encouraged and permitted in boys (only the form differs with age and social class), dependence and passivity are not only permitted but encouraged in girls. Aggressive behavior in girls—especially against parents—is negatively sanctioned (Sears et al., 1957; Komarovsky, 1953).

Further, pressures may be exerted upon girls to select girls' toys and to be more restrained, quiet, sedentary, and neat in their play than their brothers or boys in the neighborhood; to be gentler and more emotionally demonstrative. Additionally, girls are held to a more "exacting code of filial and kinship obligations" (Komarovsky, 1953:59). While girls are praised more than boys, evidence suggests that withdrawal of love on the part of the mother is a more frequent punishment tactic for girls (Sears et al., 1957). One can
only speculate on the overall possible negative effect of this tactic
upon girls since some researchers contend that for many young
females the self they value emanates from the appraisals of others.
Females of all ages, therefore, may know their worth only from the
responses of others; know their identity only from their relationship
as daughters, girl friends, wives, or mothers. Finally, the young
girl, her parents, her friends (of both sexes) may perceive success
as measured by objective, visible achievement as antithetical to
femininity (Bardwick & Douvan, 1971; Bem & Bem, 1974).

In terms of a cross-cultural analysis, an anthropologist
(Rosaldo, 1974:28) makes the following comments:

Whatever pain is in fact associated with female socialization,
most cultures assume that it is relatively easy for a young
girl to become a woman; people in most societies seem to
take that process for granted. Womanhood, by contrast (with
males), is more of a given for the female, and in most
societies we find relatively few ways of expressing the differ­
ences among women. Womanhood is an ascribed status; a
woman is seen as "naturally" what she is.

Rosaldo (1974) further notes that one result of seeing a female
as naturally what she is is that most societies have few institutional­
ized roles for females and relatively few contexts in which women
can legitimately make claims. The contribution of females to extra­
domestic relations are rarely made explicit. Females are given a
social role and definition by virtue either of their age or of their
relationship with men.

As youngsters mature, more explicit gender-role training may
be introduced by parents, teachers, and others. Boys may be given microscopes, erector and chemistry sets and are encouraged to take an interest in the masculine pursuits of mathematics and science; girls are given dolls and dishes and encouraged to play the role of housewife and mother. Children learn quickly that mommy may be proud to be a moron in mathematics and science whereas daddy knows all about those things. A boy with an interest in biology may be encouraged to be a physician; a girl with a similar interest is encouraged to consider nurses' training so that she can have a job to fall back on in case--God forbid--she needs to support herself. A girl who persists in her enthusiasm for science is likely to find her parents as horrified by the prospect of a permanent love affair with physics as some might be by the prospect of an interracial marriage (Bem & Bem, 1974).

Summary

Socialization is a dynamic, ongoing process which begins at birth and continues throughout the life cycle, although sociologists have primarily focused upon the early years of this process. Young children very early learn and internalize gender-appropriate attitudes and behavior, which are continually reinforced by significant others as well as by other agents throughout the society (e.g., the mass media). Evidence suggests that early in life females learn--explicitly or implicitly--that they are a devalued group; their self-concept
emanates from and is dependent upon the appraisals of others. All of the foregoing has implications for females who may have unfeminine (deviant) interests. Also, the socialization process as presently structured does not encourage independence, creativity, and intellectual thinking in young females.

Parents

Discussion in the literature of the agents of socialization note the core role played by the family in the socialization process since the family bears the major responsibility for teaching children the "essentials of social order" and culture in their society and in guiding their personal development. Both the family and the school have clear mandates from the society to train new generations of members so that they internalize the appropriate values, attitudes, beliefs in a host of situations (Clausen, 1964b; DeFleur et al., 1973).

Role of Parents in the Process

In our contemporary industrialized society with its high degree of specialization, youngsters interact less continuously with parents and have contact with a much wider circle of adult associates. More and more outside agents are playing a part in the socialization process, and different groups may hold varying evaluations and expectations for an individual. It may be difficult to determine which of several groups is the most salient. Nonetheless the family still has access to the
child first and over a relatively long period of time. It is within this setting that a concept of self and a gender-role concept are first formed. The relationship in the family, while involving a sub-superordinate relationship, is a personal, emotionally intense one (Clausen, 1964b; DeFleur et al., 1973; Brookover & Erickson, 1975).

Youngsters learn to distinguish the male from the female role by observing those around them (including patterns in a family with a traditional or non-traditional division of labor). Parents who are especially influential in defining the female or male role for the child may accomplish this consciously or unconsciously by example or proscription, by reward and punishment. Little girls may be explicitly told what is considered nice and ladylike; little boys, what is expected of strong men. Further, some evidence supports the contention that fathers are more concerned with sex typing in young children than are mothers.

While traditional identification theory has assumed that the same-sex parent is more crucial in determining the sex-role identity of the child, one researcher (Weitzman, 1975) suggests that a large amount of gender-role behavior can be learned only through interaction with the opposite sex. This is especially true of the feminine role which, as noted, is often defined in terms of relationships with others. It is thus possible that the father teaches his daughter to be feminine just as much as the mother does. Additionally, Slater
(1961) contends that adult role models who exhibit gender-role stereotyping in their own behavior may impede, rather than facilitate, the child's gender-role identification. Children may find it easy to identify with less differentiated and less stereotyped parental role models.

Whether same sex or cross sex identification is more salient is, at best, a complex issue and one involving many other variables. There is some evidence, however, to support the process of intergenerational continuity generally which lends credence to the importance of the family as a socializing agent in terms of values and attitudes. The research of Aldous and Hill in the Minneapolis-St. Paul area (1965) and that of Gallagher (1974) in the Philadelphia area lend tentative support to this position.

The Gallagher research utilized a simple random sample of college students, their parents, and their grandparents. The researcher used a set of attitude items regarding sexual freedom, political activism, and the social role of women. While there were differences within each of these areas, Gallagher concluded that parents do affect the character of their children's attitudes in most areas of life. Aldous and Hill used an area probability sample that involved 88 white lineages of grandparents, parents, and married children all living within or near the Greater Metropolitan Area. The researchers found the greatest continuity of norms among the three generations for religious affiliation and additionally among
female lineages. The greatest continuity on the achievement-instrumental norms of occupational and educational achievements was among male lineages.

Additionally, the field of political science provides some support for the intergenerational continuity of party preference and the influence of parents on their children (see Campbell, 1960; Lewis, 1972). Jennings and Niemi (1974) in their research, which drew on a set of nationwide samples of nearly 1700 high school seniors, point to the influences of the family and especially the mother (contrary to conventional wisdom) in party preference and other political issues. In this case same sex patterns were considerably stronger for girls. Influence of mother was stronger in both homogeneous parents (same beliefs and party identification) and heterogeneous parents.

Evidence suggests that not only do parents have different sex-related expectations for their children, but that both females and males think it preferable to have male children (Levy, 1974; Etzioni, 1968). As the socialization process proceeds, parents have more limited aspirations for their daughters than for their sons, and educational expectations for achievement are less for daughters. Parents have, as noted, the earliest influence upon the child's concept of self and the child's perception of gender-roles and gender-appropriate behavior. If parents sex-type mathematics and science and related activities as masculine, these attitudes/beliefs may be communicated
to the child explicitly or implicitly. Perception of parental expecta-
tions for females with reference to mathematics and science appears
to be important and has a stronger effect on self-concept than is true
for males. Parents do tend to reinforce gender stereotypes in their
greater acceptance of low levels of achievement in such subjects as
mathematics and science for their daughters compared with their
sons (Etzioni, 1968; Levy, 1974; Baumrind, 1972; Kaminski, 1975,
1978; Weitzman, 1975; Fox, 1976a; Block, 1973).

In a review of the literature Astin (1974) notes the salience of
occupational and social class variables. Parents of a high occupa-
tional and educational level tend to exert a positive influence on the
daughter's career and educational plans. A working mother or one
with an occupational orientation tends to influence a daughter in the
direction of occupational planning or commitment. In a specific
realm, if mothers are strong models for career aspiration and com-
petence in mathematics, they may have a potent effect upon their
daughter's attitudes and career orientations. Additionally, daughters
of employed mothers tend to perceive females less negatively on
competency characteristics than daughters of homemaker mothers.
The fact that little girls often perceive females only as homemakers,
thus, appears to shape their expectations for their own future roles
(Hartley & Klein, 1959; Iglitzin, 1973; Fox, 1976a; Broverman et al.,
1972; Rey, 1976).
The attitudes and expectations of the father may be as or more important than those of the mother since the father is more likely to be the parent who exhibits interest in mathematics and science and to whom the daughter turns for help with homework and advice about course taking. Some evidence indicates that a close relationship with both parents and some identification with the father are positive predictors of a career orientation. Research with female students who have given consideration to a career in mathematics, engineering, or science indicates the importance of well-educated fathers as well as high academic achievement and a positive self-assessment of their own skills and abilities on the part of the daughters (Sexton, 1976; Fox, 1976a; Erlick & LeBold, 1975).

Research among female scientists points to the following as possible supportive factors in developing a career orientation: (1) an intelligent and mathematically educated father; (2) the intellectual, cultural, and moral values held by both parents (not specified precisely); (3) relative absence of brothers; (4) ethnic marginality of parents (one or both born outside the United States). The rationale for the latter variable is that many European societies are not characterized by an anti-intellectualism common to this society (Osen, 1974; Helson, 1970). Generally women see fathers--rather than husbands--as more tolerant of women who enter masculine fields. This suggests a difference between the role of father vis-a-vis
daughter and the role of husband vis-a-vis wife, a difference that is of importance in the "cultivation of interests in things scientific and rational during the girls' formative years" (Rossi, 1965:91).

On the debit side the following can be noted: (1) Precocious girls generally receive less parental encouragement and support in mathematics/science than do precocious boys; (2) Scientifically precocious girls are not encouraged to accelerate in their mathematics education as are precocious boys; (3) Even among gifted high school girls, there is less discussion about future careers in comparison with gifted boys. When discussion does ensue, traditional female occupations are the focus; and (4) While training in independence seems to be an important aspect of creative, scientific pursuits, this is a devalued trait in females, and one certainly not encouraged in daughters by many parents (Astin, 1974b; Fox, 1974; Rossi, 1965). In discussing the socialization process of young girls in the family, Rossi (1965:122) notes the following with reference to the daughter:

Her "social popularity" is an asset to be cultivated and is something considered more important for the girl than the boy, for he will be the chooser, she the chosen-- A young girl with high intelligence and scientific interests must come from a very special family situation, and must be a far more rare person than the young boy of high intelligence and scientific interests. If she reaches adolescence with the same intellectual inclination, it is often despite her early family experiences rather than because of them. [emphasis added]

**Ethnic and Socioeconomic Status of Family**

The failure of many students to achieve at a high level has led
various educators and scholars to suggest that significant others or some one group are responsible for low achievement. Teachers at various grade levels frequently indicate that lower-class parents have low expectations and aspirations for their children while parents from higher status levels may expect too much from their children (see Rist, 1970, 1973 for an extended discussion of the social class variable and the schooling process). This suggests vast differences in the school achievement expected of school-age youngsters by parents.

Ladner's work (1971) in the black community suggests that black girls--regardless of social class--are encouraged to be more independent than white girls. They frequently identify with and aspire to the image of the strong black woman (see Dumas, 1977 for some implications of this). Additional research (Kandel, 1971) notes that black girls consistently have a closer and more intense relationship with their mothers than do white girls in many aspects of family life. Additionally, both black mothers and adolescents have higher educational aspirations for the adolescents than do whites. These differences persist regardless of intactness of family, type of maternal authority, or maternal ascendancy in intact families. Mothers in female-headed families are more likely to stress higher education for their daughters than for their sons. Generally, there is evidence (Scanzoni, 1971; Herriott & St. John, 1966) that minority
parents are strongly motivated to gain greater educational and occupational opportunities for their children.

With reference to input of black parents, one research effort (Bowe, 1977) found that black parents' perceived evaluations were more influential than were those of white parents in their youngsters taking science. Additionally, black parents had a greater influence on their youngster's self-conceptions of science ability than did whites. At this point in time there are few black female scientists and a dearth of research in this realm (on both males and females).

Summary

While changes have taken place in the socialization process as our society has urbanized and industrialized, the evidence seems to suggest that the family still plays a pivotal role. While it is difficult to generalize from some of the research reviewed, the data suggest that gender-roles and concept of self are first learned in the family. Also, there is some support in the literature for the process involving the intergenerational transmission of values.

While the family relationship is a sub-superordinate one, it is a personal, emotionally intense one. Socialization involves explicit as well as implicit instruction and a differential system of rewards and punishments based on sex. In mathematics and science particularly high intellectual values of both parents as well as support of the father seem to be important. Even scientifically precocious
females, however, receive less encouragement than do precocious males, with families continuing to focus on traditional careers for their daughters.

Conceivably black males—regardless of social class—undergo a somewhat different socialization process in which independence and the image of a strong black woman are stressed. While there is limited evidence that the perceived evaluations of black parents have greater influence than do those of white parents on their children taking science and on the youngster's self-concept of science ability, more research is needed among blacks and other minority families.

Schools and the Teacher

The phrase hidden curriculum has been used by many researchers to refer to different aspects of the schooling process including the various kinds of messages about what are appropriate behavior and attitudes for males and females. One point should be made at the outset: What constitutes appropriate gender-role behavior is usually taken as a given and as non-problematic among teachers, parents, and by many researchers themselves.

The following quotation from Lyles (1966:41) typifies traditional gender-role expectations in the schools:

In working with boys we employ more science materials and experiments. There is more emphasis on building things and on studies of transportation.... From studying the atom the boy's class moved easily into a study of nuclear fission. It is unlikely that girls would respond this way—mold can be studied from a medical standpoint by boys and
and in terms of cooking by girls . . . For girls we use quieter games, fairy stories, games and songs which emphasize activities such as sewing and housekeeping. For boys we use more active physical games which involve noise and muscle movement and are based on a transportation scheme.

A strong case can be made that girls and boys are not treated equally in the schools in terms of teacher interaction and expectations; text and reading materials both in general and in specific (mathematics and science) texts; and games and toys. Each of these areas is considered separately.

Teachers

A great deal of evidence exists to indicate that teacher expectations are a powerful factor in terms of self-concept, especially in the mix related to the ascribed variables of sex and/or social class. With reference to the latter variable, Rist (1973:245) notes that in many urban schools the "middle-class children are learning to control the poor, and the poor are learning to shuffle." Frazier and Sadker (1973) refer to teachers as the hidden carriers of society's gender-role stereotyping; such stereotypic thinking appears to be common among both female and male teachers. Conceivably, teachers are unconscious sexists who are not aware of the negative outcomes of their stereotyped attitudes and behavior (Fox, 1976a).

The literature points to the following: for one thing, teachers interact more frequently with boys than with girls, especially in
mathematics and science classes (review of the literature by Fox, 1976a). While boys in general do receive more teacher disapproval in the lower grades (more disapproving contacts, harsh and angry tone of voice by teacher), rather than being discriminated against, boys appear to be more intense or salient stimuli for the teacher. High achieving boys seem to receive the most favorable attention as well as more intense teacher affect and feedback. Secondly, while girls may be either ignored or rewarded for conformity and obedience, strong, consistent pressures are exerted on them to be feminine and good pupils. This process promotes characteristics that inhibit achievement and suppress the full development of youngsters. One consequence of these differential interaction/treatment patterns is likely to be a cumulative increase in autonomous independent behavior by boys and a lowering of self-esteem for girls as girls not only receive less attention but are criticized more for their lack of skill and knowledge (Howe, 1971; Levy, 1974; Frazier & Sadker, 1973; Sears & Feldman, 1974; Good et al., 1973).

From kindergarten on, many teachers make the assumption that girls are going to love reading and hate mathematics and science. Further, girls are not expected to think logically nor to understand scientific principles (Howe, 1971; Frazier & Sadker, 1973; Levy, 1974). Research among New York City high school teachers (cited in Levy, 1973; original source not given) indicates that while they
would encourage boys to build on an interest in mathematics and science, they would--at the same time--be concerned that a girl develop competencies in areas besides those two to avoid becoming lopsided. Additionally, both sexes accept a boy's excellence in these areas more readily than they do a girl's (Harrison, 1974).

In reviewing the literature, Fox (1976a) contends that not only do high school teachers appear to hold different expectations for females and males in mathematics, but they have more negative perceptions of mathematically gifted females; in some cases hostility is exhibited. Additionally, females perceive teachers as less positive toward them as learners of mathematics than do males. The impact of teachers seems to be the most potent at the extremes of attitudes: a very bad experience or a very positive one. Students who have interaction with an inspirational teacher tend to rate themselves higher in mathematics and science (Anderson, 1963). Students not doing well in courses point to male teachers as cold and impersonal to perceived teacher evaluation of self as a stupid student; and to receiving no encouragement from teachers, parents, peers (Sells, 1976-77). Sells' research was done among freshmen at the University of California, Berkeley, and would not necessarily be representative of freshmen in other schools and other parts of the country. Finally, in some systems mathematics teachers are males who also frequently teach the more advanced courses (Sherman
& Fennema, 1977, noted this in their research done among high school students, mostly white, in a midwestern city. In this case, 69% of the mathematics teachers were males).

Interestingly enough, mail questionnaires sent to 22,000 North Carolina public school teachers (43% return rate) revealed that many viewed mathematics and science as more appropriate masculine fields for teaching while English and foreign languages were seen as more appropriately feminine fields. Only social studies lacked a sex-image (Simpson, 1974).

Summary

The following can be reemphasized: (1) Although most teachers undoubtedly feel they are treating students fairly and equitably, differential evaluation/interaction patterns seem to occur based on the social class/sex variables. Not only does this process leave gender stereotypes unquestioned, but it serves to perpetuate them; (2) Not only are teacher expectations very different for each sex, but the youngsters themselves develop and are channeled into very different styles and interests based on sex: girls into homemaking and aesthetic concerns; boys into mechanics and science concerns (Harrison, 1974; Levy, 1974).

Texts and Curricular Materials

One spinoff from the feminist movement has been numerous
analyses of pictures and written materials utilized from nursery school through high school. (See especially Women on Words and Images, 1974; Fisher, 1974; U'Rem, 1971; Weitzman et al., 1972; Levy, 1973 and 1974; Frazier & Sadker, 1973; Frisof, 1974; Howe, 1971; Trecker, 1973; Saario et al., 1973.) Numerous threads have emerged. In the first place, in terms of sheer numbers, males are more prominent. One analysis of elementary readers noted the following ratios: boy-centered to girl-centered stories 5:2; adult male to adult female main characters 3:1; male to female biographies 6:1 (Women on Words and Images, 1974).

Secondly, for the most part, both in the illustrations and in the text, males and females are depicted as acting, behaving, and achieving in stereotypical roles. Thirdly, males generally excel; the following are typically seen as male characteristics: ingenuity, resourcefulness, strength, bravery, competitiveness, assertiveness. Girls, on the other hand, are generally characterized by the following: dependency, fearfulness, docility, feeling and expressing emotion, and concern with physical appearance. "Little girls endlessly play and cry over dolls, give tea parties, look on helplessly, passively, admiringly while boys take action" (Women on Words and Images, 1974:167).

Until recently little research had been done on mathematics and science books. Perhaps an assumption had been made that
numbers cannot be sex-typed. A review of the materials that are used from the early grades through high school indicates, however, that they exemplify the same characteristics as do the more general materials. Males appear more frequently; both sexes are shown in stereotyped occupational roles; females are typically pictured in a very limited range of occupations, males in a wider range. Rarely are women scientists or mathematicians included (the very creative Emmy Noether is ignored, for example). (Federbush, 1974; Mlinar, 1974). Although the new mathematics may have brought new mathematics concepts, a lot of the old social ones have been retained. The implicit message is that science and mathematics are male preserves; females need not apply.

As with the general materials, females in mathematics are shown as helpless incompetents who have difficulty adding, and utilize mathematics only in dividing pies or grocery shopping. Since teachers do play a pivotal role in this area, they could bring about some shifts by using non-stereotyped exercises and activities; by including materials on female scientists and mathematicians; and by utilizing female role models for classroom speakers (Jay & Schminke, 1975; Weitzman & Rizzo, 1974; Federbush, 1974; Rogers, 1975; Frazier & Sadker, 1973; Gaetano, 1966; and Mlinar, 1974).

Summary

Analyses of text and curricular materials utilized in the

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schools point up that these seem to reinforce traditional gender-role typing. Mathematics and science materials are not immune from the same stereotypes. These fields are pictured as the province of males. Teachers could play a pivotal role in initiating some changes.

**Toys and Games**

Toys further add to the gender-role stereotyping process by being pegged into one of three categories: (1) masculine—more varied and expensive and viewed as relatively complex, social, and active (these include doctor kits, chemistry and erector sets); (2) feminine—seen as the most solitary, simple, and passive; and (3) neutral—viewed as the most creative, with boys receiving the most intricate items. Further, many adult toy buyers define a set of traditional toys for each sex; the older the child, the greater the need to make this differentiation by many adults. Also, playtime with cross-sex siblings is spent in neutral, not sex-specific games. Finally, in catalogue pictures illustrating the use of toys and games, the father is often seen in the role of instruction or play companion, while the mother is placed in the role of spectator or cleaning up

(Lyon, 1974; material is excerpted from research by Louise Goodman and Janet Lever; exact citation is not given).

The invidious and limiting effects of gender-role stereotyping can be seen in the area of research with creative children. Since creativity is seen as requiring both sensitivity and independence,
this, in itself, poses a dilemma for some youngsters as the former trait is often perceived as feminine; the latter, as masculine. In research by Torrance (1962) using what he called a Products Improvement Test, first grade youngsters were asked to make toys "more fun to play with." Many of the boys refused to try the nurse's kit, declaring this an unsuitable toy for boys. After some of the creative boys had turned it into a doctor's kit, they were then able to think of improvements.

In later work girls were reluctant to work with science toys, declaring that as girls "they weren't supposed to know anything about things like that." Even in these early grades boys demonstrated and explained about twice as many ideas as girls in experiments involving these materials. While Torrance, in additional research, was able to change attitudes toward these toys (surely a significant finding), the boys' contributions were, nonetheless, more highly valued by peers than those of the girls even though the mean performance was almost identical. The researcher concluded that:

Apparently the school climate has helped to make it more acceptable for girls to play around with science things, but boys' ideas about science things are still supposed to be better than those of girls (pp. 112-113).

Although the peer group is an agent of socialization, children's play an activity of socialization, and role skills a product of socialization, the peer group and play time have been relatively neglected in the study of child development. The leisure patterns of elementary
school children do support important differences; a case can be made that play and games contribute to the preservation of traditional gender-role divisions in society by equipping boys with the social skills needed for occupational careers while equipping girls with the social skills better suited for family careers.

In looking at play activities, the following differences have been noted: (1) Boys play outdoors far more than girls (team sports, fantasy games like war). These outdoor games are perceived as public and open to surveillance whereas girls' indoor games (often played behind closed doors) are perceived as private affairs. (See Hennig & Jardim, 1977, for the implications of the differential emphasis on team sports and females in management careers. See Elshtain, 1974, for implications of the public/private dichotomy and females in politics.) (2) Boys more often play in: larger groups; age heterogeneous groups; competitive games; games of longer duration. They seem to resolve their disputes more effectively and have greater experience with the rules. Since their games further independence training and encourage the development of organizational skills necessary to coordinate the activities of numerous and diverse groups of humans, these games help prepare the players for successful performance in a wide range of work settings in urban society; (3) Conversely, girls' games emphasize cooperation, not competition; involve mimicking human relationships, and thus may provide
the training ground for delicate socioemotional skills; take place in private, small intimate groups (frequently the dyad); may help prepare their players for the private sphere of the home and their future roles as wives and mothers (Lever, 1976).

Mead (1934) offered the insight that team sports teach young children to play a role at the same time they take into account the role of other players. From the foregoing, it would seem that boys develop the ability to take the role of the generalized other; girls to take the role of the particular other. Obviously, the social and organizational skills learned in large play groups may generalize to non-play situations. The typical dyadic relationship in which girls are involved is characterized by the unique interaction between two individuals. Although boys also have strong friendships, the interpersonal skills they learn through games are more likely to be instrumental rather than expressive. Boys must learn to "depersonalize the attack." Not only do they learn to compete against friends, but they also learn to cooperate with teammates whom they may or may not like personally (Lever, 1976).

Summary

Toys reinforce traditional stereotypes, with both children and adults perceiving particular toys as masculine or feminine or neutral. Boys' toys are not only more expensive and varied, but are viewed as complex and active while girls' toys are seen as simple and
passive. The pernicious effects of these stereotypes can be seen in the realm of creativity in which girls early in life internalize an image of self as non- or uncreative and as one who is not expected to or should not know anything about the mysterious world of male creativity. Stereotyping is further reinforced in the games considered appropriate for each sex. While boys' games equip them with the social skills needed for the occupational world, girls' equip them with the socioemotional skills appropriate for hearth and home.

This section, thus, has examined the role of various aspects of the schooling process and noted their part in socializing youngsters for traditional roles, including occupational roles.

Peers

For most young children the earliest peer contacts come from neighborhood age-mates; their play entails social learning to a marked degree. Among pre-schoolers peer pressures are minimal. A few years later the emergence of "structures of power and prestige" within the classroom and in informal groups gives to the "population of peers" a special significance in the socialization process.

The point of view generally taken is that the peer group is not an agent of deliberate socialization, but that its members enjoy peer group interaction for its own sake. Nonetheless cliques may, unintentionally or otherwise, exert a great amount of pressure on their members to acquire the values, orientations, and outlook of the group.
Certainly as youngsters approach the junior and senior high years and members of the opposite sex are seen as potential dating material, traditional role-appropriate behavior comes into play here. The costs to the young female defined as unfeminine and/or engaging in non-traditional behavior may be high (Clausen, 1968b; DeFleur et al., 1973).

Review of the Literature

Weitzman (1975) contends that the school and parents as well as peers make it clear to the young female that the only criterion for feminine success is attractiveness to males. (This is reinforced by the mass media.) Certainly there is some support for the position that equates intellectual success with a loss of femininity among high school peer groups. Some research notes that a decline in career commitment among high school females is related to male classmates' disapproval of the use of female intelligence (Mathews & Tiedeman, 1964; Hawley, 1971, 1972; Astin, 1974). The following is consistent with the point of view just presented:

Girls soon learn that "popularity"—that peculiar ecstasy from which all other goods flow—accrues to her who hides any intelligence she may have, flatters the often precarious male-ness of adolescent boys, and devotes herself to activities that can in no way challenge their sex . . . . Most American public schools . . . make a girl with passionate intellectual interest feel a strong sense of her own inadequacy as a woman, feel guilty about these "masculine" outlooks, perhaps even wonder about her own normality (Keniston, 1964:369). In the current situation, there are indications that at least
among college women, playing down of intellectual ability is not as
common today as it was in an earlier period. Further, college
females who typically act in accordance with the feminist movement
report strong support from their network of friends (Komarovsky,
1973; Weitzman, 1975). On the other hand, reviews of the literature
(Astin, 1974; Sexton, 1976; Fox, 1976a) lend support to the position
that females tend to orient their career aspirations in keeping with
their perceptions of what their male peers will tolerate. Apparently
discrepancies exist between females' views of the ideal woman and
their perception of males' views. While females tend to see the
ideal woman as an active being, they perceive males' ideal woman
as passive. When males themselves, however, are questioned about
their ideal woman, they do not necessarily suggest that she be pas­sive. Whether accurate or not, males' views appear to have an affect
upon career decisions.

Summary

The peer group is usually not seen as an agent of deliberate
socialization, but simply as a group with intrinsic value for its
members. As youngsters move from childhood to the pre-teens and
adolescent period, the peer group may exert--intentionally or other­wise--pressure. Current evidence indicates that the playing down of
intellectual ability may not be as common as in the past among some
college females. On the other hand, in terms of career choices
and decisions, many females apparently take their cues from what they believe males see as the ideal woman.

Self-Concept

The concept of self is germane to the research concerns and to the theoretical framework being used. Symbolic interactionists point to the role played by significant others in the perception of self and to the importance of their perceived beliefs, attitudes, expectations, and evaluations to the person involved.

At least initially, parents seem to be especially important in the development of a self-concept since they are the persons present the earliest and most consistently in the child's life. Peers take on increasing importance with age while teachers may play a more limited and perhaps indirect role, but one with tremendous implications for a youngster's total life in terms of how that person comes to perceive self academically. In a general sense, Mead (1934) notes that one's self-concept is shaped through interaction with others (Wylie, 1963; Brookover et al., 1962, 1965, 1967).

Overview of the Literature

One of the difficulties in reviewing this body of literature is the lack of comparability in paradigms utilized, conceptual and operational definitions, and methodology. A perusal of Wylie (1963) and her review of the literature points to the plethora of scales
developed in this area, with attempts to tap very different dimensions of self. Often such terms as self-concept and self-esteem are used loosely and ambiguously. Rosenberg's widely used self-esteem measure (1965), for example, is a global measure of self-regard. The concerns in this research are, however, more limited and are concerned with a role-specific self-concept of ability.

With these difficulties and caveats in mind, one can point to the following: there is some empirical support (see review of the literature, Wylie, 1963) for the finding that males generally have a higher and more positive self-concept than females. Research which indirectly addresses itself to self-concept by focusing upon preference for the male or female role notes that even in elementary grades both boys and girls show a stronger preference for aspects of the masculine role (Brown, 1958). A later review of the literature (Levy, 1974) concludes that both males and females increasingly value and prefer the male role. Research among college students notes that the higher evaluation of males by both sexes is established "beyond a reasonable doubt" (McKee and Sherriffs, 1959:356). Self-concept in this instance was defined more in terms of self-liking of one's gender-role stereotype, however.

An extensive examination of the literature among younger age groups reveals contradictory evidence, however. Research among fourth to tenth grade youngsters reveals either that (1) Girls have a
greater self-esteem than boys; or (2) Only in the tenth grade is there a lower self-concept among females (Bledsoe, 1967; Bohan, 1973). The latter finding was in relationship to male peers as well as to younger females. A reevaluation of self may be taking place in which the young female comes to realize that the gender-role she is assuming is relatively inferior. The findings of Bledsoe and Bohan could, of course, simply reflect conceptual and methodological differences. Additionally, there is some support (correlations were consistently positive but small) for the position that eighth and ninth grade youngsters' self-evaluations reflect their parents' evaluations of them (Helper, 1958). Generalizing from any of these efforts is, of course, difficult.

Additional reviews of the literature (Holter, 1970; Wylie, 1963) provide the following insights: females have more modest self-estimates of ability than males even when they are doing well; self-descriptions of females are less favorable than are those of males; a sense of worthlessness is fairly widespread among females. Both sexes evaluate the attributes of females less favorably than those of males even though girls show a comparable distribution of IQ scores and possibly a superior distribution of grades, and receive at least a proportionate share of visible academic honors.

Brookover et al. (1967:20) have noted the apparent contradictions which emerge depending upon which aspect of self-concept is
An examination of research on whether there are sex differences in self-concept discloses what appear to be contradictory findings . . . . When the self-concept instrument taps conforming social behavior, a higher level of self-concept for females . . . . When the instrument taps specific self-definitions of academic ability, lower scores are observed for girls . . . .

Brookover et al. (1962, 1965, 1967), in their own research, found that self-concept of academic ability was significantly correlated with academic performance. This particular effort followed an entire class of approximately 1500 students from junior high school through three years of high school. A major finding was that changes in self-concept of ability were followed by changes in academic achievement. Additionally, the researchers noted specific self-concepts of ability related to specific areas of academic role performance which differed from the general self-concept of academic ability.

With reference to race, Throckmorton, in a review of the literature (1975) notes that it is possible to point to three sets of findings regarding self-concept of ability scores among black and white children: (1) Blacks have a higher self-concept than whites; (2) Whites have a higher self-concept than blacks; and (3) There is no difference between the two groups. The latter finding was the conclusion reached in his own research as well as that of Coleman (1961). Throckmorton notes that these three variations could be related to
differing theoretical and methodological conceptions, sampling and scale construction. Ages of subjects in these research efforts ranged from four to eighteen.

**Self-Concept in Relation to Science/Mathematics**

To date, far more research has been conducted within the area of mathematics than within science for the eighth grade age group. As previously noted, while males and females do not appear to differ on measures of general intelligence, sex differences in mathematics achievement tests are repeatedly found in adolescent and adult populations (Aiken, 1976; Maccoby & Jacklin, 1974a; Fox, 1975; Keeves, 1973). These differences as well as the disproportionate number of males (in relation to females) pursuing mathematical and scientific careers have, until recently, been perceived as a natural consequence of innate sex differences in aptitude for those fields.

Currently, a host of sociocultural variables are being explored. These include: (1) the role of parents, schools, peers, and the mass media in the socialization process of females; (2) differential exposure to mathematical games and activities outside of school (Fox, 1975); (3) differential course taking, attitudes and interests, especially of the perceived usefulness of mathematical science for future plans by males and females; (4) stereotype of mathematics as male domains; (5) support or non-support from significant others by females. Fox (1976b) notes that having the support of significant
others is necessary to encourage girls who have somewhat deviant (i.e., rare or masculine) career interest; and (6) attitudes, values, and self-confidence of females (Fox, 1976a).

In a review of the literature Fox (1976a) notes that numerous studies have found sex differences with respect to particular tasks. Males tend to rate themselves higher on academic achievement tasks; females on measures of social competence. In general, males and females tend to value males' efforts more than females', especially in the fields considered the province of males. Additionally, when males succeed, they attribute success to their abilities and skills; females, on the other hand, assume they have been lucky, not skillful. They perceive failure as a result of their own lack of ability (Deaux, 1976; Fennema, 1978; Dornbusch, 1974; cited in Ernest, 1975).

The findings of sex differences in self-concept of ability in mathematics and science are thus consistent with the general findings on sex differences in self-confidence. One research effort notes that while elementary school students are likely to believe that their own sex is best in all subjects, by high school both sexes perceive males as superior in mathematics (Ernest, 1975). Perceived parental evaluations by females of their mathematics and science ability in the eighth grade affect not only their self-concept in those areas but also decisions at a future point in time (11th and 12 grades) to elect...
science or mathematics courses (Kaminski, 1975, 1978). Additionally, the self-concept of females tends to decrease with age so that even when they are actually performing better than males in mathematics, they tend to rank themselves lower in ability (Fennema, 1974).

Striking sexual and racial differences in self-rating of specific science-related abilities are noted in the Purdue Opinion Panel survey of high school students throughout the nation in public and private schools (Erlick & LeBold, 1975). As can be seen in Table 2.1, for all of these science related abilities, males rate themselves higher than females; whites, higher than blacks. Black females have the lowest self-concept in these areas. This suggests that this group may indeed experience a double jeopardy. Those high school students (10th, 11th, and 12th grades) who were even somewhat considering science, mathematics, or engineering careers (41% of the females; 59% of the males) reported above average assessments in all of these and other categories as well (such as drive to achieve and academic ability). Females were more likely to prefer the biological or medical sciences; males were three times more likely than females to prefer future employment in mathematics, architecture, engineering, and the physical sciences.

The results of a cross-cultural effort undertaken in 1964 and 1970 by the International Association for the Evaluation of Educational Achievement are worth noting. The following countries participated
### Table 2.1

<table>
<thead>
<tr>
<th>Self-Concept of Specific Abilities</th>
<th>Percent with Above Average Self-Concept</th>
<th>Females</th>
<th>Males</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>White</td>
<td>Black</td>
<td>White</td>
</tr>
<tr>
<td>Mechanical Ability</td>
<td></td>
<td>7</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Science Ability</td>
<td></td>
<td>14</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Problem Solving Ability</td>
<td></td>
<td>24</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>Mathematics Ability</td>
<td></td>
<td>29</td>
<td>19</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: Erlick & LeBold, 1975

Both years: Australia, Belgium, England, Finland, the Federal Republic of Germany, Japan, Netherlands, Scotland, Sweden, and the United States. The size of the samples exceeded 1000 students in most cases; approximately 30 students were sampled from each school. Groups used consisted of 10-year-olds, 14-year-olds, terminal secondary, and first year university. Questions of generalizability could be raised on many counts. At any rate, the findings, while not particularly surprising, are of interest: (1) Although there is some variation among countries, males generally perform better in both mathematics and science; in some instances the gap widens with age. Gaps are much more pronounced in the physical than in the biological sciences; (2) Males have more interest and favorable attitudes toward both mathematics and science (the researchers note...

Summary

In this section material related to the self-concept generally as well as subject specific (science and mathematics) self-concept of ability has been examined. While parents play an important initial role in how a child comes to perceive self, others play a part as well as the socialization process proceeds. Difficulties because of lack of comparability of research studies have been noted and discussed. Evidence suggests that both females and males perceive the masculine role in a more positive fashion; that females more frequently have a sense of worthlessness and a lower concept of self even when they are performing well. Researchers do not always make it clear, however, whether a relationship generally exists between a sense of worthlessness and a lower self-concept or whether the researchers have made that assumption.

Specific self-concepts of ability related to specific areas of academic role performance can be delineated as well as a relationship between self-concept of academic ability and academic performance. Various sociocultural variables are being explored to explain the generally more positive self-concept and superior performance by males in science and mathematics.

A few final caveats: many of these research efforts utilized
very small samples or sample size is not indicated. Students of urban and suburban middle income schools seem to be popular subjects for research (for perhaps obvious reasons).

Perception of the Relevance of Science/Mathematics and of These as Male Domains

Research has been sparked by the finding that until around Grade 7 there are no sex differences in mathematics achievement. During the early school years the two sexes are similar in their acquisition of quantitative concepts and skill in arithmetic (Wozen-craft, 1963, found that in some groups girls, in fact, surpass boys). Around age 12 or 13, however, generally boys' mathematical skills increase faster than girls (see Maccoby & Jacklin, 1974a; Hilton & Berglund, 1974; Maccoby, 1966). Emphasis upon mathematics is stressed as it functions as a critical filter, an entry point, and tends to eliminate females from many fields—chemistry, physics, engineering, medicine, among others (Ernest, 1975; Sells, 1974). In a review of the literature, Kaminski (1978) notes evidence of a similar drop in performance in girls in science at this general age level.

While researchers with a maturation-developmental orientation might hypothesize that males simply catch up during this period, to this observer a more fruitful approach is to utilize a social-psychological, sociological approach which examines sociocultural variables and the socialization process of the two sexes. Some researchers contend that one's perceived gender-role is a critical determiner in
differential mathematics learning at this period, and that increasing
priority is given by both males and females for the development of
a personally workable gender-role. (Fennema & Sherman, 1976).

As noted throughout this paper, girls are bombarded with messages
that their mission in life is to be attractive and feminine, to catch a
man, and not to compete with males in masculine pursuits. A cru­
cial underlying assumption is that any career, scientific or otherwise,
for any female is merely an intermission from her real job--to
keep house, rear children, and care for her husband (Science: A
Man's Job?; 1973).

Overview of Literature

Evidence regarding attitudes toward and interest in mathe­
matics and science appear to be somewhat contradictory and involve
a complex array of variables. One research effort (Ernest, 1975)
noted that while boys tend to prefer science and girls English,
mathematics was the only subject that exhibited no sex differences
as far as preferences. The researcher hypothesizes that males
take more mathematics not for the superficial reason that they like it
more than do females, but rather that males are aware that such
courses are necessary prerequisites to the kinds of future occupa­
tions they envision for themselves (Hilton & Berglund, 1971, have
made somewhat similar conclusions).

Even though the assumption (Sherman, 1976) that females are
never highly motivated in terms of mathematics performance seems unwarranted; currently among high school students females are still far less likely than males to take trigonometry, plane geometry, chemistry, physics, and mechanical drawing. This is of interest since these same high school students verbalize quite liberal attitudes regarding female career roles and the fields of mathematics/science as Table 2.2 shows (Erlick & LeBold, 1975). Only a very small percentage of either sex, however, indicated intentions of becoming a scientist (3% of the females and 6% of the males). (See Ahlgren & Walberg, 1973, for some evidence of the increasingly unfavorable attitudes toward physics of high school students generally.)

The belief that mathematics is a male domain touches the very core of the issue of gender-role socialization and mathematics achievement. In a review of the literature Fox (1976a) notes that the two major hypotheses often offered as sociocultural explanations for sex differences in this area are the masculine identification thesis and the cultural reinforcement thesis. In the first hypothesis interest and achievement in mathematics are assumed to result from identification with the masculine role. This hypothesis relates to the issue of achievement motivation. It is argued that boys and girls who identify with their fathers or a generalized masculine gender-role are either better at mathematics than those with a feminine identification or at least are better mathematically than verbally.
Table 2.2
Attitudes of High School Males and Females Toward Female Career Roles

<table>
<thead>
<tr>
<th>Approval or Agreement with Issues</th>
<th>Total %</th>
<th>Male %</th>
<th>Female %</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you feel about careers in science fields for females?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approve?</td>
<td>89</td>
<td>83</td>
<td>94</td>
</tr>
<tr>
<td>Women should stick to &quot;women's jobs&quot;</td>
<td>19</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Women have as much science ability as men do.</td>
<td>70</td>
<td>63</td>
<td>78</td>
</tr>
<tr>
<td>Women are as interested in mathematics as are men</td>
<td>63</td>
<td>55</td>
<td>72</td>
</tr>
<tr>
<td>Women have the ability and endurance to make successful space flights</td>
<td>43</td>
<td>32</td>
<td>54</td>
</tr>
<tr>
<td>I approve of appointing a woman as chairman of the Atomic Energy Commission</td>
<td>34</td>
<td>24</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Erlick & LeBold, 1975

Research which has attempted to deal with this issue is not in total agreement; a major source of confusion seems to lie with the definition of masculine identification. Also, findings are often difficult to interpret because of measurement problems involved. In sum, Fox (1976a) contends that the evidence in support of the first hypothesis is not "overwhelmingly impressive."

The second hypothesis also assumes that mathematics is a masculine domain; females, therefore, receive less encouragement.
from society and may be inhibited from achieving. To Fox (1976a) this seems to be a more logically consistent argument. With reference to this argument, it has already been noted that a potential conflict between academic achievement and popularity exists for many females (Coleman, 1961; Hawley, 1971, 1972; Komarovsky, 1946, 1953; Mathews & Tiedeman, 1964; Keniston, 1964). While anecdotal evidence may exist in support of Horner's fear of success construct (1971) for females, severe criticism has been leveled at it because of technical flaws and failures to replicate. Levine and Crumrine (1975:971-972) have concluded their critique with the following remarks:

The motive to avoid success is accepted as a discovered and proven fact and is now working its way into standard sources as conventional wisdom . . . .

Failures to replicate are rarely published, and hypotheses temporarily invulnerable to the normal adversarial procedures of science may quickly attain mythical status.

(See Tresemer, 1976, for an extensive review of the fear of success literature. Also Kanter, 1977, has contended that fear of visibility may be a more viable explanation for females who are tokens in predominantly masculine fields.)

Certainly the rejection of science or advanced mathematics classes by females may be the result of complex motives. Although the fear of success construct may lack documentation, there is ample evidence that females who wish to appear feminine are more
comfortable in task situations that are labeled feminine or at least neutral than in those labeled masculine. The sex-typing of mathematics and science leads to differential expectations for males and females with respect to success in classes. These self-perceptions are reinforced by the behavior and expectations of teachers, peers, and parents (Fox, 1976a: 75-76).

A Columbia University professor who was influenced by stereotypes earlier in her life comments:

Why didn't I study mathematics at age 21? I felt it was not a "feminine" thing to do. I'm afraid that it seems to me that this is a continuing problem for many young women (quoted in Ernest, 1975:21).

Another mathematician makes the following comments regarding societal stereotypes (the word scientist could easily be substituted for mathematician):

Many people on hearing the words "female mathematician" conjure up an image of a six-foot, grey haired, tweed suited, oxford clad woman . . . . This image, of course, doesn't attract the young woman who is continually being bombarded with messages, direct and indirect, to be beautiful, "feminine", and "catch a man" (quoted in Ernest, 1975:20).

Two current developments need to be mentioned: (1) a spate of promotional materials are appearing which not only encourage women to consider careers in science, but picture women in these occupations--astronomy, physics, engineering--discussing them (see I'm Madly in Love with Electricity, 1977; Women in Science and Technology, 1975; Parents: Protect Your Children's Future.
Have them take Algebra and Geometry in High School, 1975).

(2) There is some evidence that mathematics and science are not viewed as unfeminine as they were in an earlier era. At least on the verbal level, females attest to their right to enter any field. The evidence, on the other hand, suggests, though, that male prejudice against females entering these fields either still exists or females believe it exists (Erlick & LeBold, 1975; Fennema and Sherman, 1977; Farley, 1968, cited in Fox, 1976a). The end result is the same whichever is the real situation: many females will choose other career options, possibly those seen as more traditional and, thus, more acceptable.

Of interest here is one effort done at San Diego State University which points to differences between those females preparing for traditional as opposed to non-traditional careers. Hawley (1971; 1972) found that females preparing for the former (e.g., teaching) believe significant males in their lives dichotomize attitudes and behaviors into male-female categories. They thought males, in other words, viewed behavior as appropriately male or female. Those preparing for non-traditional careers (e.g., mathematics/science majors) believe males do not see sex as a determinant of attitudes and behavior. These females believed males feel females should be free to compete with males in all areas, even those traditionally considered male domains. (No generalizations are, of
course, possible.)

Summary

The fact that boys do not generally start to excel in mathematics until around the eighth grade can be explained within a maturational perspective as attributed to a catching up process. To this researcher a more useful explanation lies in focusing upon sociocultural variables. A long process of messages delivered and received culminates in a young female's perceiving her role to be that of a feminine, attractive person who is preparing for her primary role—that of wife and mother.

Evidence indicates that many women do display less interest in mathematics/science and/or see these as irrelevant to their lives. High school females are still less likely to take advanced mathematics and science courses even though both females and males verbalize relatively liberal attitudes toward females' capabilities in and the appropriateness of their entering these fields.

Career Awareness/Interests

Occupational stereotyping by sex and ethnicity is perceived by many in our society today as one of the most flagrant inequities in the present occupational structure. Since very young children are not only aware of some of these stereotypes, but accept them as well, this serves to perpetuate traditional employment patterns in this
country (Leifer & Lesser, 1976). One team of researchers has expressed concern by suggesting the predictibility test: when a boy is born, it is difficult to predict what he will be 25 years hence. He will be permitted to fulfill and develop his own unique potential, especially if he is white and middle-class. If the newborn is a girl, however, one can usually predict with confidence how she will be spending her time 25 years later. Her individuality does not have to be considered, it is irrelevant (Bem & Bem, 1974:17). Within this framework, then, one can review the evidence.

Overview of the Literature

After an extensive review of the literature, Leifer and Lesser (1976) conclude that while young children know about relatively few of the many potential occupational choices available to them, they do understand the status hierarchy of the occupations they know about, and accept the traditional assignment of males and females into this structure. Even in the absence of specific information about occupations in the early grades, girls seem to know they are operating at a disadvantage.

While there is little information on preschoolers, girls in the early elementary grades show a far narrower range of aspired-to occupations than boys. The latter frequently select two-to-three times as many occupations as girls. While boys want to be pilots, engineers, doctors, craftsmen, and scientists, girls want to be
teachers, librarians, nurses, and stewardesses. Likewise, stereotypes are common to both sexes in terms of appropriate occupations for one sex or the other. A female's place is clearly not fixing autos or television sets or designing buildings.

Additionally, even though girls may opt for career choices, they tend to emphasize marriage and family, and seem unable or unwilling to translate these into consequences for their own lives. (Parenthetically, it can be noted that a long-term commitment both to marriage and a meaningful career outside the home is still highly problematic for many young females. Traditional gender-role expectations still place the entire responsibility on the female for household and child care arrangements.) Boys tend to focus much more extensively on details of a job or career; domestic life is ignored. Fox (1976a) notes that it is interesting that so many males perceive a conflict between family and career responsibilities for females but not for themselves.

By around the fifth or sixth grade there is some evidence to suggest that both sexes are inculcated with a gender-typed view of home and household (Iglitzin, 1973; Schlossberg & Goodman, 1972). Iglitzin's research was done in Seattle; Schlossberg & Goodman's in a model cities project (unspecified) and a predominantly middle and upper-middle class school. They note that youngsters in the middle class school stereotyped less than those in the model cities
project.

The breadth of stereotyping (and its invidious effects) is further evidenced by one research effort in which three to six-year-olds were asked the question, "What would you want to be when you grow up if you were a girl (boy):" This small sample (63) consisted of youngsters living in a middle-class suburban community (not identified) with a minimal ethnic mix. The modal family was one in which the father worked at a male-defined occupation (professions, manual work) while the mother remained at home. These children have all been born since the beginning of the women's movement. While the girls did have an answer for the above question, the boys often regarded the interviewer suspiciously, or with outright astonishment. Further, some of them did not even want to think about it. A rather regular response was "that's a weird question, you know." There was a good deal of nervous laughter, and, in two cases, openly expressed anguish. "One of these little boys put his hands to his head and sighed. 'A girl?' he asked. 'A girl?' again. 'Oh, if I were a girl I'd have to grow up to be nothing'." (Beuf, 1974:144)

There is some evidence that black youngsters do not stereotype their occupational choices in the same way as whites. Data gathered 25 years apart (Gray, 1944; Clark, 1965; Barnett & Baruch, 1973, cited in Leifer & Lesser, 1976) found the occupational aspirations for girls to be higher than those for boys. Clark's effort involved
third to sixth grade boys (N = 165) and girls (N = 139) in a Black Higher Horizon School in New York City who were given the Vocational Aperception Test. His conclusions, perhaps reflecting his own biases, were that the choices—especially of the girls—reflected unrealistic aspirations and fantasy choices. He further notes that 59% of high achieving boys did not express a level of aspiration comparable to girls.

Race and sex, in addition to their separate effects, seem to interact in complex ways to affect early career awareness. Research done thirty years ago found that, unlike white girls, black girls rarely choose housewife as their future occupation (Gray, 1944). More recent evidence (Clark, 1967) notes that lower status black girls do not perceive the role of housewife as a separate occupation as do middle-class white girls for whom this was the third most popular ranking. There is tentative evidence that black elementary children perceive the need to be better educated than whites (Hindelang, 1970) to qualify for the job. (Today many females, it might be noted parenthetically, perceive this same situation with reference to themselves). Although as noted earlier black parents are strongly motivated to gain occupational opportunities for their children, they are not always certain as to how best to help their children set goals or take the necessary steps. This is, of course, a problem faced by many parents in other sociocultural settings. Leifer and Lesser
(1976) note that research in the realm of career choices is virtually lacking among other minority groups. Certainly caution is advised in generalizing from the research done on blacks.

Self-concept and sense of competence are obviously of primary importance in career choice. To the extent that self-concept is stereotyped by one's sex and/or race, one's occupational orientation may be similarly stereotyped. Evidence indicates that young girls may underestimate their own abilities and personal qualifications for entering higher-status occupations, and also make decisions differently. The more prestigious a young boy considers an occupation to be, the more likely he is to consider it; a girl's preference, on the other hand, is either negatively or unrelated to her perception of the occupation's prestige. The implication seems to be that girls consider themselves unworthy of prestigious occupations and/or consider these inaccessible to them. If the feminist movement is acting as a catalyst in this realm, changes are apparently not yet reflected in the research in the perception of young white children (Leifer & Lesser, 1976; Barnett & Baruch, 1973, cited in Leifer & Lesser, 1976). As alluded to earlier, there are indications that young girls are eager to compete and achieve when the tasks set for them are defined as neutral or feminine. When, however, the tasks are defined as masculine (as most prestigious occupations have been) girls retreat to their "stereotypical lack of motivation" (Stein,
If role conflicts, negative stereotypes, a low self-concept, and absence of role models are barriers to the development of career interests in some other areas, they are compounded in mathematics and science. It is no accident that there are so few women scientists. The process of selecting professionals in the field begins at an early age—and girls are excluded. For a variety of reasons (some of which have been detailed here) few females even consider careers in scientific fields. The selection of occupations, then, is in part the outcome of a self-fulfilling prophecy: widely defined by themselves and others as inappropriate candidates for scientific careers, females are less apt to go into science, and choose occupations more in line with prevailing expectations. In doing so, they confirm beliefs about their inclinations and apparently about their capacities as well (Science: A Man's Job?, 1973; Zuckerman & Cole, 1975).

Two final comments: (1) While biographical materials of female scientists which give background characteristics (including a discussion of the parents) are interesting to read and perhaps provide some insights, it is not possible to make any generalizations. Kundsin (1973) for example, has a section entitled "Individual Life Experiences" with sketches by a woman meteorologist, chemist, physicist, etc.; (2) Even some of the more useful collections of articles about science as a career seem to reflect various male biases. While
Eiduson and Beckman (1973), for example, have a very small section devoted to alternate career patterns (blacks and females), the collection as a whole reflects science as a male enterprise (the persistent usage of the pronoun he conveys the subtle message that scientists are male). Even though the introduction includes a section on role conflicts, no discussion ensues of the conflicts experienced by females between their ascribed and achieved statuses. (For a collection that does address itself to some of these issues see Marrett, David & Robin, 1975.)

Summary

Occupational stereotyping by sex and ethnicity is still widespread in our society. The fact that young children internalize and accept these stereotypes seems--in essence--to perpetuate traditional employment patterns. From a very early age differences exist in terms of what are seen as appropriate occupations by each sex for each sex. Girls seem to internalize early an image of themselves as losers and as unworthy of prestigious occupations. (Boys internalize a similar image of the girls.) Additionally, girls seem to assume and to accept the fact that working outside the home means, in essence, taking on two careers. While girls are eager to compete and achieve when the tasks set for them are defined as neutral or feminine, they retreat if the tasks are seen as masculine. Black youngsters apparently do not stereotype their occupational choices in the same way as
Problems generally encountered by females in occupational entry-role conflicts, negative stereotypes, etc., are compounded for those considering mathematics and science careers. A blaming the victim and a self-fulfilling prophecy may set in which serve to confirm the beliefs society holds about the interests and capacities (or lack of) of females in these fields.

The tentativeness of many of these findings and the difficulties in comparing should again be stressed.

Relative Contribution of Parents, Teachers, and Peers

As noted earlier, communication failure does take place so that actual and perceived evaluations and expectations of significant others are not always in accord. As to the relative effect of significant others, various kinds of support can be found for one or the other as more salient. Parents are often assumed to be the more salient, with peers and teachers less potent as changers of attitudes than as reinforcers of attitudes already shaped by the home and the larger societal milieu (Fox, 1976a; Leifer & Lesser, 1976). Additionally, an increasing congruency has been observed between the perceived evaluations of parents, teachers, and friends as students move from the seventh to the tenth grade (Brookover et al., 1965).

Overview of the Literature

Some of the research done at the secondary level has assumed
that a student's age-grade peers provide the dominant point of reference for that person. Coleman (1961) and McDill and Coleman (1965) assume that peers are the dominating source of influence as adolescents. Implicit in their research is the point of view that the norms and expectations of the adolescent are not only different from those of adults, but also control the academic behavior of the adolescent. While this notion that sees the peer group as a counter culture that opposes, resists, or ignores the influences of adults has become widespread, some evidence indicates that in the career and occupational realm, the influence that peers do exercise more often supports the attitudes of adults in these areas (Douvan & Adelson, 1966; Kandel & Lesser, 1972; Leifer & Lesser, 1976). Also, research indicates that the family and other adults in some circumstances may have influence equal to or greater than that of the peer group (Joiner et al., 1969a; Simpson, 1962). Further, the contention is made that to characterize the adolescent period as a subculture at all is inappropriate (Callahan & Robin, 1969).

This is not to suggest that the peer group has no clout at all. Certainly it plays a central role in matters of taste, dress, leisure activities, and certain social values (Leifer & Lesser, 1976). However, some evidence suggests that even in these areas of behavior parents also function as significant others.

Brookover and his associates, in their six-year study of junior
and senior high school students (1962, 1965, 1967) suggest that overall, perceived parental evaluations of students' academic ability are more highly related to the students' self-conceptions of their ability in this realm than are friends or teachers although there was some variation depending on grade level. The proportion of students naming friends as significant others increased somewhat during the six-year period as did the influence of friends on students' self-concept of ability. Less than half of the students identified teachers and other school personnel as significant others in junior high; the proportion declined in later years. In somewhat similar research on general academic ability among Grand Rapids eighth graders, Franklin et al. (1978) found perceived parental evaluations of greater salience than teachers, which, in turn, were greater than peers.

In the related area of career and occupational goals, research indicates that most adolescents and young adults list their parents (usually same sex) as most responsible for their career choices (Pallone, Hurley & Rickard, 1973; Pallone, Rickard & Hurley, 1970; Jensen & Kirchner, 1955; Peters, 1941). In the Peters research friends were listed second and teachers third. The efforts of Pallone et al. (1973, 1970) found teachers to be the third or fifth choice depending on the group (the sample consisted of whites, blacks, and Puerto Ricans) while buddy or close friend was fourth or sixth depending on the group. While in some research teachers
are not cited at all, and the adolescents involved do not perceive teachers as salient, this does not necessarily mean that they do not play a role (Leifer & Lesser, 1976). Certainly, as noted in Rosenthal and Jacobson (1968), teacher expectations can be very important.

Most of the research on external influences upon career choice study them in isolation from each other. Rarely are parents, peers, schools and teachers, and the media examined in combination. In addition, most have been retrospective and used the students as their own informants.

A final comment on the role of parents and peers in this process:

Peers offer opportunities for fun and companionship; reinterpret parental directives in terms more meaningful to adolescents and specify behaviors and outlooks in areas left to them by parents; and offer a sphere in which the adolescents . . . can begin their careers of winning the respect of others. Parental influence varies according to the issue involved . . . It is misleading to speak of separate adolescent cultures or of general peer versus parental influences. For certain values or areas peers may be more influential than parents; for other issues the reverse may be true (Kandel & Lesser, 1972).

Kandel and Lesser's research was based upon survey data gathered from adolescents, their parents, and their best school friends in Denmark and the United States. While the study was designed as a replication and an extension of Coleman's work, as the quote indicates, they did not find a separate youth subculture.

Summary

Some support can be found in the research literature for the
importance of perceived parental evaluations on the academic self-concepts held by youngsters. The issue is a complex one; however, teachers and friends are also involved in the evaluation process.

While older research points to an adolescent sub- or counter-culture that supposedly controls the academic life of the student, newer research casts doubt upon this assumption. Evidence indicates that while peers certainly have input in some facets of the adolescent's life, they tend to agree or go along with parental decisions in the academic realm.

In terms of career choices, students often list parents as their most significant other. While teachers are sometimes not perceived as important in this realm, their effect may be more indirect.

Conclusions

The symbolic interaction theoretical framework has been utilized in this research effort since its concerns and concepts are compatible with the major focus of this study. The literature reviewed clearly points to a differing socialization process for males and females from birth onward. Significant others as well as additional agents play a part in this process, which has many implications for future roles and future decision-making in the life of the young female. The traits valued for females seem to be antithetical to developing an interest in and pursuing a career in mathematics/science. A process begun by parents is reinforced by the schools.
and by one's peers (or at least some male peers on the part of females). Females do not see mathematics/science as relevant to their concerns and/or see them as male domains. Research findings are tentative and fragmentary in many areas.

The Hypotheses

The hypotheses are drawn from the theoretical, and, in some cases, the empirical literature, and seem to flow from the body of literature discussed.

**Hypothesis I:** There is a positive relationship between perceived parental evaluations of science ability and self-concept of science ability.

**Sub-Hypothesis I:** The association between perceived parental evaluations of science ability and self-concept of science ability will be higher when parents believe doing well in science is important than when they do not.

**Hypothesis II:** There is a positive relationship between perceived teacher evaluation of science ability and self-concept of science ability.

**Sub-Hypothesis II:** The association between perceived teacher evaluation of science ability and self-concept of science ability will be higher when teachers believe doing well in science is important than
Hypothesis III: There is a positive relationship between perceived best friend evaluations of science ability and self-concept of science ability.

Sub-Hypothesis III: The association between perceived best friend evaluations of science ability and self-concept of science ability will be higher when friends believe doing well in science is important than when they do not.

Discussion of Main Hypotheses

In stressing the salience of human interaction and of humans as actors and reactors in this process, the symbolic interactions highlight the part played by those seen as significant others in how humans come to see their worlds including their concept of self. There is a continuing process of action, reaction, assessments, and feedback. In the socialization process children come to perceive the expectations of significant others; these perceived expectations will have an effect on the person's self-concept and what is ultimately done in terms of decision-making behavior. How one defines the situation in terms of the expectations of significant others will be real to the definer and has an effect on self-concept.

With reference to the framework of Brookover and his associates and the self-concept of specific subject areas, one can note that role
taking is involved in this process; one views self from the standpoint of others and sees self as an object. These respondents of eighth grade females may evaluate their science ability in part by taking the role of parents, teachers, or friends and making an assessment as they think these significant others might. Cues of various sorts—overt or covert, explicit or implicit—are important here. The Brookover research has provided some evidence of the part played by parents, teachers, and friends in the process. Friends seem to play an increasing role as youngsters move from junior high to high school. The teacher's effect seems to be more indirect in some cases. Conceivably social class, ethnic, and sex variables come into play here. In some cases parents and teachers may be mutually reinforcing. Parents of different social classes have differing patterns of interaction with the schools. In some cases teachers may initially define the situation, not parents. ("Your child is a slow learner" or "She likes to play with the boys' toys, not with dolls like the other girls."")

Discussion of Sub-Hypotheses

These hypotheses utilize the control variable of the perceived importance of doing well from the standpoint of one's significant others, i.e., parents, teachers, and friends, and what effect perceived importance has on one's self-concept of science ability. Of relevance with reference to parents is the support found in both the
sociological and the political science literature for the process of the intergenerational transmission of various values and attitudes.

Importance of doing well may be conveyed, and, in turn, internalized as an appropriate value. Additionally, humans internalize a conception of the importance of each role they play based upon a complex process involving cues received and the perceived evaluations and expectations (including what is seen as important) of significant others.

The theoretical framework utilized in this research posits that humans take certain postures toward their world on the basis of their assumptions about themselves in relation to their environment. Further, Cooley's "looking-glass self" enters into this process and provides a frame of reference for anticipating and evaluating new experiences. The socialization process of females as analyzed in the preceding section is of particular importance here. Affective relationships and the desire to please are of paramount importance in the dependency relationship of females. The literature notes that both in school and by parents girls are rewarded for conforming and doing well within prescribed limits. Even among females whose presentation of self is fairly strong and positive, there is a tentativeness and a need for positive feedback. (See Lakoff, 1975, for differences between males and females in language patterns, intonation, etc.)

Hypothesis IV: There is a direct effect between perceived...
Hypothesis V: There is an indirect effect of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability through parental, teacher, and best friend importance attached to doing well in science.

Hypothesis VI: The direct effects of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability will vary by race and socioeconomic position.

Hypothesis VII: The indirect effects of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability through perceived parental, teacher, and best friend importance attached to doing well in science will vary by race and socioeconomic position.

Discussion

The last set of hypotheses extends and amplifies the first set of hypotheses by scrutinizing both the direct and the indirect effects of the independent variables upon each other and upon the dependent
variable, self-concept of science ability. The cumulative effect of all variables upon the dependent variable is of concern also. Examination of these various paths helps the researcher to assess the relative contribution of parental, teacher, and friend evaluations, controlling for race and socioeconomic status.

As noted, some researchers contend that the importance of social class and ethnic variables as predictors of differential evaluations and expectations on the part of parents has been overdrawn, and that all parents desire that their children do well. With reference to blacks, there is some support in the literature for the following: (1) Black parents (especially mothers) may stress higher education more for their daughters than for their sons; (2) Black females themselves have higher occupational aspirations than black males; (3) Black females may experience a somewhat different socialization pattern (one which stresses independence) in comparison with white females.

As noted earlier, the relative effect of the perceived evaluations of parental, teacher, and friend evaluations may be difficult to sort out. It is quite possible that one or the other of these significant others is more salient to youngsters of a particular ethnic group or social class. Use of the variable of importance as an intervener enables the researcher to assess its contribution to the total evaluation process. An intervening variable may, of course, strengthen
or depress the original (direct) hypothesized relationship.

All of the hypotheses reflect the theoretical assumption implicit in the symbolic interaction framework that the evaluations of significant others affect one's evaluation of self. Additionally, the variable of importance is seen as a logical intervener between evaluations and the resulting self-concept.
CHAPTER III
RESEARCH METHODS

The purpose of this chapter is to present and discuss the research methods used to study the relative contribution of the perceived evaluations of science ability by parents, teachers, and friends on the self-concept of science ability held by eighth grade females in the Grand Rapids public schools. Discussion includes the following: the research site and the research population; the instrumentation; the variables; and analysis of the data including testing of the hypotheses.

Research Site

The Grand Rapids, Michigan public school system was selected as the research site because it represents a large metropolitan school district and because data important to this study were made available. Grand Rapids, Michigan, supposedly mirrors the ethnic diversity of cities like Detroit, but is far more accessible to Kalamazoo and is of a more manageable size. It is the second largest Michigan city (population about 200,000) and has the second largest public school system. It is the Kent County seat. Grand Rapids is often referred to as a "working class" city, with considerable ethnic and racial diversity. The various ethnic groups include:
Polish, Dutch, native American, Hispanic, Black, and very small Lithuanian, Serbian, and Oriental communities.

Because of a sizable number of Roman Catholic and Christian Reformed families, a large proportion of white youngsters are enrolled in schools maintained by these two denominations. A great variety of government, business, and industrial jobs are available in the area. Several institutions of higher learning are either within the confines of the city or are within commuting distance. In the two-year period from 1974-1976 the total city population declined approximately 10,000 persons. At the same time, the number of households in the city increased, and the average family size shrunk. The household and family size findings appear consistent with the following national trends: although large-scale migration from rural areas to urban areas has apparently slowed, migration from central cities to surrounding suburbs continues at a rapid pace. Indications are that larger families are leaving the central cities at a more rapid rate than smaller families. The latter tendency, combined with overall birth rates, are reflected in an older central city population (Center for Educational Studies, n. d.).

The Research Population

This research involves the eighth grade female population of the Grand Rapids Public Schools in the 1976-1977 school year. Two groups from the population were excluded from the research.
effort: those absent from school the day the questionnaire was administered and special education students who were not taken out of their special education classes to fill out a questionnaire.

Nine of the schools in the city have an eighth grade. It is difficult to characterize many of the nine schools of the research population by social class since many of them serve the center city as well as outlying middle and upper-income areas because of busing. The schools are located throughout the following types of Grand Rapids neighborhood areas which have been identified: (1) Growth neighborhoods characterized by above average household income, higher-priced housing, white collar occupations, and an absence of households with only elderly occupants; (2) Aging neighborhoods characterized by blue collar occupations, lower incomes and housing values, some deterioration and a fairly high percentage of households with only elderly occupants; (3) Staging areas characterized by low-wage, low-skill occupations with a general absence of white-collar occupations. Few households with only elderly occupants are located in the staging area. "Sustained high vacancy rates" tend to be a typical phenomenon as are a high proportion of low-skill occupations and no occupation indicated (the latter term is believed to indicate unemployment); (4) Mature neighborhoods: while generalizations are difficult, these areas tend to have a "disproportionate number of professional and managerial households living in older housing structures
with low housing turnover and little deterioration"; and (5) city center neighborhood, which is characterized as a renewal or regrowth neighborhood (Center for Educational Studies, n. d.).

**Race, Sex, Age**

Two of the schools are small, have no busing program, are predominantly middle-class, and over 75% white, and closely resemble suburban schools. One of the center city schools is approximately 99% black. Because of a bilingual program, one inner city school has most of the native American and Hispanic students. Table 3.1 indicates that the racial population of Grand Rapids is 88% Caucasian; 11% black, and 0.7% other. If one compares these proportions with the racial composition of the eighth grade public school population it is apparent that the proportion of blacks in the public schools is greater than is the proportion of blacks in the City of Grand Rapids. Table 3.2 indicates that blacks constitute 27% of the male eighth grade public school population and 29% of the female eighth grade population.

This distribution is reasonable to expect since because of higher birth rates and a lower median school age, black children are a larger group proportionately in the schools than that minority is in the population.

Two additional factors can be noted: (1) Some of the more affluent upper-middle class families live in the suburbs perceived as prestigious (East Grand Rapids, for one); (2) Some middle and
Table 3.1

Racial Composition, City of Grand Rapids

<table>
<thead>
<tr>
<th>Race</th>
<th>Population</th>
<th>% of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>174,025</td>
<td>88.0</td>
</tr>
<tr>
<td>Black</td>
<td>22,296</td>
<td>11.3</td>
</tr>
<tr>
<td>Other</td>
<td>1,328</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>197,649</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 3.2

Grand Rapids Eighth Grade Public School Respondents by Race, 1976-1977

<table>
<thead>
<tr>
<th>Race</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>White</td>
<td>575</td>
<td>66</td>
<td>558</td>
<td>65</td>
</tr>
<tr>
<td>Black</td>
<td>236</td>
<td>27</td>
<td>250</td>
<td>29</td>
</tr>
<tr>
<td>Other</td>
<td>54</td>
<td>7</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>865</td>
<td>100.0</td>
<td>856</td>
<td>100.0</td>
</tr>
</tbody>
</table>

...upper-middle class youngsters attend a parochial school, more probably the Christian Reformed denomination. The latter denomination may have a larger middle-class membership than does the Roman Catholic Church. Both of these factors work to siphon off
middle and upper-middle class families from the public school route. The move to the suburbs and the attendance at parochial schools such as the Christian Reformed denomination has probably been primarily a white phenomenon since blacks as well as many other minorities are still disproportionately clustered in the lower end of the socioeconomic scale in our society. For example, the median income for minority families in 1976 was $9,821 in contrast to a median income of $15,537 for white families (U.S. Commission on Civil Rights, 1978).

A breakdown by race within the category of age is presented in Table 3.3. The following can be noted: (1) Age for both whites and minorities ranges from 11 through 16 years; (2) The mode for both groups is 13; (3) The age distribution for whites and minorities is quite similar, with the latter group having smaller percents in ages 13, 14 and 16 (only .2% for the latter age) and a larger percent for age 12.

Table 3.4 alerts the researcher to the fact that the eighth grade population is about equally divided between males and females. One can note from Table 3.5 that the age distribution for males and females is quite similar. There are no females in age 11, however, and a larger cluster in age 13 (a 5% differential for the latter category).

**Females' Racial Composition**

A breakdown within the female population by race is presented
### Table 3.3

Grand Rapids Eighth Grade Respondents by Race Within Age, 1976-1977

<table>
<thead>
<tr>
<th>Age</th>
<th>White</th>
<th>Minority</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>.2</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>115</td>
<td>10.0</td>
<td>99</td>
</tr>
<tr>
<td>13</td>
<td>666</td>
<td>58.8</td>
<td>310</td>
</tr>
<tr>
<td>14</td>
<td>318</td>
<td>28.1</td>
<td>159</td>
</tr>
<tr>
<td>15</td>
<td>28</td>
<td>2.5</td>
<td>18</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>.4</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1133</td>
<td>100.0</td>
</tr>
<tr>
<td>558</td>
<td>100.0</td>
</tr>
<tr>
<td>1721</td>
<td>99.9</td>
</tr>
</tbody>
</table>

### Table 3.4

Grand Rapids Eighth Grade Respondents by Sex, 1976-1977

<table>
<thead>
<tr>
<th>Sex</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>865</td>
<td>50</td>
</tr>
<tr>
<td>Females</td>
<td>856</td>
<td>50</td>
</tr>
</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1721</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 3.5

Grand Rapids Eighth Grade Respondents by Sex Within Age, 1976-1977

<table>
<thead>
<tr>
<th>Age</th>
<th>Male N</th>
<th>Male %</th>
<th>Female N</th>
<th>Female %</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>3</td>
<td>.3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>.1</td>
</tr>
<tr>
<td>12</td>
<td>111</td>
<td>12.8</td>
<td>103</td>
<td>12.0</td>
<td>214</td>
<td>12.4</td>
</tr>
<tr>
<td>13</td>
<td>469</td>
<td>54.2</td>
<td>507</td>
<td>59.2</td>
<td>976</td>
<td>56.8</td>
</tr>
<tr>
<td>14</td>
<td>249</td>
<td>28.8</td>
<td>228</td>
<td>26.6</td>
<td>477</td>
<td>27.8</td>
</tr>
<tr>
<td>15</td>
<td>29</td>
<td>3.4</td>
<td>17</td>
<td>2.0</td>
<td>46</td>
<td>2.6</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>.5</td>
<td>1</td>
<td>.1</td>
<td>5</td>
<td>.2</td>
</tr>
<tr>
<td></td>
<td>Total 865</td>
<td>100.0</td>
<td>Total 856</td>
<td>99.9</td>
<td>Total 1721</td>
<td>99.9</td>
</tr>
</tbody>
</table>

In Table 3.6. Nearly two-thirds of the female population are white while slightly over one-third are in the minority category.

Table 3.6

Grand Rapids Eighth Grade Female Respondents Racial Distribution

<table>
<thead>
<tr>
<th>Racial Category</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>558</td>
<td>65</td>
</tr>
<tr>
<td>Minority</td>
<td>298</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>856</td>
<td>100.0</td>
</tr>
</tbody>
</table>

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Table 3.7 reveals that within the minority category 84% are black with small representation among other groups.

Table 3.7
Grand Rapids Eighth Grade Minority Female Respondents, Distribution by Race

<table>
<thead>
<tr>
<th>Race</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>250</td>
<td>84.0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>11</td>
<td>4.0</td>
</tr>
<tr>
<td>Oriental</td>
<td>6</td>
<td>2.0</td>
</tr>
<tr>
<td>Native American</td>
<td>10</td>
<td>3.0</td>
</tr>
<tr>
<td>Other</td>
<td>21</td>
<td>7.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>298</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Instrumentation

The Data

A questionnaire of 99 items based on instrumentation developed by Brookover et al. (1962, 1965, 1967) was administered to all eighth grade students as the first part of a five-year longitudinal study entitled "The Effects of Schooling and Culture on Disaffiliation Career Development," with Edsel Erickson as Principal Project Director and Donna Kaminski as Associate Project Director. The questionnaire included items on parental, teacher, and friend evaluations of ability, surveillance, educational aspirations and educational expectations,
importance attached to doing well, as well as items tapping school climate. The items used in this research came out of the larger questionnaire (see Appendix B for the complete questionnaire and Appendix A for the items used in this research).

Initially Wilbur Brookover and his associates were involved in a three project research program at Michigan State University on various facets of the self-concept of academic ability construct. The three projects represented continuous phases of a six-year study on the relation of self-concept of academic ability to school achievement among students in one school class while in the seventh through the twelfth grades. The research site was Lansing, Michigan. A self-concept of academic ability scale was devised as were subject specific scales of ability (such as self-concept of science--mathematics, English--ability).

Brookover's interest in developing items and scales was sparked by two factors: what he saw as an increasing emphasis in our society upon the need for people with high levels of both general and technical education existing alongside a pervasive common sense assumption that only a relatively constant proportion of humans in our society are capable of high level learning. Brookover took the position that few people achieve anywhere near the level set by their innate capacities. He researched one factor he considered salient in preventing humans from working at their maximum level, i.e.,
the student's self-concept of his/her learning ability (Brookover et al., 1962). Brookover's social psychological theory of learning is delineated elsewhere (Brookover, 1959) and has already been discussed in this dissertation.

After pretesting by Brookover and his associates, the self-concept of academic ability scale and the subject specific scales were reduced to eight items. Several versions of the original scales with slight modifications have been used and are currently extant. Analysis of the academic self-concept items yielded reproducibility coefficients of .95 for males and .96 for females. The mathematics scale was also analyzed and yielded a reproducibility coefficient above .90. As the subject specific scales correlated with subject specific achievement in the anticipated fashion, no further analyses of these scales were undertaken (Brookover et al., 1967).

Items for the Grand Rapids questionnaire were selected by Edsel Erickson and Donna Kaminski. Two questions were taken from each of the subject specific scales of Brookover and his associates. Time limitations in terms of being able to finish the questionnaire in one class period prevented inclusion of all the items in each scale. The question of what happens when scale items are taken out of context is of relevance here. The two self-concept of science ability items used were in the second and in the last position in the original scale so they were not adjoining. Some sociologists
contend that taking items out of context makes a different scale. Throckmorton (1975) utilized a subscale of three items (first, middle, and last in terms of position) of the mathematics and of the spelling scales of Brookover and his associates. In a factor analysis done by Throckmorton on these items the factor loadings ranged from .81 to .89. On the basis of this evidence at least, it seems reasonable to assume a high level of consistency among the items in the subject specific scales.

The decision by this researcher to use the perceived evaluations of significant others as independent variables stemmed from the findings of Brookover et al. (1962, 1965, 1967) and, as noted, are consistent with and flow out of the assumptions of the symbolic interaction framework. Additionally, a decision was made to add importance as a control and as an intervening variable after consultations with the researcher's Doctoral Committee. The importance variable was added to the self-conceptualization model by Robert Bilby, a graduate student, who worked with both Wilbur Brookover and Edsel Erickson. Additionally, other researchers have used this variable as providing input into the evaluations - self-concept process.

As noted, the present research endeavor utilizes the female eighth grade population of the Grand Rapids public schools. As discussed in Chapters I and II, many changes are confronting youngsters at this time in their lives. Developmental research points to cogni-
tive changes and attempts to strive for an "identity" and to combine "personal desires with social demands" (Piaget & Inhelder, 1969; Erikson, 1968). Dating patterns may emerge, with many youngsters attempting to define and work out an appropriate gender-role for themselves.

The following variables were taken out of the larger questionnaire to be used in this research: sex (only females were used); ethnic identity; occupation of parents to assess a socioeconomic position; and items relating to self-concept of science ability; perceived parental, teacher, and best friend evaluations of science ability; and perceived importance attached by parents, teachers, and best friends to doing well in science.

A briefing session was held for the Western Michigan University graduate students involved in the administration of the questionnaire. Before the questionnaire was administered, permission slips were sent home with all eighth grade youngsters to be signed by parents. Refusals were less than 1% of the population. If at all possible, two graduate students administered the questionnaire in each classroom. A brief explanation of the study was given at the beginning of the period, and students were urged to ask questions if they did not understand a question. They were also urged to be as specific as possible about parental occupation(s). The response rate for males and females varied among the nine schools. The lowest response rate
for the nine schools was 66%; the highest, 88%. The mean response rate for all the schools was 80.6%. As noted, students absent the day the questionnaire was administered did not fill one out nor did special education students in special education classes.

Data were coded, put on a computer tape, and statistical analysis was ultimately performed through the Computer Center at Western Michigan University. Coding was done by the Assistant Project Director with the assistance of other graduate students. Twenty questionnaires were not used since only one or two pages had been filled out. For the 1721 questionnaires that were used, missing data were filled in with the mean value of the particular variable involved, e.g., if the question on teacher importance were left blank on a questionnaire, the coder filled in the mean response for that question.

The Variables

Sex. As noted, only females were utilized. The question asked: "Are you a boy or a girl?"

Race. This item asked "What is your ethnic background?" There were nine possible responses (see Appendix A). Since there were so few respondents who responded other than white or black, the non-white categories were collapsed and included within black. Thus, two categories were used: white and minority.

Occupation of the Parent(s). Students were asked "If your parent(s) work, what kind of job do they have?" As noted, respondents
were asked to be as specific as possible. Father's occupation was used to determine the occupational position of the respondent's family. If this were blank or respondent indicated that father was unemployed, deceased, or separated from mother, then mother's occupation (if given) was used. If an occupation given by a respondent was not listed in the scale, coders attempted to categorize it as closely as possible with the best fit in terms of educational requirements and salary or wage (Computer Programmer and Systems Analyst were two such occupations encountered; these were coded Professional, Technical, and Kindred Workers). Also, if the occupation question were left blank, if both parents were not employed, or if the answer(s) were illegible, a score of nineteen was assigned to that question.

The socioeconomic index used was O. D. Duncan's Socioeconomic Scale for All Occupations (see Reiss et al., 1961). This scale uses the occupations detailed in the 1950 Census Population as well as a transformed North Hatt (NORC) prestige rating of occupations. The latter, first utilized in 1947 and replicated in 1962, has been widely used. Duncan, however, notes certain drawbacks: (1) Since the scale was designed to represent a range of occupational prestige, it was not designed to include all occupations; (2) Traditional female occupations are not included. The socioeconomic index suggested by Duncan is one that combines the available information on education and income levels of persons engaged in the several occupations.
Additionally, this approach weighs the age distribution of each occupation using the age-specific education and income patterns respectively as weights. Further, the index was designed to have: (1) Face validity in terms of its consistent variables; and (2) Sufficient predictive efficiency with respect to the NORC occupational prestige ratings that it can serve as an acceptable substitute for the latter.

The scale ranges from 02 to 96. Parental occupations were divided into quartiles of approximately the same size. The quartiles, rankings, and some of the occupations included are as follows:

1. Lowest: 03-16: roofers and slaters, laundry and dry cleaning operatives, truck drivers, paperhangers, janitors, porters, waiters, charwomen, farm laborers (wage), coal mining laborers.


4. Fourth (highest): 51-96: editors and reporters, stock and bond salesmen, librarians, musicians and music teachers, chiropractors, bankers, architects, lawyers, recreation
and group workers.

It should be made clear that this is not equivalent to the social class designations frequently used in sociology. Because Grand Rapids is a predominantly working class community and some students are siphoned off into the parochial schools, the highest occupational category here reflects a wide range of occupations. Additionally, as noted, many upper-middle class families live in the more affluent suburbs. If a rough grouping were made using social class designations, the highest would encompass upper-middle to lower-middle; the third category, lower-middle and working; the second category, working; and the lowest, lower class with some working class.

The range of parental occupations for the eighth grade females was similar to that for the range of the Duncan Scale. The lowest score for parental occupation of these youngsters was 03; the highest 96.

Additionally, a breakdown by socioeconomic position of family of these youngsters within race was compiled. Table 3.8 provides the following information: (1) Parents of white females are clustered in the higher occupational quartiles while parents of minority females are clustered in the lower occupational quartiles; (2) The range of percentage spread among the four occupational quartiles is greater for minority parents than is the range for white parents (13% to 37%
for minority parents; 19% to 32% for white parents).

Table 3.8
Female Eighth Grade Respondents by Race and Occupational Position of Parents

<table>
<thead>
<tr>
<th>Duncan Scale Occupational Position (Quartiles)</th>
<th>Racial Category</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
<td>Minority</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Highest (4th)</td>
<td>174</td>
<td>32</td>
<td>38</td>
<td>13</td>
</tr>
<tr>
<td>Next Highest (3rd)</td>
<td>175</td>
<td>31</td>
<td>57</td>
<td>19</td>
</tr>
<tr>
<td>Next Lowest (2nd)</td>
<td>103</td>
<td>18</td>
<td>92</td>
<td>31</td>
</tr>
<tr>
<td>Lowest (1st)</td>
<td>106</td>
<td>19</td>
<td>111</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>558</td>
<td>100</td>
<td>298</td>
<td>100</td>
</tr>
</tbody>
</table>

Additionally the socioeconomic variable was dichotomized for purposes of hypothesis testing. The choice of cut-off points in the Duncan Scale was based upon the percent of respondents in the range of occupations. An attempt was made to use cut-off points that reflected a division of the population into halves. Thus, the Duncan Scale values ranging from 02-23 included approximately one-half, 48%, of the respondents. The Duncan Scale values ranging from 24-96 included 52% of the respondents. Therefore, respondents whose parental occupations fell within the 02-23 range were categorized as of low socioeconomic position; those respondents whose parental occupations fell within the 24-96 range were categorized as of
high socioeconomic position. It is apparent that the high socioeconomic category encompassed a wide range of occupations.

As noted, respondents were also dichotomized by race into two categories: white and minority. Table 3.9 presents the breakdown of eighth grade females dichotomized both by race and socioeconomic position.

Table 3.9
Eighth Grade Female Respondents Dichotomized by Race and Socioeconomic Position

<table>
<thead>
<tr>
<th>Socioeconomic Position</th>
<th>Racial Category</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>White</td>
<td>Minority</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>349</td>
<td>62</td>
<td>95</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>209</td>
<td>38</td>
<td>203</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>558</td>
<td>100.0</td>
<td>298</td>
</tr>
</tbody>
</table>

The following can be noted: (1) While 62% of the white females are in the high socioeconomic position category, 32% of the minority females are in that category; (2) While 68% of the minority females are in the low socioeconomic position category, 38% of the white females are in that category; (3) The clustering of the white females in the two higher occupational quartiles and the clustering of minority females in the two lower occupational quartiles probably reflects the occupational and educational discrimination still experienced by
minority groups in our society.

As noted in Chapter I, the evaluation and self-concept questions were conditional in nature and reflect a future "completion of the act" consistent with the Meadian tradition. The meanings, thus, attached to conditional questions are conceivably quite different from the meanings attached to a straightforward question such as "How do your parents evaluate you in science?"

**Perceived Parental Evaluation of Science Ability.** This variable was measured by the female's response to the question "Do your parent(s) say you can do schoolwork in science better, the same or poorer than other students your age?" Responses ranged from the highest, "among the best" to the lowest, "among the poorest." Because of the paucity of responses in the two lower categories, they were collapsed into one category. Thus, four categories ranging from highest to lowest resulted: "among the best," "better," "the same," and "poorer," or "among the poorest."

**Perceived Teacher Evaluation of Science Ability.** This variable was measured by the female's response to the question "Does your Science teacher say you can do schoolwork in science better, the same, or poorer than other students your age?" Responses ranged from the highest, "among the best," to the lowest, "among the poorest." Because of the paucity of responses in the two lower categories, collapsing identical to that done for parental evaluations was done so
the following four categories resulted: "among the best," "better," "the same," and "poorer," or "among the poorest."

Perceived Best Friend Evaluation of Science Ability. This variable was measured by the female's response to the question "Does your best friend say you can do schoolwork in science better, the same, or poorer than other students your age?" Responses ranged from the highest, "among the best," to the lowest, "among the poorest." Because of the paucity of responses in the two lower categories, collapsing identical to that done for parental and teacher evaluations was done so the following four categories resulted: "among the best," "better," "the same," and "poorer" or "among the poorest."

Table 3.10 presents the frequency distribution of responses for parents, teachers, and friends on the evaluation question. The following can be highlighted: (1) Respondents most frequently (roughly around 50%) see parents, teachers, and friends as rating the respondents about the same as other eighth grade students with reference to work they can do in science; (2) Roughly one-third of the respondents see parents, teachers, and friends as rating respondents better than other eighth graders with reference to work they can do in science; (3) In contrast to parents and teachers, friends are more frequently seen by respondents as rating respondents the same as or poorer than other eighth graders; (4) Few significant others are perceived as rating respondents either as the poorest or as the best.
Table 3.10

Perceived Parental, Teacher and Best Friend Evaluations of Science Ability Held by Eighth Grade Female Respondents

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Parents</th>
<th>Teachers</th>
<th>Friends</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
</tr>
<tr>
<td>Among the best</td>
<td>84 10</td>
<td>86 10</td>
<td>74 9</td>
</tr>
<tr>
<td>Better than other 8th grade students</td>
<td>291 34</td>
<td>325 38</td>
<td>259 30</td>
</tr>
<tr>
<td>The same as other 8th grade students</td>
<td>452 53</td>
<td>411 48</td>
<td>495 58</td>
</tr>
<tr>
<td>Poorer or among the poorest</td>
<td>29 3</td>
<td>34 4</td>
<td>28 3</td>
</tr>
</tbody>
</table>

**Self-Concept of Science Ability.** This variable was measured by adding the female's responses to two questions: (1) "Think of all the students in the eighth grade in your school. What kind of schoolwork do you think you could do in science compared to your classmates?" The range of scores from high to low was as follows: "I am among the best," "I am better than most," "I am average," "I am below average," and "I am among the poorest." (2) "What kinds of grades do you think you really could get in science?" The range of scores from high to low was as follows: "Mostly A's," "Mostly B's," "Mostly C's," "Mostly D's," and "Mostly E's."

The combined items total ranged from a high score of ten to
a low score of two. Because of the paucity of responses in the lower ranges of the possible total, the lower (2-5) scores were collapsed into one category. Thus, six categories for the combined scores resulted. Table 3.11 highlights the following: (1) Few response scores fall at either the high or the low ends of the continuum (5% or 6%); (2) 60% of the respondents place themselves in the middle of the continuum in terms of the range of scores.

Table 3.11

<table>
<thead>
<tr>
<th>Combined Scores</th>
<th>Self-Concept of Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>High 10 &quot;Among the best,&quot; &quot;Mostly A's&quot;</td>
<td>47</td>
</tr>
<tr>
<td>9 Some combination of 10 and 8</td>
<td>166</td>
</tr>
<tr>
<td>8 &quot;Better than most,&quot; &quot;Mostly B's&quot;</td>
<td>230</td>
</tr>
<tr>
<td>7 Some combination of 8 and 6</td>
<td>282</td>
</tr>
<tr>
<td>6 &quot;Average,&quot; &quot;Mostly C's&quot;</td>
<td>86</td>
</tr>
<tr>
<td>Low 5-2 &quot;Below average&quot; or &quot;Among the poorest,&quot; &quot;Mostly D's and E's&quot;</td>
<td>45</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>856</strong></td>
</tr>
</tbody>
</table>

Perceived Parental Importance Attached to Doing Well in Science.

This variable was measured by the female's response to the question "How important is it to your parent(s) that you do well in science?"
Responses ranged from the highest, "very important" to "important" to "not too important" to the lowest, "it doesn't matter to my parents at all."

Perceived Teacher Importance Attached to Doing Well in Science. This variable was measured by the students response to the question "How important is it to your science teacher that you do well in science?" Responses ranged from the highest, "very important" to "important" to "not too important" to the lowest, "it doesn't matter to my teacher at all."

Perceived Best Friend Importance Attached to Doing Well in Science. This variable was measured by the student's response to the question "How important is it to your best friend that you do well in science?" Responses ranged from the highest, "very important" to "important" to "not too important" to the lowest, "it doesn't matter to my friends at all."

Table 3.12 presents the frequency distribution of responses for parents, teachers, and friends on the importance question. The following can be noted: (1) Roughly four-fifths of the respondents see their parents and teachers as considering doing well in science as important or very important. However, only slightly more than one-third of the respondents see their friends as attaching importance or high importance to doing well in science; (2) While only one-fifth or less of the respondents, on the other hand, see parents and teachers
as not attaching much importance to doing well in science, nearly
two-thirds of the respondents see their friends as not attaching much
importance to doing well in science; (3) Overall, then, the pattern for
friends' responses as seen by respondents is different from that for
parents and teachers, with friends seen as attaching less importance
to doing well in science; (4) The frequency distribution of responses
for parents, teachers, and friends on the evaluation variable (Table
3.10) and on the importance variable (Table 3.12) highlights a differ-
ence. While at least 80% of parents and teachers are seen by respond-
ents as attaching high importance to doing well in science, less than
half (44% or 48%) of the parents and teachers are seen as evaluating
respondents' science abilities highly.

Table 3.12
Perceived Parental, Teacher, and Best Friend Importance
Attached to Doing Well in Science Held by Eighth Grade
Female Respondents

<table>
<thead>
<tr>
<th>Importance</th>
<th>Parents N</th>
<th>%</th>
<th>Teachers N</th>
<th>%</th>
<th>Friends N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>279</td>
<td>33</td>
<td>229</td>
<td>27</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>Important</td>
<td>456</td>
<td>53</td>
<td>462</td>
<td>54</td>
<td>249</td>
<td>29</td>
</tr>
<tr>
<td>Not too important</td>
<td>110</td>
<td>13</td>
<td>133</td>
<td>16</td>
<td>410</td>
<td>48</td>
</tr>
<tr>
<td>It doesn't matter at all</td>
<td>11</td>
<td>1</td>
<td>32</td>
<td>4</td>
<td>147</td>
<td>17</td>
</tr>
</tbody>
</table>
Analysis of the Data

The implications of using a research population instead of a research sample are discussed, followed by a discussion of all hypotheses and sub-hypotheses and the method(s) by which each was tested and what was considered support for each hypothesis.

Usage of a Research Population

In sociology samples are generally used to represent populations for reasons of economy and because selection of a sample is often feasible when complete enumeration of a population is not. While a research effort based upon data from a population distribution may be seen as the ideal by some researchers, for pragmatic reasons a sample distribution is more frequently used. When sample data are used, tests of statistical significance or estimates of the parameter are performed. These tests merely supply the researcher with a probability figure that can be used in making a decision about whether it is possible to generalize beyond the sample to the population from which the sample was drawn.

If a researcher has a population distribution, however, one theoretically has a complete set of data, and the task of the researcher is to describe and analyze the relationships among the variables in that population. Tests of statistical inference are not appropriate as one is not concerned with generalizing from a sample to a population. The summarizing measures from the complete enumerations of
characteristics of populations are known as parameters. Since they are based on complete enumerations of the relevant data, these parameters are theoretically accurate and constant even though the researcher is aware that they are subject to errors of various kinds and are not really constant (measurement errors, for one). In spite of the discrepancy between theory and empirical reality, parameters are treated as though they are accurate (Loether & McTavish, 1974a and 1974b).

**Hypotheses I, II and III**

These hypotheses posit a positive relationship between perceived parental, teacher, and best friend evaluation of science ability and self-concept of science ability. For all three hypotheses, thus, self-concept of science ability is the dependent variable, and perceived parental, teacher, and friend evaluations the independent variables. Each of these hypotheses was tested with usage of the Gamma measure of association.

Gamma is a normed or standardized measure of association appropriate for ordinal level variables; its value varies from -1.00 to +1.00. It is a "symmetric measure indicating the relative preponderance of like (unlike) ranked pairs among pairs ranked differently on both variables" (Loether & McTavish, 1974a: Figure 7.8). Additionally, Gamma is a PRE (proportionate reduction in error) measure. Loether and McTavish (1974a:212) note that PRE measures
Ratios of the amount of error made in predicting under two situations: first, the situation where there is not more information than simply the distribution of the dependent variable itself, and secondly, a situation where there is additional knowledge about an independent variable and the way the dependent variable is distributed within the categories of that independent variable. PRE measures simply state the proportion by which one can reduce errors made in the first situation by using information from the second situation.

Following Davis (1971:49), the following cutting points were used to indicate strength of the Gamma association: .70 or higher --- very strong; .50 to .69 --- substantial; .30 to .49 --- moderate; .10 to .29 --- low; .01 to .09 --- negligible; .00 --- no association.

Davis uses these terms in characterizing different values of Yule's Q, which is virtually synonymous in function with Gamma. Yule's Q, however, is generally used with 2 x 2 tables while Gamma is used with R x C tables.

In discussing bivariate relationships one can point to four characteristics of an association: (1) The existence—if the distribution of one variable differs in some respect between at least some of the categories of the other variable; (2) The degree (strength) of the association; (3) The direction, e.g., direct or inverse; and (4) The nature or general pattern, e.g., an association may be linear or curvilinear (Loether & McTavish, 1974a:185-192).

Sub-Hypotheses I, II and III

Sub-Hypotheses I, II, and III use the importance variable as a
control and posit that the relationship between perceived parental, teacher and friend evaluations and self-concept of science ability will be strengthened if parents, teachers, and friends are seen as attaching high importance to doing well in science. In all three sub-hypotheses the self-concept of science ability is the dependent variable and perceived parental, teacher, and friend evaluations are the independent variables.

Each of these sub-hypotheses was tested using the Gamma measure of association and controlling for the variable of importance. Two contingency tables were constructed for each of the independent variables and the dependent variable. The first table in each set controlled for low importance; the second, for high importance. The Gammas for the two tables were then compared to see what, if any, difference existed. The following were used as cut-off points for support of each of the sub-hypotheses: .00 between the Gammas indicated no support; .01 to .09 difference indicated support.

**Hypotheses IV through VII**

These hypotheses were tested with the usage of a path model. Up to this point the variables in the research have been largely treated as ordinal, i.e., those designed to include the features of nominal variables, but which, additionally, can be ordered or ranked. Interval level variables, on the other hand, include the logical and ranking features of nominal and ordinal variables; additionally, the
scale of measurement of an interval variable is defined in terms of
a standard unit size. Loether and McTavish (1974a:17) note, how-
ever, that "definition of a unit which can be unambiguously detected
and counted is a difficult undertaking." Further they note that

Much of statistics implies the use of interval level scores,
and because of the added powers of these procedures, there
is a strong motivation to use these techniques whenever they
can be justified.

In a path analysis a decomposition process, so to speak, takes
place in which direct and indirect effects of variables singly and in
combination are examined. The Beta or path weights indicate the
amount of change in the dependent variable (in this case, self-concept
of science ability) that is associated with a unit change (one standard
deviation) in a given independent variable over and above the contribu-
tion of the other independent variables to the dependent variable. The
decision to assume an interval level for these data in order to utilize
a path model stems from the fact that the response categories in the
variables used do represent a considerable spread. Additionally,
since in a path analysis the computations are automatically standard-
ized, this standardization process makes the data as interval as is
possible. A path analysis, thus, simply involves use of standardized
regression equations in examining a theoretical model(s).

The objective is to compare a model of the direct and indirect
relationships that are presumed to hold between several variables to
the observed data in a research effort so that the fit of the model to
the data can be examined. Path analysis, then, provides a very pertinent way of relating theory and data when several or many variables are to be handled simultaneously (Loether & McTavish, 1974a). As noted, the direct and indirect impact of variables upon the other variables can be examined and the scope of the research endeavor is, therefore, enlarged. Hopefully, this enables the researcher to explain more and provides greater insights regarding the social world under consideration.

One sociologist notes the following:

Path analysis provides a theoretical model specified as a system of simultaneous equations which are linear, additive, and, usually, recursive. Any sociological thinking, whether or not labeled "theory," which conceptualizes phenomena in terms of "variables" and relations between variables can be and in fact ought to be directed toward this kind of expression . . . . Path analysis is an important step in an important direction precisely because it forces systematic and explicit theoretical work (Boyle, 1971:451).

Boyle's interest in spurring sociologists on to use path analysis involved some interesting experimentation on his part in which he took interval level data and data in which interval level were assumed and then compared the path coefficients as well as the path regression coefficients. The results were remarkably similar.

The theoretical model for this path analysis was based upon the assumption that the perceived evaluations of those seen as significant others, i.e., parents, teachers, and friends, play a role in the self-conceptions that eighth grade females have of their own science
ability. Further, the assumption was made that since females' concept of self emanates from the perceived evaluations of others and cues are relevant in this process, the perceived importance attached by significant others to doing well in science functions as an intervening variable between evaluations and the resulting self-concept of science ability.

Zero-order correlations were computed as input for the path analyses. In all cases the direct path weights (for Hypotheses IV and VI) and the indirect path weights (for Hypotheses V and VII) from each of the independent variables to the dependent variable—self-concept of science ability—were examined.

The following cut-off points were established to use in support of Hypotheses IV and V: direct or indirect positive path weights of .00 to .09 indicated no support; path weights of .10 to .39 indicated support. A path weight of .09 or less indicates that for every standard unit of change in the independent variable, no change takes place in the dependent variable. Path weights of .10 to .39 indicate that some modest change does take place.

Hypothesis IV posits a direct relationship between perceived parental, teacher, and best friend evaluations and self-concept of science ability. Thus, the three direct paths from parental, teacher, and friend evaluations to self-concept of science ability were examined. Hypothesis V posits an indirect relationship between parental,
teacher, and best friend evaluations and self-concept of science ability going through the intervening variable of parental, teacher, and friend importance attached to doing well in science. Thus, three indirect paths were examined: parental evaluation through parental importance to self-concept of science ability (P evaluation → P importance → SCSA); teacher evaluation through teacher importance to self-concept of science ability; (T evaluation → T importance → SCSA); friend evaluation through friend importance to self-concept of science ability (F evaluation → F importance → SCSA).

For Hypotheses VI and VII direct and indirect path weights of less than .10 were considered too weak to be meaningful. In comparing path weights that were at least .10 in size, any difference was considered to support the hypothesis. The direct path weight for parental evaluations for white females of high socioeconomic position, for example, was .1565; that for minority females of high socioeconomic position was .1525. This difference was interpreted as supporting the hypothesis. Although a comparison of these path weights does not reveal marked change, it does represent a slight shift.

Hypothesis VI posits that the direct effects of perceived parental, teacher, and friend evaluations of science ability on self-concept of science ability will vary by race and socioeconomic position. This hypothesis was tested by using a path analysis. As a result of
dichotomizing the variables of race and socioeconomic position of respondents, four groups of females were identified for whom direct and indirect path weights were computed: white females of low socioeconomic position; white females of high socioeconomic position; minority females of low socioeconomic position; minority females of high socioeconomic position.

Hypothesis VII posits that the indirect effects of perceived parental, teacher, and friend evaluations of science ability and self-concept of science ability going through the intervening variable of perceived parental, teacher, and friend importance attached to doing well in science will vary by race and socioeconomic position of respondents. Thus, three indirect paths were examined and compared for each of the four groups of respondents: white females of low socioeconomic position; white females of high socioeconomic position; minority females of low socioeconomic position; minority females of high socioeconomic position. The indirect paths examined were: parental evaluation through parental importance to self-concept of science ability (P evaluation $\rightarrow$ P importance $\rightarrow$ SCSA); teacher evaluation through teacher importance to self-concept of science ability (T evaluation $\rightarrow$ T importance $\rightarrow$ SCSA); friend evaluation through friend importance to self-concept of science ability (F evaluation $\rightarrow$ F importance $\rightarrow$ SCSA).
Summary

This chapter has presented the research methods used in this study. The data used are drawn from the first year data collected as part of a much larger longitudinal study which is to follow the eighth grade population of the Grand Rapids Public Schools through the high school years. The focus of this research is upon the female population at the eighth grade level, and follows the framework developed by Wilbur Brookover and his associates at Michigan State University on the self-concept of ability in subject specific areas. This research endeavor represents a collaboration of Western Michigan University with the Grand Rapids Public Schools, Office of Curriculum Planning and Evaluation. The nine schools utilized represent some neighborhood, ethnic, as well as socioeconomic diversity.

Items used have been drawn from a larger questionnaire administered by Western Michigan University graduate students during February, 1977. Coding and statistical analysis of the data were done at Western Michigan University. Duncan's Socioeconomic Index was used to code parental occupation(s). Variables used have been discussed; where appropriate, operational definitions have been given. The data were analyzed using seven hypotheses and three sub-hypotheses.

The Gamma measure of association was used to test Hypotheses and Sub-Hypotheses I, II, and III. The data were treated as interval
level to test Hypotheses IV through VII, and path analyses with four variations controlling for race and socioeconomic position of respondents were used.
CHAPTER IV
FINDINGS

This chapter gives a presentation of the findings in support or in non-support of each hypothesis and sub-hypothesis. The contingency tables using the Gamma measure of association to test Hypotheses I, II, and III are examined as well as the contingency tables using importance as a control variable to test Sub-Hypotheses I, II, and III. The path model for all respondents is examined as a measure of support for Hypotheses IV and V. Four variations of the path model which control for race and socioeconomic position of respondents are examined as a measure of support for Hypotheses VI and VII. The correlation coefficients tables used as input for the path analyses are included as are the coefficients of multiple determination ($R^2$) for the dependent variable in relation to the independent variables.

Hypotheses I, II and III

Hypothesis I: There is a positive relationship between perceived parental evaluations of science ability and self-concept of science ability.

The data in Table 4.1 lend support to Hypothesis I. The relationship is a positive (direct) one with a linear pattern. The Gamma measure of association (+.49) indicates a relationship of moderate
tending toward substantial strength. Support is found, therefore, for the importance of perceived parental evaluations on the self-concept of science ability held by eighth grade females.

With reference to Table 4.1, the following additional information can be highlighted: (1) The low parental evaluation, low self-concept cell contains 55% of the responses for that column; (2) The high parental evaluation, high self-concept cell contains 38% of the responses for that column; (3) The low parental evaluation, high self-concept cell is empty; the high parental evaluation, low self-concept cell is relatively empty (7%).

**Hypothesis II**: There is a positive relationship between perceived teacher evaluation of science ability and self-concept of science ability.

The data in Table 4.2 lend support to Hypothesis II. The relationship is a positive (direct) one with a linear pattern. The Gamma measure of association (+.56) indicates a relationship of substantial strength. Support is found, therefore, for the relevance of perceived teacher evaluations for the self-concept of science ability among eighth grade females.

Additionally, the following can be highlighted from Table 4.2: (1) The low teacher evaluation, low self-concept cell contains 47% of the responses for that column; (2) The high teacher evaluation, high self-concept cell contains 41% of the responses in that column;
<table>
<thead>
<tr>
<th>Parental Evaluations</th>
<th>Poorer or Among the Poorest</th>
<th>The Same as Others</th>
<th>Better than Most</th>
<th>Among the Best</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>12</td>
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<tr>
<td>Combination of 10 &amp; 8</td>
<td>1</td>
<td>4</td>
<td>50</td>
<td>11</td>
<td>90</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>10</td>
<td>135</td>
<td>30</td>
<td>77</td>
</tr>
<tr>
<td>Combination of 8 &amp; 6</td>
<td>4</td>
<td>14</td>
<td>197</td>
<td>43</td>
<td>78</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>17</td>
<td>50</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Low 5-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below average or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>among the poorest,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mostly D's or E's</td>
<td>16</td>
<td>55</td>
<td>17</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>100.0</td>
<td>452</td>
<td>100.0</td>
<td>291</td>
</tr>
</tbody>
</table>

Gamma = +.49
<table>
<thead>
<tr>
<th>Self-Concept Scores</th>
<th>Teacher Evaluations</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poorer or</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Among the</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poorest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Among the best,</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>mostly A's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Same as Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Combination of 10 &amp; 8</td>
<td>1</td>
<td>3</td>
<td>43</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Better than most,</td>
<td>3</td>
<td>9</td>
<td>114</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>mostly B's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Combination of 8 &amp; 6</td>
<td>4</td>
<td>12</td>
<td>185</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Average mostly C's</td>
<td>10</td>
<td>29</td>
<td>50</td>
<td>12</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Among the Best,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mostly D's or E's</td>
<td>16</td>
<td>47</td>
<td>17</td>
<td>4</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>34</td>
<td>100.0</td>
<td>411</td>
<td>100.0</td>
<td>325</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Gamma = .56
(3) The low teacher evaluation, high self-concept cell as well as the high teacher evaluation, low self-concept cells are empty; (4) The overall pattern of the relationship between perceived teacher evaluations of science ability and self-concept of science ability is quite similar to the pattern for perceived parental evaluation and self-concept of science ability.

**Hypothesis III:** There is a positive relationship between perceived best friend evaluations of science ability and self-concept of science ability.

The data in Table 4.3 lend support to Hypothesis III. The relationship is a positive (direct) one with a linear pattern. The Gamma measure of association (+.54) indicates a relationship of substantial strength. Support is found, therefore, for the importance of perceived best friend evaluations on the self-concept of science ability among eighth grade females.

Additionally, the following can be noted from Table 4.3: (1) The low friend evaluation, low self-concept cell contains slightly more than half (54%) of the responses for that column; (2) The high friend evaluation, high self-concept cell contains slightly over two-fifths (43%) of the responses for that column; (3) The high self-concept, low friend evaluation cell is empty while the low self-concept, high friend evaluation cell is relatively empty (3%); (4) The overall pattern for perceived friend evaluations is similar to that for per-
Table 4.3

Relationship between Perceived Best Friend Evaluations of Science Ability and Self-Concept of Science Ability among Eighth Grade Female Respondents

<table>
<thead>
<tr>
<th>Self-Concept Scores</th>
<th>Best Friend Evaluations</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poorer or Among the</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Among the Poorest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High 10</td>
<td>Among the best,</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>mostly A's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Combination of 10 &amp; 8</td>
<td>0</td>
<td>0</td>
<td>62</td>
<td>12</td>
<td>80</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>Better than most,</td>
<td>2</td>
<td>7</td>
<td>147</td>
<td>30</td>
<td>72</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>mostly B's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Combination of 8 &amp; 6</td>
<td>3</td>
<td>10</td>
<td>208</td>
<td>42</td>
<td>66</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Average</td>
<td>8</td>
<td>29</td>
<td>55</td>
<td>11</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>mostly C's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low 5-2</td>
<td>Below average or</td>
<td>15</td>
<td>54</td>
<td>21</td>
<td>4</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>among the poorest,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mostly D's or E's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>28</td>
<td>100.0</td>
<td>495</td>
<td>100.0</td>
<td>259</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Gamma = +.54
ceived parental and teacher evaluations and self-concept of science ability.

Summary

Hypotheses I, II, and III postulating a positive (direct) relationship between perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability are supported, with Gammas ranging from moderate to substantial in strength. The pattern for all three sets of significant others is similar, with a linear relationship in the distribution of responses.

Sub-Hypotheses I, II, and III

These hypotheses used the variables of perceived parental, teacher, and friend importance attached to doing well in science as control variables.

Sub-Hypothesis I: The association between perceived parental evaluation of science ability and self-concept of science ability will be higher when parents believe doing well in science is important than when they do not.

A comparison of the Gammas in Tables 4.4 and 4.5 in which parental importance is controlled reveals no support for Sub-Hypothesis I. While the Gammas for low importance and for high importance are positive and of moderate tending toward substantial strength, they
are the same (+.49) and the difference between them, thus, is zero. The relationship between perceived parental evaluation of science ability and self-concept of science ability, therefore, does not increase when parents are perceived as giving high importance to doing well in science.

Sub-Hypothesis II: The association between perceived teacher evaluation of science ability and self-concept of science ability will be higher when teachers believe doing well in science is important than when they do not.

A comparison of the Gammas in Tables 4.6 and 4.7 in which teacher importance is controlled reveals support for Sub-Hypothesis II. The Gamma for low importance in Table 4.6 is +.50 while the Gamma for high importance in Table 4.7 is +.57. Thus, the difference between the Gammas in the two tables is a positive .07. This is interpreted as providing support for the hypothesis. The association between perceived teacher evaluations and self-concept of science ability, therefore, increases modestly when teachers are perceived as giving high importance to doing well in science.

Sub-Hypothesis III: The association between perceived best friend evaluation of science ability and self-concept of science ability will be higher when friends believe doing well in
Table 4.4

Relationship between Perceived Parental Evaluations of Science Ability and Self-Concept of Science Ability for Eighth Grade Female Respondents, Controlling for Perceived Parental Importance Attached to Doing Well in Science

Parental Importance - Low

<table>
<thead>
<tr>
<th>Parental Importance</th>
<th>Self-Concept Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below Average or Among the Poorest, Mostly D's or E's</td>
</tr>
<tr>
<td>Very important</td>
<td>N</td>
</tr>
<tr>
<td>Important</td>
<td>0</td>
</tr>
<tr>
<td>Not too important</td>
<td>1</td>
</tr>
<tr>
<td>It doesn't matter to parents</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>

Gamma = +.49
<table>
<thead>
<tr>
<th>Parental Importance</th>
<th>Self-Concept Scores</th>
<th>2-5 Below Average or Among the Poorest, Mostly D's or E's</th>
<th>6 Average, Mostly C's</th>
<th>7 Combination of 8 &amp; 10</th>
<th>8 Better than Most, Mostly B's</th>
<th>9 Combination of 8 &amp; 6</th>
<th>10 Among the Best, Mostly A's</th>
<th>Total N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>N %</td>
<td>6 16</td>
<td>3 4</td>
<td>3 1</td>
<td>15 8</td>
<td>25 16</td>
<td>28 67</td>
<td>80 11</td>
</tr>
<tr>
<td>Important</td>
<td>N %</td>
<td>5 13</td>
<td>25 34</td>
<td>72 31</td>
<td>71 36</td>
<td>84 55</td>
<td>12 28</td>
<td>269 36</td>
</tr>
<tr>
<td>Not too important</td>
<td>N %</td>
<td>15 39</td>
<td>42 58</td>
<td>158 67</td>
<td>106 55</td>
<td>42 28</td>
<td>2 5</td>
<td>365 50</td>
</tr>
<tr>
<td>It doesn't matter to parents</td>
<td>N %</td>
<td>12 32</td>
<td>3 4</td>
<td>3 1</td>
<td>2 1</td>
<td>1 1</td>
<td>0 0</td>
<td>21 3</td>
</tr>
<tr>
<td>Total</td>
<td>N %</td>
<td>38 100.0</td>
<td>73 100.0</td>
<td>236 100.0</td>
<td>194 100.0</td>
<td>152 100.0</td>
<td>42 100.0</td>
<td>735 100.0</td>
</tr>
</tbody>
</table>

Gamma = +.49
Table 4.6

Relationship between Perceived Teacher Evaluations of Science Ability and Self-Concept of Science Ability for Eighth Grade Female Respondents, Controlling for Perceived Teacher Importance Attached to Doing Well in Science

Teacher Importance - Low

<table>
<thead>
<tr>
<th>Teacher Importance</th>
<th>Self-Concept Scores</th>
<th>2-5 Below Average or Among the Poorest, Mostly D's or E's</th>
<th>6 Average, Mostly C's</th>
<th>7 Combination of 8 &amp; 10</th>
<th>8 Better than Most, Mostly B's</th>
<th>9 Combination of 8 &amp; 6</th>
<th>10 Among the Best, Mostly A's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td></td>
<td>N 0 0</td>
<td>0 0</td>
<td>3 5</td>
<td>2 5</td>
<td>2 11</td>
<td>3 60</td>
<td>10 6</td>
</tr>
<tr>
<td>Important</td>
<td></td>
<td>3 16</td>
<td>4 18</td>
<td>13 23</td>
<td>14 32</td>
<td>7 39</td>
<td>2 40</td>
<td>43 26</td>
</tr>
<tr>
<td>Not too important</td>
<td></td>
<td>7 37</td>
<td>10 45</td>
<td>39 68</td>
<td>27 61</td>
<td>8 44</td>
<td>0 0</td>
<td>91 55</td>
</tr>
<tr>
<td>It doesn't matter to teacher</td>
<td></td>
<td>9 47</td>
<td>8 37</td>
<td>2 4</td>
<td>1 2</td>
<td>1 6</td>
<td>0 0</td>
<td>21 13</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19 100.0</td>
<td>22 100.0</td>
<td>57 100.0</td>
<td>44 100.0</td>
<td>18 100.0</td>
<td>5 100.0</td>
<td>165 100.0</td>
</tr>
</tbody>
</table>

Gamma = +.50
Table 4.7

Relationship between Perceived Teacher Evaluations of Science Ability and Self-Concept of Science Ability for Eighth Grade Female Respondents, Controlling for Perceived Teacher Importance Attached to Doing Well in Science
Teacher Importance - High

<table>
<thead>
<tr>
<th>Teacher Importance</th>
<th>2-5 Below Average or Among the Poorest, Mostly D's or E's</th>
<th>6 Average, Mostly C's</th>
<th>7 Combination of 8 &amp; 10</th>
<th>8 Better than Most, Mostly B's</th>
<th>9 Combination of 8 &amp; 6</th>
<th>10 Among the Best, Mostly A's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
<td>N %</td>
</tr>
<tr>
<td>Important</td>
<td>0 0</td>
<td>1 2</td>
<td>4 2</td>
<td>9 5</td>
<td>30 20</td>
<td>32 76</td>
<td>76 11</td>
</tr>
<tr>
<td>Not too important</td>
<td>9 35</td>
<td>21 33</td>
<td>73 32</td>
<td>88 47</td>
<td>83 56</td>
<td>8 19</td>
<td>282 41</td>
</tr>
<tr>
<td>It doesn't matter to teacher</td>
<td>10 38</td>
<td>40 62</td>
<td>146 65</td>
<td>87 47</td>
<td>35 24</td>
<td>2 5</td>
<td>320 46</td>
</tr>
<tr>
<td>Total</td>
<td>26 100.0</td>
<td>64 100.0</td>
<td>225 99.9</td>
<td>186 100.0</td>
<td>148 100.0</td>
<td>42 100.0</td>
<td>691 100.0</td>
</tr>
</tbody>
</table>

Gamma +.57
science is important than when they do not.

A comparison of the Gammas in Tables 4.8 and 4.9 in which best friend evaluation is controlled reveals support for Sub-Hypothesis III. The Gamma for low importance in Table 4.8 is +.51 while the Gamma for high importance in Table 4.9 is +.58. The difference between the Gammas in the two tables is a positive .07. This is interpreted as providing support for the hypothesis. Thus, the association between perceived best friend evaluations and self-concept of science ability increases modestly when friends are perceived as giving high importance to doing well in science.

Conclusions and Summary for Sub-Hypotheses I, II, and III

The Gammas for high and low importance attached to doing well in science on the part of parents, teachers, and friends are summarized in Table 4.10.

Support for Sub-Hypothesis I was not found while modest support was found for Sub-Hypotheses II and III. Thus, while the association between perceived parental evaluation and self-concept of science ability is not strengthened when parents are perceived as giving high importance to doing well in science, the relationship between perceived teacher and friend evaluations and self-concept of science ability does increase modestly when teachers and friends are seen as attaching high importance to doing well in science.
Table 4.8  

Relationship between Perceived Best Friend Evaluation of Science Ability and Self-Concept of Science Ability for Eighth Grade Female Respondents, Controlling for Perceived Best Friend Importance Attached to Doing Well in Science  

Best Friend Importance - Low  

<table>
<thead>
<tr>
<th>Best Friend Importance</th>
<th>2-5 Below Average or Among the Poorest, Mostly D's or E's</th>
<th>6 Average, Mostly C's</th>
<th>7 Combination of 8 &amp; 10</th>
<th>8 Better than Most, Mostly B's</th>
<th>9 Combination of 8 &amp; 6</th>
<th>10 Among the Best, Mostly A's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>N 3 %</td>
<td>N 2 %</td>
<td>N 4 %</td>
<td>N 3 %</td>
<td>N 10 %</td>
<td>N 17 %</td>
<td>N 65 %</td>
</tr>
<tr>
<td>Important</td>
<td>4 11 %</td>
<td>14 24 %</td>
<td>36 18 %</td>
<td>31 22 %</td>
<td>43 41 %</td>
<td>8 31 %</td>
<td>136 24 %</td>
</tr>
<tr>
<td>Not too important</td>
<td>19 55 %</td>
<td>37 64 %</td>
<td>154 79 %</td>
<td>103 74 %</td>
<td>51 49 %</td>
<td>1 4 %</td>
<td>365 66 %</td>
</tr>
<tr>
<td>It doesn't matter to friends</td>
<td>11 31 %</td>
<td>6 10 %</td>
<td>3 2 %</td>
<td>1 1 %</td>
<td>0 0 %</td>
<td>0 0 %</td>
<td>21 4 %</td>
</tr>
<tr>
<td>Total</td>
<td>35 100.0</td>
<td>58 100.0</td>
<td>195 100.0</td>
<td>139 100.0</td>
<td>104 100.0</td>
<td>100.0</td>
<td>557 100.0</td>
</tr>
</tbody>
</table>

Gamma = +.51
Table 4.9

Relationship between Perceived Best Friend Evaluations of Science Ability and Self-Concept of Science Ability for Eighth Grade Female Respondents, Controlling for Perceived Best Friend Importance Attached to Doing Well in Science

<table>
<thead>
<tr>
<th>Best Friend Importance</th>
<th>2-5 Below Average or Among the Poorest, Mostly D's or E's</th>
<th>6 Average, Mostly C's</th>
<th>7 Combination of 8 &amp; 10</th>
<th>8 Better than Most, Mostly B's</th>
<th>9 Combination of 8 &amp; 6</th>
<th>10 Among the Best, Mostly A's</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
</tr>
<tr>
<td></td>
<td>1  10</td>
<td>1  4</td>
<td>3  3</td>
<td>5  6</td>
<td>14 22</td>
<td>15 71</td>
<td>39 13</td>
</tr>
<tr>
<td>Important</td>
<td>3  30</td>
<td>7  25</td>
<td>30 35</td>
<td>41 45</td>
<td>37 60</td>
<td>5  24</td>
<td>123 41</td>
</tr>
<tr>
<td>Not too important</td>
<td>2  20</td>
<td>18 64</td>
<td>54 62</td>
<td>44 48</td>
<td>11 18</td>
<td>1  5</td>
<td>130 44</td>
</tr>
<tr>
<td>It doesn't matter to</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
<td>N  %</td>
</tr>
<tr>
<td>friends</td>
<td>4  40</td>
<td>2  7</td>
<td>0 0</td>
<td>1  1</td>
<td>0 0</td>
<td>0 0</td>
<td>7  2</td>
</tr>
<tr>
<td>Total</td>
<td>10 100.0</td>
<td>28 100.0</td>
<td>87 100.0</td>
<td>91 100.0</td>
<td>62 100.0</td>
<td>21 100.0</td>
<td>299 100.0</td>
</tr>
</tbody>
</table>

Gamma = +.58
Table 4.10

A Comparison of the Gammas, Controlling for the Perceived Importance Attached to Doing Well in Science on the Part of Parents, Teachers, and Friends

<table>
<thead>
<tr>
<th>Gammas</th>
<th>High Importance</th>
<th>Low Importance</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td>.49</td>
<td>.49</td>
<td>0</td>
</tr>
<tr>
<td>Teachers</td>
<td>.57</td>
<td>.50</td>
<td>.07</td>
</tr>
<tr>
<td>Friends</td>
<td>.58</td>
<td>.51</td>
<td>.07</td>
</tr>
</tbody>
</table>

Hypotheses IV and V

The path model for all eighth grade females (Figure 1) was used to test these hypotheses. Table 4.11 gives the correlation coefficients used as input to compute the path weights in Figure 1. The coefficient of multiple determination ($R^2$) for the dependent variable, self-concept of science ability, is .31.

Hypothesis IV: There is a direct effect between perceived parental, teacher, and best friend evaluations and self-concept of science ability.

The path weights in Figure 1 lend support to Hypothesis IV. The direct paths from the independent variables, perceived parental, teacher, and friend evaluations, to the dependent variable, self-concept of science ability are all positive, and all are larger than .09. For every standard unit of change then in parent, teacher, or friend
Figure 1. Path Model with No Controls for All Eighth Grade Female Respondents
Table 4.11

Correlation Coefficients for the Path Model for all Eighth Grade Female Respondents

<table>
<thead>
<tr>
<th></th>
<th>Parental Evaluation</th>
<th>Teacher Evaluation</th>
<th>Friend Evaluation</th>
<th>Parental Importance</th>
<th>Teacher Importance</th>
<th>Friend Importance</th>
<th>Self-Concept Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td>0.59031</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>0.61442</td>
<td>0.54444</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>0.23882</td>
<td>0.19435</td>
<td>0.18693</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>0.18097</td>
<td>0.25023</td>
<td>0.20606</td>
<td>0.29232</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Importance</td>
<td>0.19245</td>
<td>0.19420</td>
<td>0.25477</td>
<td>0.31154</td>
<td>0.33310</td>
<td>1.00000</td>
<td></td>
</tr>
<tr>
<td>Self-Concept Ability</td>
<td>0.41963</td>
<td>0.49417</td>
<td>0.46020</td>
<td>0.07608</td>
<td>0.19418</td>
<td>0.10550</td>
<td>1.00000</td>
</tr>
</tbody>
</table>
evaluations, modest change takes place in the self-concept of science ability of respondents.

While the perceived evaluations of all three sets of significant others do have a modest effect, the weight of the path from teacher evaluation to self-concept of science ability is the strongest; the best friend evaluation path is next; and the path from parental evaluation to self-concept is the weakest.

The findings from this path model in which multivariate relationships were examined are consistent with the findings discussed with relation to Hypotheses I, II, and III in which the bivariate relationship between each set of significant others and self-concept of science ability was examined. In all cases the relationship between the independent variable and the dependent variable is a direct (positive) one.

_Hypothesis V:_ There is an indirect effect of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability through parental, teacher, or best friend importance attached to doing well in science.

The indirect path weights in Figure 1 going from parental, teacher, and friend evaluations through parental, teacher, and friend importance to self-concept of ability do not lend support to
Hypothesis V. Table 4.12 reproduces the indirect path weights which are computed. The indirect parental and friend paths are not only negative but too weak to be meaningful. While the indirect teacher path is positive, it is too weak to provide support for the hypothesis. For every standard unit of change in the independent variable, then, no change takes place in the dependent variable. In examining the multivariate relationships in this path model, therefore, the intervening variable of importance is not a meaningful one.

Table 4.12

Indirect Path Weights for all Eighth Grade Female Respondents with Importance as the Intervening Variable

<table>
<thead>
<tr>
<th>Indirect Path Weights</th>
<th>All Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation $\rightarrow$ Importance $\rightarrow$ Self-Concept Science Ability</td>
<td>-.0150</td>
</tr>
<tr>
<td>Teacher Evaluation $\rightarrow$ Importance $\rightarrow$ Self-Concept Science Ability</td>
<td>.0207</td>
</tr>
<tr>
<td>Best Friend Evaluation $\rightarrow$ Importance $\rightarrow$ Self-Concept Science Ability</td>
<td>-.0106</td>
</tr>
</tbody>
</table>

Summary

Support was found for Hypothesis IV in which the direct paths from the independent variables to the dependent variable were examined. The teacher evaluation path was the strongest. Support was not found for Hypothesis V in which the indirect paths from the inde-
pendent variables through the intervening variable of importance to the dependent variable were examined. The assumptions posited by the researcher to undergird the usage of the intervening variable were thus not supported.

**Hypotheses VI and VII**

Four variations of the path model controlling for race and socioeconomic position of these eighth grade females were used to test these hypotheses. Figure 2 gives the path weights for white females of low socioeconomic position; Figure 3 the path weights for white females of high socioeconomic position; Figure 4 the path weights for minority females of low socioeconomic position; and Figure 5 the path weights for minority females of high socioeconomic position.

**Hypothesis VI:** The direct effect of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability will vary by race and socioeconomic position.

A comparison of the direct path weights for all four groups of respondents lends support to Hypothesis VI. Before elaborating upon overall comparison among the four variations, a brief discussion of each group is in order.

Table 4.13 gives the correlation coefficients used as input to
Figure 2. Path Model Variation for White Eighth Grade Female Respondents of Low Socioeconomic Position
Figure 3. Path Model Variation for White Eighth Grade Female Respondents of High Socioeconomic Position
Figure 4. Path Model Variation for Minority Eighth Grade Female Respondents of Low Socioeconomic position
Figure 5. Path Model Variation for Minority Eighth Grade Female Respondents of High Socioeconomic Position
compute the path weights in Figure 2 for white females of low socio-economic position (N = 209). The coefficient of multiple determination ($R^2$) for the dependent variable is .26. The following can be highlighted from Figure 2: (1) The path from teacher evaluations to self-concept is considerably stronger than the paths for parental and friend evaluations; (2) The paths for parental and friend evaluations are quite similar in size.

Table 4.14 gives the correlation coefficients used as input to compute the path weights in Figure 3 for white females of high socio-economic position (N = 349). The coefficient of multiple determination ($R^2$) for the dependent variable is .39. The following can be highlighted from Figure 3: (1) The teacher evaluation path is stronger than either the parental or best friend path; (2) The best friend path is next in size, with the parental path the weakest.

Table 4.15 gives the correlation coefficients used as input to compute the path weights in Figure 4 for minority females of low socio-economic position (N = 203). The coefficient of multiple determination ($R^2$) for the dependent variable is .28. The following can be highlighted from Figure 4: (1) The path from friend evaluation to self-concept is the strongest and is somewhat larger than the path from teacher evaluations to self-concept; (2) The path from parental evaluations to self-concept is too weak to be meaningful.

Table 4.16 gives the correlation coefficients used as input to
Table 4.13

Correlation Coefficients for the Path Model Variation for White Eighth Grade Female Respondents of low Socioeconomic Position

<table>
<thead>
<tr>
<th></th>
<th>Parental Evaluation</th>
<th>Teacher Evaluation</th>
<th>Friend Evaluation</th>
<th>Parental Importance</th>
<th>Teacher Importance</th>
<th>Friend Importance</th>
<th>Self-Concept</th>
<th>Science Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td></td>
<td>0.63687</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>0.58001</td>
<td>0.57464</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>0.21346</td>
<td>0.21540</td>
<td>0.10987</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>0.11173</td>
<td>0.20945</td>
<td>0.22613</td>
<td>0.29744</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Importance</td>
<td>0.11322</td>
<td>0.14275</td>
<td>0.18964</td>
<td>0.33177</td>
<td>0.32830</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept</td>
<td>0.41500</td>
<td>0.46578</td>
<td>0.41690</td>
<td>0.08075</td>
<td>0.14873</td>
<td>0.08953</td>
<td>1.00000</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.14
Correlation Coefficients for the Path Model Variation For White Eighth Grade Female Respondents of High Socioeconomic Position

<table>
<thead>
<tr>
<th></th>
<th>Parental Evaluation</th>
<th>Teacher Evaluation</th>
<th>Friend Evaluation</th>
<th>Parental Importance</th>
<th>Teacher Importance</th>
<th>Friend Importance</th>
<th>Self-Concept Science</th>
<th>Self-Concept Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td>0.62802</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>0.67729</td>
<td>0.57115</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>0.24379</td>
<td>0.19780</td>
<td>0.22367</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>0.14158</td>
<td>0.26575</td>
<td>0.18191</td>
<td>0.24838</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Importance</td>
<td>0.20150</td>
<td>0.21357</td>
<td>0.26058</td>
<td>0.31157</td>
<td>0.26721</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept</td>
<td>0.51661</td>
<td>0.55368</td>
<td>0.53375</td>
<td>0.10704</td>
<td>0.07351</td>
<td>0.13241</td>
<td>1.00000</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.15
Correlation Coefficients for the Path Model Variation for Minority Eighth Grade Female Respondents of Low Socioeconomic Position

<table>
<thead>
<tr>
<th></th>
<th>Parental Evaluation</th>
<th>Teacher Evaluation</th>
<th>Friend Evaluation</th>
<th>Parental Importance</th>
<th>Teacher Importance</th>
<th>Friend Importance</th>
<th>Self-Concept</th>
<th>Science</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td>0.48039</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>0.53100</td>
<td>0.48454</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>0.24522</td>
<td>0.20035</td>
<td>0.19400</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>0.20898</td>
<td>0.20193</td>
<td>0.17737</td>
<td>0.37976</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Importance</td>
<td>0.22172</td>
<td>0.14619</td>
<td>0.25798</td>
<td>0.34244</td>
<td>0.36639</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept</td>
<td>0.30310</td>
<td>0.43815</td>
<td>0.45568</td>
<td>0.13781</td>
<td>0.20410</td>
<td>0.11588</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.16  
Correlation Coefficients for the Path Model Variation for Minority Eighth Grade Female Respondents of High Socioeconomic Position

<table>
<thead>
<tr>
<th></th>
<th>Parental Evaluation</th>
<th>Teacher Evaluation</th>
<th>Friend Evaluation</th>
<th>Parental Importance</th>
<th>Teacher Importance</th>
<th>Friend Importance</th>
<th>Self-Concept Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td>0.56869</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>0.59567</td>
<td>0.48540</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>0.18700</td>
<td>0.12820</td>
<td>0.12601</td>
<td>1.00000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>0.26348</td>
<td>0.29931</td>
<td>0.21779</td>
<td>0.20852</td>
<td>1.00000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Importance</td>
<td>0.20646</td>
<td>0.33367</td>
<td>0.32891</td>
<td>0.13817</td>
<td>0.10569</td>
<td>1.00000</td>
<td></td>
</tr>
<tr>
<td>Self-Concept</td>
<td>0.41888</td>
<td>0.46781</td>
<td>0.35776</td>
<td>0.05486</td>
<td>0.30207</td>
<td>0.11897</td>
<td>1.00000</td>
</tr>
</tbody>
</table>
compute the path weights in Figure 5 for minority females of high socioeconomic position (N = 95). The coefficient of multiple determination ($R^2$) for the dependent variable is .30. The following can be noted in Figure 5: (1) The path from teacher evaluation to self-concept is considerably stronger than the paths for parental and friend evaluations to self-concept; (2) The parental and friend paths are not only considerably weaker than the teacher path, but they are quite similar to each other in size.

Comparison of the Four Path Variations Controlling for Race and Socioeconomic Position of Respondents

Table 4.17 gives the direct path weights for parental, teacher, and best friend evaluations and self-concept of science ability for all four groups of eighth grade females. Each path is briefly discussed, followed by an overall comparison.

Parents. While the path weights for parents for all four groups of females show some variation, three are quite similar in strength. The path weight for minority females of low socioeconomic position, however, is considerably weaker than the other three and is too weak to be meaningful.

Teachers. The path weights for teacher evaluations are also quite similar, although they are a little stronger for females of high socioeconomic position regardless of racial category.

Friends. There is considerable variation in the range of
Table 4.17

Direct Path Weights for the Four Path Variations for Parental, Teacher and Friend Evaluations and Self-Concept of Science Ability for Eighth Grade Female Respondents

<table>
<thead>
<tr>
<th>Paths</th>
<th>White Females</th>
<th>White Females</th>
<th>Minority Females</th>
<th>Minority Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Socio-Economic Position</td>
<td>High Socio-Economic Position</td>
<td>Low Socio-Economic Position</td>
<td>High Socio-Economic Position</td>
</tr>
<tr>
<td></td>
<td>N = 209</td>
<td>N = 349</td>
<td>N = 203</td>
<td>N = 95</td>
</tr>
<tr>
<td>Parental Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Self-Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Ability</td>
<td>.1462</td>
<td>.1565</td>
<td>.0113</td>
<td>.1525</td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Self-Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Ability</td>
<td>.2753</td>
<td>.3117</td>
<td>.2721</td>
<td>.3050</td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Self-Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Ability</td>
<td>.1674</td>
<td>.2613</td>
<td>.3221</td>
<td>.1265</td>
</tr>
</tbody>
</table>
friend evaluations. Some similarity in path weights exists for (a) white females of high socioeconomic position and minority females of low socioeconomic position and for (b) white females of low socioeconomic position and minority females of high socioeconomic position. Additionally the strongest path is for minority females of low socioeconomic position.

All: The following can be underscored in comparing all the paths in Table 4.17: (1) All of the paths are positive, and there are differences in path weights by race and socioeconomic position of respondents. Support is therefore found for Hypothesis VI. Many of the differences between and among path weights are slight and represent only modest changes; (2) Only one path—the parental path for minority females of low socioeconomic position—is too weak to be meaningful; (3) Overall, the teacher evaluation paths are the strongest, followed by friends; the parental paths are, overall, the weakest.

Hypothesis VII: The indirect effects of perceived parental, teacher, and best friend evaluations of science ability and self-concept of science ability through perceived parental, teacher, and best friend importance attached to doing well in science will vary by race and socioeconomic position.

A comparison of the indirect path weights which have been computed and reproduced in Table 4.18 does not show support for
Table 4.18

Indirect Path Weights for the Four Path Variations Using Importance as an Intervening Variable between Parental, Teacher, and Friend Evaluations and Self-Concept of Science Ability among Eighth Grade Female Respondents

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td>-.0091</td>
<td>-.0128</td>
<td>-.0009</td>
<td>-.0101</td>
</tr>
<tr>
<td></td>
<td>→ Importance →</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-Concept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td>.0104</td>
<td>.0110</td>
<td>.0226</td>
<td>.0666</td>
</tr>
<tr>
<td></td>
<td>→ Importance →</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-Concept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend Evaluation</td>
<td>-.00003</td>
<td>-.0074</td>
<td>-.0114</td>
<td>-.0492</td>
</tr>
<tr>
<td></td>
<td>→ Importance →</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-Concept</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis VII. While there are some differences among the four groups of females, all indirect path weights—regardless of sign—are too weak to be meaningful. The assumptions made by the researcher to undergird usage of the importance variable as an intervening variable are therefore not supported. Had the negative path weights been larger than .09, this would have meant that importance as an intervening variable was functioning as a depressant for the relationship between the perceived evaluations of significant others and self-concept of science ability. In that case, the relationship would have been the inverse of the hypothesized relationship.

Summary for Chapter

The evidence showing a positive relationship between perceived parental, teacher, and friend evaluations and self-concept of science ability supports Hypotheses I, II, and III. The Gammas ranged in strength from moderate tending toward substantial for parents, to substantial for teachers and friends. No support was found for Sub-Hypothesis I and only modest support for Sub-Hypotheses II and III using importance as a control variable. All direct path weights were interpreted as supporting Hypotheses IV and VI. Support was not found for Hypotheses V and VII as all indirect path weights—regardless of sign—were too weak to be meaningful.
CHAPTER V

SUMMARY, IMPLICATIONS OF FINDINGS, ADDITIONAL FINDINGS, LIMITATIONS OF THE RESEARCH, RECOMMENDATIONS FOR FUTURE RESEARCH

Introduction

The final chapter presents a summary and implications of the findings as well as additional findings. Limitations of the present research endeavor are discussed in addition to recommendations for future research.

Summary of Findings

To aid the reader, a summary is presented in Table 5.1. This table briefly states each hypothesis, notes the method(s) for testing and gives a brief conclusion as to whether evidence was found in support of each hypothesis.

The following findings can, thus, be noted:

1. A direct association was found to exist between the self-concept of science ability held by eighth grade females and their perceptions of how parents, science teachers, and best friends evaluate these science abilities. This finding is in accord with prior research (Bowe, 1977; Kaminski, 1978; Brookover et al., 1962, 1965 1967) and is supportive of Hypotheses I, II, III, and IV.

2. The relative contribution to the resulting self-concept of
PLEASE NOTE:

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Table 5.1
Summary of the Major and Sub-Hypotheses, Method of Analysis, and Conclusions for the Grand Rapids, Michigan Research on the Female Eighth Grade Public School Population

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Method of Analysis</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Positive relationships between perceived parental evaluations &amp; self-concept of science ability</td>
<td>Gamma</td>
<td>Moderate support (t, 49)</td>
</tr>
<tr>
<td>Sub-I. Importance as a control variable</td>
<td>Gamma</td>
<td>No support (Gammas the same)</td>
</tr>
<tr>
<td>II. Positive relationship between perceived teacher evaluations &amp; self-concept of science ability</td>
<td>Gamma</td>
<td>Substantial support (t, 56)</td>
</tr>
<tr>
<td>Sub-II. Importance as a control variable</td>
<td>Gamma</td>
<td>Support (t,07 difference between the Gammas)</td>
</tr>
<tr>
<td>III. Positive relationship between perceived best friend evaluations and self-concept of science ability</td>
<td>Gamma</td>
<td>Substantial support (t, 54)</td>
</tr>
<tr>
<td>Sub-III. Importance as a control variable</td>
<td>Gamma</td>
<td>Support (t,07 difference between the Gammas)</td>
</tr>
<tr>
<td>IV. Direct effect of parents', teachers', &amp; friends' evaluations on self-concept of science ability</td>
<td>Direct Path Weights</td>
<td>Support. Order of magnitude of effect: teachers, friends, parents</td>
</tr>
<tr>
<td>V. Indirect effect of parents', teachers', &amp; friends' evaluations on self-concept of science ability</td>
<td>Indirect Path Weights</td>
<td>No support. Indirect paths--regardless of sign--very weak</td>
</tr>
<tr>
<td>VI. Direct effect of parents', teachers', &amp; friends' evaluations and self-concept will vary by race &amp; socioeconomic position</td>
<td>Direct Path Weights, Four path variations controlling for race &amp; socioeconomic position of respondents</td>
<td>Support. Variation by race &amp; socioeconomic position. Overall, teacher effect greatest; then friends &amp; parents</td>
</tr>
<tr>
<td>VII. The indirect effect of parents', teachers', &amp; friends' evaluations &amp; self-concept will vary by race &amp; socioeconomic position</td>
<td>Indirect Paths. Four path variations for race &amp; socioeconomic position of respondents</td>
<td>No support. Some variation but all path weights--regardless of sign--very weak</td>
</tr>
</tbody>
</table>
science ability was greatest for the perceived evaluations of science teachers; next for best friends' evaluations; and least for parents' evaluation. This finding differs from findings in prior research on other self-concepts of ability, particularly self-concepts related to English language skills (Brookover et al., 1962, 1965, 1967).

3. When teachers and friends place high importance on doing well in science, the relationships between perceived teacher and friend evaluations of science ability and self-concept of science ability are enhanced. This finding supports Sub-Hypotheses II and III. Support was not found for the variable of high parental importance posited in Sub-Hypothesis I.

4. The importance attached to doing well in science variable does not function as an intervening variable between perceived parental, teacher, and best friend evaluations and the resulting self-concept of science ability, either for all eighth grade respondents as posited in Hypothesis V or when race and socioeconomic position of respondents are controlled as posited in Hypothesis VII. In all cases the effect was too weak to be meaningful.

5. When race and socioeconomic position of respondents were controlled as posited in Hypothesis VI the following can be underscored: (a) overall, a stronger association exists between perceived teacher evaluations and self-concept of science ability than exists for either perceived parental or best friend evaluations; (b) in contrast to the
other two paths, the contribution of the teacher evaluations path to self-concept of science ability is especially relevant for white females of high socioeconomic position and minority females of high socioeconomic position; (c) the importance of the perceived evaluations of best friends is especially pertinent for white females of high socioeconomic position and minority females of low socioeconomic position; (d) overall, the importance of perceived parental evaluations is less than that for the two other paths. The effect of parental evaluations is negligible for one group--minority females of low socioeconomic position.

6. Parents and teachers tend to be perceived by respondents as placing value on doing well in science; friends tend to be perceived as not attaching value to doing well in science.

7. While around half of the parents, teachers, and friends of the respondents are seen as evaluating the science abilities of the respondents the same as those of other eighth graders, parents, teachers, and friends are, nonetheless, seen as expecting the respondents to do well in science.

Implications of Findings

Discussion of Hypotheses I, II, III, IV

Findings from these hypotheses support some of the theoretical and empirical literature reviewed in Chapter II. Implicit in the sym-
bolic interaction framework is the assumption that the evaluations and expectations of those defined as significant others do play a salient role in the process of self-evaluation. Conceivably, this is especially crucial for females since, as the socialization literature attests, their view of self emanates from the evaluations of others, and they may be especially attuned to cues from significant others.

The overall concern of this research is upon the relative contribution of the perceived evaluations of parents, teachers, and friends to the self-concept of science ability held by eighth grade females. The evidence suggests that not only does each of these significant others' evaluations make a contribution, but the contribution of teachers to this process is greater than that of friends; the contribution of friends, in turn, is greater than that of parents.

The order of the influence of parents, teachers, and friends in this research is different from that found in some of the research done in the area of general academic ability. Brookover et al. (1962, 1965, 1967), and Franklin et al. (1978) found a higher association between perceived parental evaluations and self-concept of general academic ability than between perceived teacher or friend evaluations and self-concept of general academic ability. Language skills seemed to be a factor in the general academic ability realm. Brookover and his associates also noted that less than half of the junior high students in their population identified teachers and other school personnel as
of concern to them or as being concerned with how well they performed in school. The Brookover research asked respondents to name those they considered important to them.

Further, Kaminski (1975, 1978) noted the salience of parental evaluations for the self-concept of young females in both the areas of mathematics and science. Her research, however, utilized only parental evaluations as perceived by the youngsters and did not assess the relative contribution of parents, teachers, and best friends. Likewise, Bowe's research (1977) assessed only perceived parental evaluations in a comparison of black and white youngsters and their self-concept of science ability, and did not assess the relative contribution of parents', teachers', and best friends' evaluations of students' ability in science.

This study highlights assumptions contained within the symbolic interaction framework that there is nothing hard and fast regarding the role of significant others. As a young female moves from one situation and/or role to another, her significant others may be different; or one or the other set may increase in importance. Thus, an eighth grade female's significant others may be different with reference to subject-specific areas in contrast to general academic ability.

As noted, in subject-specific areas such as science it is possible that teachers become particularly relevant during the junior
high years. Students typically have a special science teacher who may be seen as an expert. While parents may claim and be perceived as experts in some other academic areas (as in reading and English), it is possible that most parents do not claim (nor are they so perceived by their youngsters) expertise in science. It is possible that a mystique surrounds science as Osen (1974) contends happens with mathematics. At any rate, this research highlights the role of the teacher in science. Since science teachers may be perceived as experts, it is possible that they do the initial labeling and defining of the youngster. Parents, in turn, may take these assessments by the teacher as their own. If the science teacher, for example, proclaims to parents that "Beth isn't very good in science," this assessment may be internalized by the parents themselves without any questioning. Beth may ultimately have a very negative conception of her own science ability and possibly about science generally.

In highlighting the possible roles played by mathematics and science teachers, Fox (1976a) notes that not only do high school teachers appear to hold different expectations for males and females in mathematics, but precocious female students may be perceived in a negative and even hostile fashion by these teachers. It is also possible to point to very fragmentary evidence (Anderson, 1963) noting that students who have an inspirational teacher tend to rate themselves higher in mathematics and science.
It is of interest to note that in this study when teachers are seen as evaluating respondents in a highly positive way (among the best), none of the respondents see themselves as below average or among the poorest in comparison with other eighth grade students. This finding again underscores the crucial role that teacher evaluations of science abilities—as seen by respondents—seem to play in the resulting self-concept of science ability of respondents.

Finally, the role of friends in the evaluations-self-concept process has been highlighted, more so for some groups of females than for others. The fact that best friends are perceived as not attaching as much importance to doing well in science may have implications for discouraging females from doing well in science or in considering science careers. Conceivably, if friends view doing well in science or pursuing a scientific career as unfeminine (one can only speculate in this realm as the research does not bear directly upon this point), this may mean that young females themselves do not attach importance to doing well in science. Not electing to take science courses later on in the school career or having poor grades in those courses taken may possibly function as critical filters for science careers.

While the overall importance of teacher evaluations as seen by eighth grade females with reference to their own science abilities has been underscored, the following caveats of Brookover and Erickson (1975) are worth emphasizing: (1) No conclusion is warranted that one
set of significant others does not have any influence or cannot increase its influence; (2) The perceived evaluations of all three sets of significant others account for some of the variation; and (3) Parents, teachers, and best friends are often seen by youngsters as sharing the same evaluations. Brookover et al. (1965), in their research, found an increasing congruency among the perceived evaluations for all three sets of significant others as students moved from junior high to high school.

Discussion of Sub-Hypotheses I, II, and III and Hypothesis V

The mixed results of the importance variable when used as a control and when used as an intervening variable give rise to a plethora of tentative speculations and insights. Although there is a difference between the Gammas for low and for high importance for teachers and for friends, in both cases the difference is of rather modest size (t. 07). Also, the somewhat narrow range of all the Gammas in the control tables may suggest a certain homogeneity among parents, teachers, and best friends.

While the importance variable used as a control does, then, have a very modest effect, the effect washes out when used as an intervening variable in the path model involving Hypothesis V. A comparison of the bivariate correlations between parental, teacher, and friend importance provides clues in attempting to explain what is
going on. In comparing the two sets of correlations, it is apparent that the evaluation correlations are far stronger than are the correlations for the importance variable. The evaluation correlations are as follows: .61 between parents and best friends; .54 between teachers and best friends; and .59 between teachers and parents. In contrast, correlations for the importance variable are as follows: .31 between parents and best friends; .33 between teachers and best friends; and .29 between parents and teachers. The comparison points up the far weaker relationships existing for the importance variable in contrast to the evaluation variable.

Additionally, a look at the direct paths from parental, teacher, or friend importance to the self-concept of ability attests to the limited explanatory power of the importance variable (with two exceptions all of the direct paths are too weak to be meaningful). Whether importance is used as an intervening variable or as a control variable, the overall evidence suggests a negligible effect upon the self-concept of science ability of eighth grade females.

The theoretical assumptions for positing the salience of the importance variable rest upon the fact that humans internalize an importance of each role played based upon cues received regarding evaluations and expectations of significant others including what is seen as important. As eighth grade females interact with their significant others, evaluations and expectations with regard to themselves
arise as well as notions attached to various kinds of behavior. In this research, however, the resulting self-concept of science ability among the respondents seems primarily contingent upon the direct path from evaluations of significant others to self-concept, and not upon the indirect path involving importance as an intervening variable.

As noted previously, many females are socialized to conform and to please within a dependency relationship; yet some of the young females in this research apparently separate the evaluation and the importance dimensions to a large extent. While these youngsters are aware that getting good grades in science is important to their significant others, at the same time this dimension does not spill over into, nor is it reflected in the evaluations these respondents perceive their significant others holding regarding the respondents' science ability.

A related point--made previously--underscores the fact that considerable behavior is a compliant act in which an effort is made to maintain, or in some instances, to heighten a desired social relationship. Certainly, however, one can comply by engaging in certain behavior (trying to do well in science), but at the same time separate this act from other dimensions of the relationship (perceived evaluations of significant others regarding one's science ability). A young female, then, might be fully aware of the importance attached by parents and teachers to her doing well in science, but this, per se, does not affect her self-concept of science ability.
The cognitive dissonance framework can provide insights here. If females perceive the dimensions of importance and evaluation of significant others as creating a situation of dissonance, for example, modesty and not standing out in a crowd versus doing well, these youngsters may attempt to make these messages more consistent in a variety of ways. Conflicts not easily resolved may arise. It is possible that recognized inconsistency may be neutralized by compartmentalization (Lindesmith et al., 1975:107).

Level of commitment is also a factor in whether, and to what extent, dissonance arises. If commitment to doing well in science is minimal on the part of a young female, then dissonance may not arise. Also, dissonance may be neutralized by support from significant others. If friends, for example, do not consider doing well in science important, the young female may simply learn to live with the situation. Certainly the finding that respondents see parents, teachers, and friends as evaluating the respondents' science abilities rather modestly but that, nonetheless, these significant others expect respondents to do well in science holds many possibilities for situations of cognitive dissonance to arise.

**Discussion of Hypothesis VI**

The direct effects of the variables of race and socioeconomic position of respondents are--at best--difficult to sort out, and a confounding process may take place. This point should be kept in mind.

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in discussing the implications of the findings. Some caution should be exercised. The overall greater strength of the teacher evaluation path when race and socioeconomic position of respondents are controlled is consistent with the finding for all the eighth grade females when race and socioeconomic position are not controlled. Thus, one might tentatively conclude that, in general, the variables of race and socioeconomic position per se do not affect the order of the effect of significant others on self-concept of science ability.

The fact that teacher evaluations are particularly important to two groups of youngsters—white and minority females of high socioeconomic position—is of interest since this finding cuts across the racial category. One can speculate that some of the females in both groups may perceive the teacher as an expert with perhaps a superior educational background in contrast to that of their parents. Since the high socioeconomic category contains such a wide spread of occupations, the parents of some of these youngsters undoubtedly hold lower-level jobs and have a limited education. Conceivably, some of these youngsters are upwardly mobile, and the teacher becomes an especially relevant significant other.

Likewise, the perceived evaluations of respondents' science abilities by friends are particularly relevant to two groups of females: white females of high socioeconomic position and minority females of low socioeconomic position. This finding crosses the racial/socio-
economic categories. For these groups perhaps Coleman's subculture thesis is of relevance, and peers function as significant others (not to the exclusion of teachers, however) in the academic realm. Certainly the potential role that friends might play in the social change process is underscored. In terms of corrective efforts a double-barreled effort focused both on teachers and on best friends would seem to be in order for these two groups of females.

The fact that the path for friend evaluations is the weakest of the three paths for minority females of high socioeconomic position should also be noted. If some of these youngsters are upwardly mobile and engaging in anticipatory socialization, present friends may not function as relevant others in the academic realm. The overall small size of the parental paths is also of interest.

Perhaps the most interesting finding, however, is the negligible effect of parental evaluations as seen by minority females of low socioeconomic position. This finding is especially pertinent in view of the literature which points to the interest of black parents in gaining educational and occupational opportunities for their children. The minority youngsters of low socioeconomic position in this research apparently do not perceive their parents as meaningful in the realm of science ability evaluations. One can note a point made earlier that parents may not generally be perceived as experts in science. One might speculate that, overall, youngsters of lower socioeconomic
levels would be less likely to see their parents as important in the science area because of the generally lower educational and occupational levels of the parents in contrast to parents of high socioeconomic levels. The very weak parental path for only minority females of low socioeconomic position, however, suggests that something else is involved.

Additionally, some of the literature notes a differing socialization pattern for black females (regardless of social class) which stresses greater independence in contrast to the traditional socialization pattern for young white females. The only reflection of this pattern in the ordering of significant others by minority females is in the generally small or weak effect of parental evaluations.

The importance of teacher evaluations for both socioeconomic minority groups underscores research findings which have pointed to the salience of teacher expectations. The size of the teacher path for these females highlights the role that teachers are seen by these females to play and the potential role which teachers might play with reference to encouraging and aiding females to take science courses and to seek science careers. If indeed—as some of the research contends—teachers do respond to students in urban schools primarily in terms of social class (many of those in the lower socioeconomic groups are also minorities), then this has serious implications for females of low socioeconomic position. If Rist's contention (1973:245)
that in the urban school middle-class youngsters learn to "control the poor" and the poor "learn to shuffle" pertains generally, then certainly the role of teachers is one of tremendous import.

**Discussion of Hypothesis VII**

The findings do not support the assumption that the indirect paths from parental, teacher, and friend evaluations to self-concept of science ability will vary by race and socioeconomic position of the respondents. All path weights—regardless of sign—were too weak to be meaningful. This finding is consistent with the finding for all respondents in which controls were not utilized (Hypothesis V) and generally reflects the low explanatory power of the importance variable.

Even though the indirect path weights are very weak, it is of interest to note that the paths for teachers are positive while those for parents and best friends are negative. Perhaps this difference simply reflects the generally higher direct path weights between teacher evaluations and self-concept of science ability.

**Implications for Theoretical Framework**

The symbolic interaction framework seems to be supported by the findings of this research. The evaluations of parents, teachers, and friends as perceived by eighth grade females do play a part in the self-concept of science ability held by these youngsters. The conclusions, thus, support the symbolic interaction literature which contends that a human's view of self emanates from the perceived evaluations of
others, especially significant others. By cues of various sorts (including the process of labeling) significant others convey messages regarding their evaluations of competencies and abilities of these eighth grade females in subject specific areas. The distribution of responses in the contingency tables lends support to the relationship between the perceived evaluations of significant others and self-concept of science ability. The relationship is in the expected direction, and the incongruent cells (high parental, teacher, or friend evaluations; low self-concept or vice versa) are empty or nearly so.

Further, a point made earlier should be reemphasized: whether these assessments are accurate is not the issue; what is important is that it is the female student's perceptions which will influence present and subsequent behavior in terms of decisions and choices. If 50% of the eighth grade females perceive their parents, teachers, and friends as rating them the same as other eighth graders in terms of what they can do in science, that is the salient factor, not whether the parents, teachers, and friends, in fact, do.

Additionally, the assumption made in the symbolic interaction framework that humans' significant others may vary from role and/or situation to another seems to be supported. The overall importance of teacher evaluations of respondents' science abilities as seen by the respondents lends credence to this assumption. Logically one might expect the perceived evaluations of parents to be a stronger factor as
prior research indicates they are in the realm of academic ability. Also, while teacher evaluations are of import in the science realm, teacher evaluations may be a negligible factor in the non-academic areas of eighth grade females' lives. Friends may assume importance here.

The fact that the variables of importance and evaluation seem to tap two different dimensions of behavior does not lend support to the assumptions made by the researcher with reference to the relationship between these two variables. As noted, the cognitive dissonance framework is of aid here.

Additional Findings

Additional Direct Paths

Two sets of direct paths which are not explicitly a part of the hypotheses which were tested but which are part of the whole picture merit some comment. These are: (1) The paths from perceived parental, teacher, and best friend evaluations to perceived parental, teacher, and best friend importance attached to doing well in science; and (2) The paths from perceived parental, teacher, and best friend importance attached to doing well in science to self-concept of science ability. Both sets of path weights are reproduced in Table 5.2.

With reference to the first set the following can be noted: (1) All path weights are positive, varying in strength from .1870 to .3289;
Table 5.2

Direct Path Weights, all Path Variations, from Parental, Teacher, and Friend Evaluation to Parental, Teacher, and Friend Importance and from Parental, Teacher and Friend Importance to Self-Concept of Science Ability

<table>
<thead>
<tr>
<th></th>
<th>All Female Respondents</th>
<th>White Females Low Socio-economic Position</th>
<th>White Females High Socio-economic Position</th>
<th>Minority Females Low Socio-economic Position</th>
<th>Minority Females High Socio-economic Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Importance</td>
<td>.2388</td>
<td>.2135</td>
<td>.2438</td>
<td>.2452</td>
<td>.1870</td>
</tr>
<tr>
<td>Teacher Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Importance</td>
<td>.2502</td>
<td>.2095</td>
<td>.2657</td>
<td>.2019</td>
<td>.2993</td>
</tr>
<tr>
<td>Best Friend Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best Friend Importance</td>
<td>.2548</td>
<td>.1896</td>
<td>.2606</td>
<td>.2580</td>
<td>.3289</td>
</tr>
<tr>
<td>Parental Importance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept Science Ability</td>
<td>-.0631</td>
<td>-.0492</td>
<td>-.0527</td>
<td>-.0038</td>
<td>-.0544</td>
</tr>
<tr>
<td>Teacher Importance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept Science Ability</td>
<td>.0830</td>
<td>.0497</td>
<td>.0417</td>
<td>.1120</td>
<td>.2227</td>
</tr>
<tr>
<td>Best Friend Importance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Concept Science Ability</td>
<td>-.0417</td>
<td>-.0002</td>
<td>-.0285</td>
<td>-.0442</td>
<td>-.1498</td>
</tr>
</tbody>
</table>
(2) Because of the size of the path weights one can note that for any one standard unit of change in the evaluation variable, some change takes place in the importance variable; (3) The strongest path is for minority females of high socioeconomic position and perceived friend evaluations. The weakest are for white females of low socioeconomic position and perceived friend evaluations and for minority females of high socioeconomic position and parental evaluations.

With reference to the second set of path weights, one can note, with the exception of three of these, that all are extremely weak regardless of sign. Two positive paths merit comment. Both of these are for teacher importance and self-concept of science ability for minority females. Although the path for females of high socioeconomic position is stronger than that for females of low socioeconomic position, both provide an additional bit of evidence regarding the importance of science teachers as significant others. The third path is a negative one between best friend importance and self-concept of science ability for minority females of high socioeconomic position. In this case the path weight is large enough so that one can infer that it actually depresses to a modest extent the self-concept of science ability held by these young females.

A Comparison of the Coefficients of Multiple Determination

It will be recalled that the multiple correlation ($R$), like the
simple product-moment correlation coefficient, is simply the correlation between the actual scores on the dependent variable (in this case, self-concept of science ability) and the scores on the dependent variable predicted by use of the multiple regression equation. Like the coefficient \( r \), the multiple correlation coefficient can be interpreted more usefully by squaring. Thus, \( R^2 \) can be interpreted as indicating the proportion of the variation in the dependent variable which is explained by the regression equation (Loether & McTavish, 1974:314).

As Blalock (1972:464) notes: "...the square of the multiple correlation always represents the proportion of the total variation explained by the independent variables acting together."

Although the \( R^2 \) for each path variation was noted in the Findings Chapter, Table 5.3 reproduces all of them. A comment is in order in comparing them. Within the path variations controlling for race and socioeconomic position of respondents, considerably more variance (39%) is explained for white females of high socioeconomic position than for the other three groups of females. The \( R^2 \) for the other three groups--white females of low socioeconomic position and minority females of both low and high socioeconomic position--are quite similar in size to each other and to the \( R^2 \) (31%) for all respondents in which the variables of race and socioeconomic position were not controlled.

Since there are no standardized conventions within sociology
for what constitutes a small or a large $R^2$, various researchers would categorize the coefficients of multiple determination in this research in different terms. However, the proportion of variation in the dependent variable left unexplained by the multiple regression equation is considerable. Certainly, the possibility exists that many other variables outside the model are involved in contributing to these eighth grade females' self-concept of science ability (e.g., grades in science courses and interest in a science career, school climate, occupation of mother). Conceivably also the size of the correlation coefficients between the independent variables of parental, teacher, and best friend evaluations of science ability suggest the possibility of an interactive, not an additive, effect among these three variables. If, as Blalock notes (1972:456), one has two highly interrelated independent variables, the second will be explaining "essentially the same variation as the first since there will be considerable overlap."
Extreme Cases

As part of the analysis of the data, routine cross tabulations controlling for race and socio-economic position of respondents were run on parental, teacher, and friend evaluations and self-concept of science ability; parental, teacher, and friend importance and self-concept of science ability; and self-concept of science ability within racial and socioeconomic categories. As part of the overall analysis this researcher looked at the extreme cells for additional insights. The following seems germane.

Evaluation variable: incongruent cells (high parental, teacher, or friend evaluations, low self-concept or vice versa). (1) The small N's make generalizations impossible; (2) In all cases except one the cells were empty or contained only one or two cases. The exception occurred in the higher parental evaluations and lower self-concept cells in which one-fourth (six out of twenty-four) minority females of low socioeconomic position placed themselves. This may reflect the negligible effect of parental evaluations seen by this group of females.

Congruent cells (high parental, teacher, or friend evaluations; high self-concept or vice versa). (1) Perhaps predictably, white females of high socioeconomic position were the largest group within high self-concept, high parental, teacher, or friend evaluation cells; (2) The low, low cells contained a smattering of cases (zero through six); the largest number of cases (eight) was for white females of low
socioeconomic position and teacher evaluations. There is some evidence in the literature to support this finding with reference to teacher evaluations.

**Importance variable: incongruent cells.** (1) There was a small cluster of cases for high parental importance but low self-concept for all groups except white females of high socioeconomic position; minority females of low socioeconomic position also noted high teacher importance but low self-concept; (2) White females of both socioeconomic groups clustered in the high self-concept cells but perceived low friend importance. These inconsistencies may reflect the generally higher responses on the importance than on the evaluation variable.

**Congruent cells.** There was some clustering for all four groups of respondents in the high teacher, high self-concept cells. The same situation existed for high parental importance except for white females of low socioeconomic position.

**Socioeconomic Position and Self-Concept**

In comparing white and minority females of high socioeconomic position, of those who saw themselves as among the best, four-fifths, perhaps not surprisingly, were white. Interestingly, of those who placed themselves at the other end of the continuum—among the poorest, or poorer—two-thirds of those were also white while one-third were in the minority category. This latter finding represented only a small number of cases (12), however.
In contrasting females of low socioeconomic position, nearly
70% of those who saw themselves as among the best were minority. Again, this finding represents a small number of cases (only 16). At
the low end of the continuum white and minority females were more
evenly divided. Of those who saw themselves as poorer or among the
poorest, 45% were white; 55% minority.

**Racial Category**

Within the white group more than four-fifths of those seeing
themselves as among the best were females of high socioeconomic
position. About two-thirds of those who saw themselves as poorer or
among the poorest were of low socioeconomic position.

Within the minority group, of those who saw themselves as
among the best nearly two-thirds were of low socioeconomic position
while over four-fifths of those who saw themselves as poorer or among
the poorest were also of low socioeconomic position. The high self-
cept of ability held by some minority females of low socioeconomic
position may reflect the independence socialization pattern discussed
earlier or perhaps may reflect unrealistic images of self.

No clear-cut conclusions emerge from this discussion except
perhaps the overall findings with reference to white females of high
socioeconomic position. Both racial and socioeconomic factors seem
to be operative. Overall, most respondents do not place themselves
nor do they see significant others placing them at the extremes. The
small number of N's at the extremes, as noted, makes generalizations difficult.

Limitations of the Research

While limitations of the research and recommendations for future research overlap and mesh to a considerable degree, each area is discussed separately. Some of the factors pointed to in this section are amplified in the recommendations section.

Certainly, any one research endeavor can utilize only a limited number of variables and, thus, tap only one small segment of the total picture. As noted earlier, the present research has addressed itself primarily to the evaluation dimension. Other variables—such as expectations and aspirations held by significant others—undoubtedly play a role in the decision-making process. By the very nature of the research act, then, limitations of various sorts are built in to any research effort.

The following comments are in order. While perceived evaluations are one highly salient dimension of human behavior and decision making, the actual evaluations of others are another dimension which could be looked at to get a more comprehensive picture. For example, interviews with parents, teachers, and best friends would provide additional insights as might interviews with the subjects themselves. Conceivably, incongruency exists between the assessments made by eighth grade females regarding the evaluations of their significant
others and the actual assessments of those significant others.

Possibly interviews might include questions to tap two different dimensions: self-concept of science ability and interest in a career in science. As yet, very little evidence exists to indicate that a relationship necessarily exists between the two variables. Certainly information gathered in future research efforts could be used to test a possible relationship between the two variables.

Additionally, an interview schedule might provide insights as to whether parents do, in fact, see themselves as experts in the science realm. It is possible that variations occur because of social class, race, sex, education, or occupation of parent(s). While Fox (1976a) noted that daughters often seek advice and help in mathematics from fathers, there is little evidence to indicate whether this is a valid observation with reference to science. Some evidence (Hoffman, 1974; Broverman et al., 1972) points to the importance of a working mother in terms of young females' feelings of independence and their attitudes toward females generally. Occupation of mother might be of relevance also.

Since the present research has underscored the salience of teacher evaluations on the resulting self-concept of science ability, teacher interviews might be of especial value. Are teachers, not parents, in fact, doing the initial labeling in terms of students' science ability? While sex of teacher was briefly discussed in this study, race and age might be additional variables of relevance. It is
also possible that there are differences in the effect of the perceived
evaluations of parents, teachers, and best friends on self-concept of
science ability among minority groups other than blacks. In this
study it was not possible to do separate analyses for minority groups
other than blacks since the N's were too small.

The present research is cross-sectional and, thus, has taken a
snapshot of one point in time. Longitudinal research, which gives a
motion picture effect, would be of value to see what changes take
place over time as youngsters move from junior to senior high. It is
also possible that the eighth grade is not the most appropriate level
for research attempting to tap self-concept of science ability and the
relationship to the assessments of significant others as seen by the
student. Perhaps the beginning high school years are a more appro­
priate time as youngsters are at that point making subject course
choices, and, in some cases, beginning or even crystallizing career
plans.

Because a large number of middle and upper-middle class
youngsters are in parochial schools in Grand Rapids, it is possible
that biases have been introduced. Had these youngsters been included
it is possible that the high evaluation, high self-concept cells might
have contained a larger number of cases than they did. This conclu­
sion seems reasonable since of those cases in the high evaluation,
high self-concept cells, many were white females of high socioecon-
omic position. A comparison with other eighth grade populations in other cities would also be of benefit. Different racial and ethnic mixes in other cities might highlight differences too. Certainly future research efforts need to focus increasing attention upon black or other minority youngsters per se.

While the mean response rate of 80.6% among the nine schools with an eighth grade in this study is considerably higher than the response rate for some other research efforts, it is possible that biases were introduced by the exclusion of some students. As noted, this rate reflects the exclusion not only of absentees but of special education students in special education classes as well.

While every measure of socioeconomic or occupational position has drawbacks, conceivably a scale other than the Duncan Occupational Index might produce somewhat different results. Additionally, the cutting points used in the present study for the Duncan Scale may have masked subtle effects of social class differences. The cutting points used to divide respondents into high and low socioeconomic position made for—as noted—an extremely broad range of occupations within the high category (24–96 in the Duncan Scale).

Since Grand Rapids is a predominantly "working class" city, had occupation and education of parents been used as designation of social class location, conceivably most respondents would be toward the lower end of the scale.
Finally, the path model specified in the research design was tested and analyzed, but other path models could certainly be utilized by other researchers in their own research designs. Age and general ability of respondents as well as the variables of school achievement, aspirations, expectations, and interest in a science career or in science courses are among the possibilities. As noted earlier, the explanatory power of the importance variable is extremely limited, and thus the usefulness of this variable for future research efforts is dubious.

Recommendations for Future Research

An assumption has been made in the present research endeavor that having more females take science courses and enter science careers is a desirable state of affairs. There is, however, little evidence to suggest a necessary relationship between self-concept of science ability and aspirations for a career in science. That question awaits further research. In attempting to relate this research to the larger society, however, a point to be stressed is that if young females are interested in pursuing a career as a physicist or chemist or whatever, options for entering non-traditional careers should be available to them. Conceivably, a great loss is incurred when females are discouraged from taking science courses and/or considering a career in science. That some young females will opt for a career within a traditional field or a full-time homemaking career is, of course, their
prerogative. But these same females should at least be aware that other options do exist, and that these options at least in some cases are perceived by significant others as appropriate. The latter statement implies great changes taking place in the social/structural arrangements within the larger society.

A very general recommendation points to the continuing need for a plethora of research efforts encompassing various facets of the topic of the self-concept of science ability held by young females and the part significant others play in the process. Additionally, studies replicating past research efforts are needed; sociologists have sometimes seen replicating efforts as less prestigious and creative than undertaking original research designs. Up to this point, there has been a dearth of research focused on females and males (including minorities) at the eighth grade level with reference to science.

A good starting point might be to see whether there is a relationship between self-concept of science ability and aspirations for a science career. Additionally, a related area to be explored focuses on what, if any, differences exist between males and females in self-concept of science ability and future plans. Two research efforts merit comment. Kaminski (1978) noted that more males (32%) than females (19%) in high school rated themselves high in science ability. Erlick and LeBold's research (1975) done among high school students found a finding similar to Kaminski's. Males consistently rated
themselves higher than females on mathematics, mechanical, problem solving, and science ability. Additionally, Kaminski found for both sexes a significantly greater proportion of the high self-concept than the above average self-concept students selecting an advanced science course in high school (p. 59). While taking an advanced science course does not necessarily lead to preparing for a scientific career, provocative questions that bear further research are raised. Likewise Erlick and LeBold found that for those high school students who were even considering science or mathematics careers, all reported above average assessments of themselves for all of the aforementioned abilities.

Researchers should also examine their own assumptions and assumptions made by past researchers which may reflect sexist assumptions and take traditional gender-role appropriate behavior as a given. Sociologists as well as other social scientists are currently engaged in a process of self-examination. Linda Bourque and Jean Grossholtz, for example, recently (1974) analyzed the research of their political science colleagues in the area of women and political participation and critiqued the past efforts of many of their colleagues for the implicit and, in some cases, explicit sexist assumptions.

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1The noun sexism is a recently coined word which refers to discriminatory behavior on the part of one sex toward the other based solely on the variable of sex. It is more frequently used to refer to discrimination on the part of males toward females.
Longitudinal studies similar to the one currently under way in Grand Rapids, Michigan and other similar to those of Wilbur Brookover and his associates in Lansing, Michigan are sorely needed. It would be possible, then, to assess the stability of some of the research variables used in the present study, and address the following questions: Is the self-concept of science ability held by eighth grade females a stable one as these youngsters move from junior through senior high school? Do changes take place over time in the relative effect of significant others; and/or does a congruency among parents, teachers, and friends occur—as Brookover noted in his research—as youngsters move through the high school years?

Since the present research endeavor highlights the crucial role played by teachers in the evaluation process, additional research focused on teachers and the schools would be highly useful. The following kinds of questions merit attention: Are the sex and the race of teachers germane variables as some of the literature suggests? (Most of the literature reviewed in this study dealt with the sex variable.) What role do counselors and other school personnel play in the counseling process in terms of non-traditional career choices by young females? Are counselors, in reality, a conservative influence as some of the literature suggests? Do females in middle schools have different experiences in the science realm than females in junior high schools?

In what ways, if any, do differing school climates affect the
self-concept of science ability held by young females. Although the concept of school climate has been used in different ways, Brookover and Erickson's conception of school academic climate (1975:364) seems especially appropriate for the research concerns delineated here:

The school social climate encompasses a composite of variables as defined and perceived by the members of this group. These factors may be broadly conceived as the norms of the social system and expectations held for various members as perceived by the members of the group and communicated to members of the group.

This definition highlights definitions of appropriate behavior which characterize a social system (the school, in this case). Implications are far-reaching for young females having non-traditional interests. In recent research (1978) Brookover found the school climate variable rather than the variables of race and socioeconomic position per se to have the largest correlation with achievement in elementary schools.

As noted, interviews with parents, teachers, and friends would be a valuable supplement to the perceived evaluations of respondents. Additionally, the following family variables might provide helpful input: Do young women from a one-parent family have a different concept of self and science ability than youngsters from two-parent families? In a one-parent family, is sex of parent salient? Is employment of mother or kind of job she holds important variables as some of the research suggests? Further, do mothers' or fathers' evaluations play a larger role in the daughter's self-concept of science ability? Research reviewed points to the salience of the father in the
socialization process, more especially with reference to female scientists or mathematicians. As noted earlier, do parents not, in fact, see themselves as experts in science? Are there race and social class differences operating? Finally, is the socialization process of daughters in families undergoing any changes as a result of the feminist movement?

Additional attention to the influence of friends would also be in order. For example, why did two groups of youngsters—white females of high socioeconomic position and minority females of low socioeconomic position—in this study find the evaluations of friends especially relevant? Is this finding typical of other populations as well? Do friends actually perceive science as an unfeminine interest, or is this simply an assumption made by females? While some tentative insights were given, hopefully additional research will address some of these concerns.

It seems fitting to close with some remarks made by Brookover and his associates (1965:210-212). While Brookover's remarks pertain primarily to students who are perceived as having a low IQ, these remarks have implications for young females and their self-concept of science ability:

Perhaps the most important implication of this investigation concerns a theme in educational literature that only a limited number of students are able to learn mathematics, language, science, and other school subjects to the extent required by our advanced technological society. When it is
assumed that only one-fifth to one-tenth of our students have "talent" for high achievement, and that little can be done for the rest, the nation's collective achievement and development is unnecessarily hindered. . . . it /the total investigation/ has shown that role expectations and self-concepts of ability are significant factors in influencing the student's self concept of academic performance. Further, it has shown that the student's self-concept of academic ability can be modified by significant others and thereby affect their achievement . . . . In light of these findings, it is suggested that current educational practices which assume relatively fixed characteristics of students be re-evaluated.

Summary

The major focus of this study has been upon the relationship between the self-concept of science ability of eighth grade females and their assessments of parental, teacher, and friend evaluations of these science abilities. At the eighth grade level, not only is there evidence of declining performance in mathematics and science by females, but additionally, youngsters are likely to have a special science teacher in contrast to the all inclusive classroom of the elementary school.

Seven hypotheses and three sub-hypotheses were drawn up. The Gamma measure of association as well as a path model were used to test the hypotheses. Four path variations controlling for the race and socioeconomic position of the respondents were used. Additionally, the variable of importance attached to doing well in science was used both as a control and as an intervening variable.

The findings supported the importance of the perceived evaluations of parents, teachers, and friends with reference to science ability and the resulting self-concept of science ability among eighth
grade females. Overall, the importance of teacher evaluations as seen by respondents was highlighted. Perceived friend evaluations were especially relevant for two groups of females. Perceived parental evaluations had, overall, the weakest effect.

Limitations of the research include the following: (1) Only perceived evaluations were addressed; (2) The presence of possible bias because of a large number of middle and upper-middle class youngsters in parochial schools; (3) Non-respondents may have biased results; (4) Cut-off points utilized in the Duncan Scale may have masked or obscured social class differences.

Further research is needed as studies focusing upon the science abilities of youngsters at the junior high level are limited.
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APPENDICES
APPENDIX A
QUESTIONNAIRE

1. Are you a boy or a girl?
   _____ a. boy
   _____ b. girl

2. What is your ethnic background?
   _____ a. white
   _____ b. black
   _____ c. hispanic
   _____ d. oriental
   _____ e. native american
   _____ f. other (plus not specified)
   _____ g. black and white
   _____ h. native american and white
   _____ i. black and native american

3. If your parent(s) work, what kind of job do they have?

1. Think of all the students in the eighth grade in your school. What kind of schoolwork do you think you could do in science compared to your classmates?
   _____ a. I am among the best
   _____ b. I am better than most
   _____ c. I am average
   _____ d. I am below average
   _____ e. I am among the poorest

2. What kinds of grades do you think you really could get in science?
   _____ a. Mostly A's
   _____ b. Mostly B's
   _____ c. Mostly C's
   _____ d. Mostly D's
   _____ e. Mostly E's

3. Do your parent(s) say you can do school work in science better, the same, or poorer than other students of your age?
   _____ a. Among the best
   _____ b. Better
c. The same
  d. Poorer
  e. Among the poorest

4. Does your science teacher say you can do school work in science better, the same, or poorer than other students your age?
   a. Among the best
   b. Better
   c. The same
   d. Poorer
   e. Among the poorest

5. Does your best friend say you can do school work in science better, the same, or poorer than other students your age?
   a. Among the best
   b. Better
   c. The same
   d. Poorer
   e. Among the poorest

6. How important is it to your parent(s) that you do well in science?
   a. Very important
   b. Important
   c. Not too important
   d. It doesn't matter to my parents at all

7. How important is it to your science teacher that you do well in science?
   a. Very important
   b. Important
   c. Not too important
   d. It doesn't matter to my teacher at all

8. How important is it to your best friend that you do well in science?
   a. Very important
   b. Important
   c. Not too important
   d. It doesn't matter to my friends at all
APPENDIX B

GRAND RAPIDS QUESTIONNAIRE

Longitudinal Research, 1976-1977

Directions: We are trying to learn more about students and their work in schools. We would like for you to respond to the following questions. This is not a test of any sort and will not affect your work in school. Your teacher and your principal will not see your answers. There are no right or wrong answers; we simply want you to tell us your answer to each question.

PLEASE PRINT

Name ____________________________ (Last Name) ____________________________ (First Name) ____________________________ (Middle Name)

Name of your school ____________________________

How old were you on your last birthday?

a. 11 years old
b. 12 years old
c. 13 years old
d. 14 years old
e. 15 years old

Are you a boy or a girl?

a. boy
b. girl

What is your ethnic background?

a. white
b. black
c. hispanic
d. oriental
e. native american
f. other (plus not specified)
g. black and white
h. native american and white
i. black and native american

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PLEASE WRITE YOUR ANSWERS TO THESE QUESTIONS

1. If your parent(s) work, what kind of job do they have?
__________________________________________________________________________

2. If you could have any job, which one would you like to have after you finish school?
__________________________________________________________________________

3. Sometimes the job you get is not the job you wish for. What kind of job do you think you will get after you finish school?
__________________________________________________________________________

4. If you could be like anyone in the world, who would you want to be like? (Write the name of this person.)
__________________________________________________________________________

5. What do you like most about this person?
__________________________________________________________________________

6. Are there any people you feel have a special interest in your taking Math courses and in your doing well in them?
   ___ a. Yes
   ___ b. No

7. Are these people your (check all that apply)
   ___ a. friends
   ___ b. parents
   ___ c. counselors
   ___ d. teachers
   ___ e. other

8. Are there any people you feel have a special interest in your taking Science courses and in your doing well in them?
   ___ a. Yes
   ___ b. No
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

9. Are these people your (check all that apply)
   ___a. friends ___d. teachers
   ___b. parents ___e. other
   ___c. counselors

10. Are there any people you feel have a special interest in your taking English courses and in your doing well in them?
    ___a. Yes
    ___b. No

11. Are these people your (check all that apply)
    ___a. friends ___d. teachers
    ___b. parents ___e. other
    ___c. counselors

12. Are there any people you feel have a special interest in your doing well in Athletics?
    ___a. Yes
    ___b. No

13. Are these people your (check all that apply)
    ___a. friends ___d. teachers
    ___b. parents ___e. other
    ___c. counselors

STOP

WAIT TO GO FURTHER

THINK OF YOUR PARENT(S). ANSWER LIKE THEY WOULD. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

14. Do your parent(s) say you can do school work better, the same, or poorer than other students your age?
    ___a. among the best ___d. poorer
    ___b. better ___e. among the poorest
    ___c. the same
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

15. What grades do your parent(s) think you can get?
   ___ a. mostly A's  ___ d. mostly D's
   ___ b. mostly B's  ___ e. mostly E's
   ___ c. mostly C's

16. Would your parent(s) say you would be with the best, average, or below average student when you graduate from high school?
   ___ a. among the best  ___ d. below average
   ___ b. above average  ___ e. among the poorest
   ___ c. average

17. Do your parent(s) think you could graduate from college?
   ___ a. yes, for sure  ___ d. probably not
   ___ b. yes, maybe  ___ e. no
   ___ c. not sure

18. How important is it to your parent(s) that you get mostly B's or better?
   ___ a. very important  ___ c. not too important
   ___ b. important  ___ d. It doesn't matter to my parents

19. Do your parent(s) know how you are doing in school?
   ___ a. They know everything I do in school
   ___ b. they know almost everything about my school work
   ___ c. they know some things about my school work
   ___ d. they only know a little bit about my school work
   ___ e. they know nothing about my school work

20. How far in school do your parent(s) wish you would go?
   ___ a. quit now
   ___ b. go to high school for a while
   ___ c. graduate from high school
   ___ d. go to a school to be a secretary or learn a trade
   ___ e. go to college for a little while
   ___ f. graduate from college
   ___ g. more than 4 years of college

21. How far in school do your parent(s) think you would go?
   ___ a. quit now
   ___ b. go to high school for a while
   ___ c. graduate from high school
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

____ d. go to a school to be a secretary or learn a trade
ten e. go to college for a little while
en f. graduate from college
g. more than 4 years of college

22. Do your parent(s) say you can do school work in Math better, the same, or poorer than other students your age?
   __ a. among the best
   __ b. better
   __ c. the same
   ____ d. poorer
   ____ e. among the poorest

23. Do your parent(s) say you can do school work in Science better, the same, or poorer than other students your age?
   __ a. among the best
   __ b. better
   __ c. the same
   ____ d. poorer
   ____ e. among the poorest

24. How important is it to your parent(s) that you do well in Math?
   __ a. very important
   __ b. important
   __ c. not too important
   ____ d. it doesn't matter to my parents at all

25. How important is it to your parent(s) that you do well in Science?
   __ a. very important
   __ b. important
   __ c. not too important
   ____ d. it doesn't matter to my parents at all

STOP

WAIT TO GO FURTHER

THINK OF YOUR BEST FRIEND. ANSWER LIKE HE OR SHE WOULD. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

26. Would your best friend say you can do school work better, the same, or poorer than other students your age?
   __ a. among the best
   __ b. better
   __ c. same
   ____ d. poorer
   ____ e. among the poorest
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

27. What grades does your best friend think you can get?
   ___ a. mostly A's   ___ d. mostly D's
   ___ b. mostly B's   ___ e. mostly E's
   ___ c. mostly C's

28. How important is it to your best friend that you get mostly B's or better?
   ___ a. very important   ___ c. not too important
   ___ b. important   ___ d. it doesn't matter to my best friend

29. Does your best friend know how you are doing in school?
   ___ a. he or she knows everything I do in school
   ___ b. he or she knows almost everything about my school work
   ___ c. he or she knows some things about my school work
   ___ d. he or she only knows a little bit about my school work
   ___ e. he or she knows nothing about my school work

30. How far in school does your best friend think you will go?
   ___ a. quit now
   ___ b. go to high school for a while
   ___ c. graduate from high school
   ___ d. go to a school to be a secretary or learn a trade
   ___ e. go to college for a little while
   ___ f. graduate from college
   ___ g. more than 4 years of college

31. Does your best friend say you can do school work in Math better, the same, or poorer than other students your age?
   ___ a. among the best   ___ d. poorer
   ___ b. better   ___ e. among the poorest
   ___ c. the same

32. Does your best friend say you can do school work in Science better, the same, or poorer than other students your age?
   ___ a. among the best   ___ d. poorer
   ___ b. better   ___ e. among the poorest
   ___ c. the same
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

33. How important is it to your friend that you do well in Math?
   a. very important
   b. important
   c. not too important
   d. it doesn't matter to my friend at all

34. How important is it to your friend that you do well in Science?
   a. very important
   b. important
   c. not too important
   d. it doesn't matter to my friend at all

STOP
WAIT TO GO FURTHER

THINK OF YOUR FAVORITE TEACHER, THE ONE YOU LIKE THE BEST. ANSWER LIKE HE OR SHE WOULD. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

35. Would your favorite teacher say you can do school work better, the same, or poorer than other students your age?
   a. among the best
   b. better
   c. the same
   d. poorer
   e. among the poorest

36. What grades does your favorite teacher think you can get?
   a. mostly A's
   b. mostly B's
   c. mostly C's
   d. mostly D's
   e. mostly E's

37. Would your favorite teacher say you would be with the best, average or below average students when you graduate from high school?
   a. among the best
   b. above average
   c. average
   d. below average
   e. among the poorest

38. Does your favorite teacher think you could graduate from college?
   a. yes, for sure
   b. yes, maybe
   c. not sure
   d. probably not
   e. no
PICK ONE ANSWER.  PUT A CHECK NEXT TO YOUR ANSWER.

39. How important is it to your favorite teacher that you get mostly B's or better?
   ___ a. very important  ___ c. not too important
   ___ b. important  ___ d. it doesn't matter to my teacher

40. Does your favorite teacher know how you are doing in school?
   ___ a. He/she knows everything I do in school
   ___ b. He/she knows almost everything about my school work
   ___ c. He/she knows some things about my school work
   ___ d. He/she knows only a little bit about my school work
   ___ e. He/she knows nothing about my school work

41. How far in school does your favorite teacher think you will go?
   ___ a. quit now
   ___ b. go to high school for a while
   ___ c. graduate from high school
   ___ d. go to school to be a secretary or learn a trade
   ___ e. go to college for a little while
   ___ f. graduate from college
   ___ g. more than 4 years of college

42. Does your Math teacher say you can do school work in Math better, the same, or poorer than other students your age?
   ___ a. among the best  ___ d. poorer
   ___ b. better  ___ e. among the poorest
   ___ c. the same

43. Does your Science teacher say you can do school work in Science better, the same, or poorer than other students your age?
   ___ a. among the best  ___ d. poorer
   ___ b. better  ___ e. among the poorest
   ___ c. the same

44. How important is it to your Math teacher that you do well in Math?
   ___ a. very important  ___ c. not too important
   ___ b. important  ___ d. it doesn't matter to my teacher at all

45. How important is it to your Science teacher that you do well in Science?
   ___ a. very important  ___ c. not too important
   ___ b. important  ___ d. it doesn't matter to my teacher at all.
STOP

WAIT TO GO FURTHER

WE WOULD LIKE TO KNOW WHAT YOU THINK ABOUT YOUR SCHOOL WORK. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

46. Think of your friends. Do you think you can do school work better, the same, or poorer than your friends?
   ___ a. among the best   ___ d. poorer
   ___ b. better   ___ e. among the poorest
   ___ c. the same

47. Think of the students in your class. Do you think you can do school work better, the same, or poorer than the students in your class?
   ___ a. among the best   ___ d. poorer
   ___ b. better   ___ e. among the poorest
   ___ c. the same

48. When you graduate from high school, do you think you will be with the best students, average students, or below average students?
   ___ a. among the best   ___ d. below average
   ___ b. above average   ___ e. among the poorest
   ___ c. average

49. Do you think you could graduate from college?
   ___ a. yes, for sure   ___ d. probably not
   ___ b. yes, maybe   ___ e. no
   ___ c. not sure

50. If you went to college, do you think you would be one of the best, average, or poorest students?
   ___ a. among the best   ___ d. below average
   ___ b. above average   ___ e. among the poorest
   ___ c. average

51. If you want to be a doctor or a teacher, you need more than four years of college. Do you think you could do that?
   ___ a. yes, for sure   ___ d. probably not
   ___ b. yes, maybe   ___ e. no
   ___ c. not sure
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

52. Forget how your teachers mark your work. How good do you think your own work is?
   ___ a. excellent    ___ d. below average
   ___ b. very good    ___ e. poor
   ___ c. average

53. What marks do you think you really can get if you try?
   ___ a. mostly A's    ___ d. mostly D's
   ___ b. mostly B's    ___ e. mostly E's
   ___ c. mostly C's

54. Think of all the students in the eighth grade in your school. What kind of school work do you think you could do in Math compared to your classmates?
   ___ a. I am among the best
   ___ b. I am better than most
   ___ c. I am average
   ___ d. I am below average
   ___ e. I am among the poorest

55. Think of all the students in the eighth grade in your school. What kind of school work do you think you could do in Science compared to your classmates?
   ___ a. I am among the best
   ___ b. I am better than most
   ___ c. I am average
   ___ d. I am below average
   ___ e. I am among the poorest

56. Think of all the students in the eighth grade in your school. What kind of schoolwork do you think you could do in Reading compared to your classmates?
   ___ a. I am among the best
   ___ b. I am better than most
   ___ c. I am average
   ___ d. I am below average
   ___ e. I am among the poorest

57. Think of all the students in the eighth grade in your school. What kind of school work do you think you could do in Writing compared to your classmates?
   ___ a. I am among the best
   ___ b. I am better than most
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

____ c. I am average
____ d. I am below average
____ e. I am the poorest.

58. What kind of grades do you think you really could get in **Math**?
   ____ a. mostly A's
   ____ b. mostly B's
   ____ c. mostly C's
   ____ d. mostly D's
   ____ e. mostly E's

59. What kind of grades do you think you really could get in **Science**?
   ____ a. mostly A's
   ____ b. mostly B's
   ____ c. mostly C's
   ____ d. mostly D's
   ____ e. mostly E's

60. What kind of grades do you think you really could get in **English**?
   ____ a. mostly A's
   ____ b. mostly B's
   ____ c. mostly C's
   ____ d. mostly D's
   ____ e. mostly E's

61. What kind of grades do you think you really could get in **Reading**?
   ____ a. mostly A's
   ____ b. mostly B's
   ____ c. mostly C's
   ____ d. mostly D's
   ____ e. mostly E's

STOP

WAIT TO GO FURTHER

AGAIN, WE WOULD LIKE TO KNOW HOW YOU FEEL ABOUT THESE QUESTIONS. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

62. How far would you like to go in school?
   ____ a. quit now
   ____ b. go to high school for a while
   ____ c. graduate from high school
   ____ d. go to a school to be a secretary or learn a trade
   ____ e. go to college for a little while
   ____ f. graduate from college
   ____ g. more than 4 years of college
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

63. Sometimes what you expect to do isn't the same as what you'd like to do. How far in school will you really go?
   a. quit now
   b. go to high school for a while
   c. graduate from high school
   d. go to a school to be a secretary or learn a trade
   e. go to college for a little while
   f. graduate from college
   g. more than 4 years of college

64. How important to you are the grades you get in school?
   a. very important
   b. important
   c. not too important
   d. grades don't matter to me at all

65. How important is it to you to be one of the best in your class in grades?
   a. very important
   b. important
   c. not too important
   d. grades don't matter to me at all

66. 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 too badly
   d. It doesn't bother me at all

67. How important to you are grades compared with other things in school?
   a. good grades are the most important thing in school
   b. good grades are among the most important things in school
   c. some other things in school are more important
   d. good grades don't matter to me at all

68. Do you agree or disagree: "People like me will never do well in school even though we try hard."
   a. strongly agree
   b. agree
   c. disagree
   d. strongly disagree
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

69. Do you agree or disagree: "You have to be lucky to get good grades in this school."
   ___a. strongly agree       ___c. disagree
   ___b. agree                ___d. strongly disagree

70. How important is it to you to do well in Math?
   ___a. very important       ___c. not too important
   ___b. important            ___d. it doesn't matter to me at all

71. How important is it to you to do well in Science?
   ___a. very important       ___c. not too important
   ___b. important            ___d. it doesn't matter to me at all

72. If you came home with a good report card, what would your parent(s) likely do?
   ___a. nothing in particular
   ___b. praise me
   ___c. give me special privileges
   ___d. give me money or some other reward
   ___e. other (write in)______________________________

73. If you came home with a poor report card, what would your parent(s) most likely do?
   ___a. nothing in particular
   ___b. scold me
   ___c. take away privileges
   ___d. punish me severely in some way
   ___e. other (write in)______________________________

74. When I do a good job on my school work, I am more popular with other students.
   ___a. no       ___c. yes
   ___b. doesn't matter

75. If I do well in school, it will be easier for me to get the job I want when I graduate.
   ___a. no       ___c. yes
   ___b. doesn't matter
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

76. Do you think that Math will be useful to you later on in helping you earn a living?  
   ___ a. very useful  ___ c. not particularly useful  
   ___ b. useful  ___ d. not at all useful

77. Do you think that Science will be useful to you later on in helping you earn a living?  
   ___ a. very useful  ___ c. not particularly useful  
   ___ b. useful  ___ d. not at all useful

STOP
WAIT TO GO FURTHER

WE WOULD LIKE TO KNOW ABOUT THE TEACHERS IN THIS SCHOOL.  
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

78. Of the teachers that you know in this school, how many care if the students get bad grades?  
   ___ a. almost all of the teachers  
   ___ b. most of the teachers  
   ___ c. half of the teachers  
   ___ d. some of the teachers  
   ___ e. almost none of the teachers

79. Of the teachers that you know in this school, how many only care that students pass their classes, and now how hard they work?  
   ___ a. almost all of the teachers  
   ___ b. most of the teachers  
   ___ c. half of the teachers  
   ___ d. some of the teachers  
   ___ e. almost none of the teachers

80. Of the teachers that you know in this school, how many tell students to try hard to do better in their school work?  
   ___ a. almost all of the teachers  
   ___ b. most of the teachers  
   ___ c. half of the teachers  
   ___ d. some of the teachers  
   ___ e. almost none of the teachers
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

81. How often do teachers in this school try to help students who do badly on their school work?
   ___a. they always try to help
   ___b. they usually try to help
   ___c. they sometimes try to help
   ___d. they seldom try to help
   ___e. they never try to help

STOP

WAIT TO GO FURTHER

WE WOULD LIKE TO KNOW ABOUT THE OTHER STUDENTS IN YOUR SCHOOL. PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER.

82. If most of the students here could go as far as they wanted in school, how far would they go?
   ___a. finish grade
   ___b. go to high school for a while
   ___c. finish high school
   ___d. go to college for a while
   ___e. finish college

83. How many students in this school care if they get bad grades?
   ___a. almost all of the students
   ___b. most of the students
   ___c. half of the students
   ___d. some of the students
   ___e. almost none of the students

84. How many students don't do as well as they could do in school because they are afraid other students won't like them as much?
   ___a. almost all of the students
   ___b. most of the students
   ___c. half of the students
   ___d. some of the students
   ___e. almost none of the students
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

85. How many students in your school try hard to get good grades on their tests?
   ___ a. almost all of the students
   ___ b. most of the students
   ___ c. half of the students
   ___ d. some of the students
   ___ e. almost none of the students

86. How important do you think most of the students in this school feel it is to do well in school work?
   ___ a. they feel it is very important
   ___ b. they feel it is important
   ___ c. they feel it is somewhat important
   ___ d. they feel it is not very important
   ___ e. they feel it is not important at all

87. Compared to students from other schools, how well will most of the students from your school do in high school?
   ___ a. they will be among the best
   ___ b. they will do better than most
   ___ c. they will do about the same as most
   ___ d. they will do poorer than most
   ___ e. they will be among the worst

88. How many students in your school try hard to get good grades on their tests in Math?
   ___ a. almost all of the students
   ___ b. most of the students
   ___ c. half of the students
   ___ d. some of the students
   ___ e. almost none of the students

89. How many students in your school try hard to get good grades on their tests in Science?
   ___ a. almost all of the students
   ___ b. most of the students
   ___ c. half of the students
   ___ d. some of the students
   ___ e. almost none of the students
PICK ONE ANSWER. PUT A CHECK NEXT TO YOUR ANSWER

90. How many students in your school try hard to get good grades on their tests in Reading?
   a. almost all of the students
   b. most of the students
   c. half of the students
   d. some of the students
   e. almost none of the students

91. How many students in your school try hard to get good grades on their tests in English?
   a. almost all of the students
   b. most of the students
   c. half of the students
   d. some of the students
   e. almost none of the students