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The relationship between classroom learning and biographical variables, personality and attitudinal variables, and students' perceptions of the school environment.

Brian A. Grant

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THE RELATIONSHIP BETWEEN CLASSROOM LEARNING
AND BIOGRAPHICAL VARIABLES, PERSONALITY AND
ATTITUINAL VARIABLES, AND STUDENTS' PERCEPTIONS OF THE SCHOOL ENVIRONMENT

by

Brian A. Grant

B. A. Carleton University, 1975

Ottawa, Ontario

A Thesis
Submitted to the Faculty of Graduate Studies through the Department of Psychology in Partial Fulfillment of the Requirements for the Degree of Master of Arts at the University of Windsor

Windsor, Ontario, Canada

1979
ABSTRACT

A total of 1415 grade 10 and 12 students from coeducational, single-sex male, and single-sex female schools served as subjects in a study designed to investigate the relationship between classroom learning (measured using average grades) and biographical variables, personality and attitudinal variables, and perceptions of the school environment. To achieve the purpose the following four objectives were established: (a) determine the relative importance of variables predicting average grades, (b) test Walberg's (1977) Mediation model, (c) determine if different variables are the best predictors for males and females, and (d) determine if different variables are the best predictors for coeducational and single-sex school students. The students completed questionnaires measuring their biography, personality, attitudes, and perceptions of their school environment. In general, the results indicated the following: (a) grades of students can be predicted with approximately 40% of the variance accounted for, (b) self-concept of ability and need for achievement were the most important predictor variables, (c) the grades of males were more influenced by environmental variables than were the grades of females, and (d) the type of school attended did not have a major influence on the variables which predicted grades. The Mediation model received partial support; and further development was recommended. It was also recommended that further experimental research be conducted to determine the direction of the correlational relationships found in this study.
ACKNOWLEDGEMENTS

I wish to thank Dr. F. W. Schneider for the use of data collected under his direction and for his advice during the preparation of this thesis. A thank-you is also extended to the members of my thesis committee. Finally, a special thanks to the many students who volunteered to complete the questionnaires which made the study possible.

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TABLE OF CONTENTS

ABSTRACT
i

ACKNOWLEDGEMENTS
ii

LIST OF TABLES
vii

Chapter

I INTRODUCTION

Theoretical Perspective
2

Empirical Research
7

Biographical Variables
8
Personality and Attitudinal Variables
10
Type of School
15
Educational Environment
17
Summary
22

Objectives and Hypotheses
24

II METHOD

Sample
27

Subjects
27
Schools
29

Instruments
29

Biographical Variables
29
Personality and Attitudinal Variables
29
Environmental Variables
36

Procedure
38

III RESULTS

Percentage of Variance Analyses
41

Coeducational Schools
42
Single-Sex Schools
44
Patterns
45
Regressión Analyses

Coeducational Schools 51
Single-Sex Schools 59
Patterns 65
Self-Concept of Ability 66

Correlational Analyses

Coeducational Schools 70
Single-Sex Schools 71
Patterns 72

IV DISCUSSION

Hypotheses and Relative Importance of Variables 73

Percentage of Variance Findings 75
Regression Findings 79
Correlational Findings 83

Objectives

Mediation Model 87
Sex Differences 89
Type of School Differences 90

Implications

Future Directions 94

Appendix

A Need for Achievement: Personality Research Form (Jackson, 1969) 99

B Need for Affiliation: Personality Research Form (Jackson, 1969) 101

C Femininity Scale: California Psychological Inventory (Gough, 1957) 103

D Self-Concept of Ability 106

E Anxiety Scale: Multiple Affective Adjective Check List (Zuckerman & Lubin, 1965) 108

F Attitude Toward Teachers Scale 109

G Attitude Toward School Scale 111

H High School Characteristics Index (Stern, 1970) 113
I Results from Principal Axis Factor Analysis of Eight High School Characteristics Index Scales Following a Varimax Rotation

J Pretesting Instructions to Students

K Intercorrelation Matrix for Male (N=250) and Female (N=281) Coeducation Students

L Intercorrelation Matrix for Male (N=247) and Female (N=321) Single-Sex Students

FOOTNOTES

REFERENCES

VÍTA AUCTORIS
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of Subjects from Each School, Grade, and Sex</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Reliability Coefficients for Personality and Attitudinal Scales</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>Reliability Coefficients for the High School Characteristics Index Scales</td>
<td>39</td>
</tr>
<tr>
<td>4</td>
<td>$R^2$ Values for Various Sets of Variables</td>
<td>43</td>
</tr>
<tr>
<td>5</td>
<td>Correlation Coefficients from Cross-Validation Analyses</td>
<td>52</td>
</tr>
<tr>
<td>6</td>
<td>Stepwise Regression Results for Male Coeducational Students</td>
<td>53</td>
</tr>
<tr>
<td>7</td>
<td>Stepwise Regression Results from the Most Important Predictors for Male Coeducational Students</td>
<td>54</td>
</tr>
<tr>
<td>8</td>
<td>Stepwise Regression Results for Female Coeducational Students</td>
<td>57</td>
</tr>
<tr>
<td>9</td>
<td>Stepwise Regression Results from the Most Important Predictors for Female Coeducational Students</td>
<td>58</td>
</tr>
<tr>
<td>10</td>
<td>Stepwise Regression Results for Male Single-Sex Students</td>
<td>60</td>
</tr>
<tr>
<td>11</td>
<td>Stepwise Regression Results from the Most Important Predictors for Male Single-Sex Students</td>
<td>61</td>
</tr>
<tr>
<td>12</td>
<td>Stepwise Regression Results for Female Single-Sex Students</td>
<td>63</td>
</tr>
<tr>
<td>13</td>
<td>Stepwise Regression Results from the Most Important Predictors for Female Single-Sex Students</td>
<td>64</td>
</tr>
<tr>
<td>14</td>
<td>$R^2$ Values for Regression Equations Using All Variables With and Without Self-Concept of Ability</td>
<td>68</td>
</tr>
<tr>
<td>15</td>
<td>Correlations Between Average Grade and the Variable, Separate for Each Group</td>
<td>69</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

Research in education has generally failed to consider classroom learning in the context in which it occurs (Backman & Secord, 1968; Charters, 1973; Cronbach, 1957; Hunt, 1975; Walberg, 1977). Charters points out that educators have viewed the student as an isolated entity functioning outside the complex social setting of the classroom. To overcome this problem a number of writers have strongly advocated the interactionist perspective for education (Cronbach, 1957; Hunt, 1975; Walberg, 1977). The interactionist perspective takes into consideration both the person and the situation or environment in which behavior occurs.

The purpose of this study was to investigate the effects on classroom learning of both person and environmental variables, thereby employing an interactionist approach. Specifically, the purpose of the study was to establish that the grades of secondary school students could be predicted using biographical, personality and attitudinal, and environmental variables. The grades of students were used as a measure of classroom learning (that is, academic performance).

The remainder of the introduction is divided into three sections. The first section will discuss the theoretical perspective which was used for organizing the present research. The second section will present the results of empirical investigations which have studied the relationships between academic performance and each of the following
categories of variables: biographical, personality and attitudinal, and environmental. The third section of the introduction will present the hypotheses derived from the review of the empirical results and the theoretical perspective.

Theoretical Perspective

The theoretical perspective to be discussed is based on the work of Hunt (1975) and Walberg (1977). Prior to consideration of specific details of the perspective we will consider the requirements for a theory, in general, and for a theory of academic performance, in particular. We will then review the B-P-E paradigm described by Hunt (1975). The B-P-E paradigm will be used to evaluate the Mediation model presented by Walberg (1977). The final section of the theoretical perspective will indicate how the B-P-E paradigm assisted in organizing the present research and how the present research provides a partial test of the Mediation model.

According to Cooley and Lohnes (1976), theory is both a descriptive and a predictive system. They suggest that if the prediction is verified, then the descriptive system is justified, but they add that theory must be comprehensive, logical, and parsimonious, as well as provide relevant description. Calls have been made for better theoretical systems to relate academic performance to personality variables and aspects of the school environment. Specifically, Entwistle (1972) stresses the need for elaborate theoretical models which can lead to more sophisticated investigations of the relationship between personality and academic achievement. And Nielson and Kirk (1974) call for educational environment
theories that can specify important aspects of the environment, that show the processes by which environments affect classroom learning, and that test our ideas of what constitutes a "good" learning environment. Further, a theory is needed which will integrate the effects of personality and environment on academic performance in order to avoid the pitfalls of viewing the student as an isolated entity and of considering the environment's influence as independent of the student.

Theories which meet the above criteria do not appear to exist at this time, but moves have recently been made which will assist in their formulation. Hunt (1975) argues for the use of the Lewinian formula \( B = f(P,E) \) (Behavior is a function of the Person and the Environment) in what he calls the B-P-E paradigm. He suggests that this can be used as an organizational system for research. The major requirement of the paradigm is the specification of its components. That is, in educational research we should be able to clearly specify the dependent variables --representing the behavior under consideration-- and the independent variables--representing the characteristics of the person and the environment.

Merely identifying these three components may seem a useless exercise in classification, but it is an essential step to understanding the interactions that describe the relation between two or three of the components. (Hunt, 1975, p. 217)

Hunt proposes four characteristics for the B-P-E paradigm:

(1) It should be interactive...(2) it should view the person in developmental perspective...(3) it should consider person-environment interaction in reciprocal terms... (4) it should consider practical implications of such interactions so that conceptions can be enriched by application. (p. 219)
The B-P-E paradigm can serve two purposes. First, in the organization of educational research which is atheoretical, it can suggest what types of variables should be considered and how these variables should be analyzed in order to understand behavior. Second, it can serve as an evaluation system for educational models.

Walberg (1977) has proposed the Mediation model for classroom learning. The Mediation model will be reviewed and then subjected to evaluation using the components of the B-P-E paradigm. It will be shown that Walberg's model meets most of the requirements of the B-P-E paradigm even though Walberg (1977) has suggested that the model is not complete.

Walberg's model indicates factors which affect outcome following classroom instruction. Outcome can be considered in terms of immediate outcome and extended outcome. We will concentrate on immediate outcome which can be measured using grades obtained in school. The model indicates that outcome is influenced by four major factors: aptitude, content opportunity, teacher characteristics, and student background. But, Walberg (1977), on the basis of previous research, suggests that the effects of teacher characteristics and student background can be measured by students' perceptions of the classroom environment. Therefore, if measures of the students' perceptions of the environment are available the model has only three factors which affect outcome: aptitude, content opportunity, and students' perception of the environment. The specific content of each factor is considered below along with an evaluation of the Mediation model using the B-P-E paradigm.

The first requirement of the B-P-E paradigm is that each of its components be specified. The Walberg model defines the behavior (B)
being studied as outcome which includes post-test knowledge, post-test understanding, post-test attitudes, and structural change. The model defines the person (P) in terms of aptitude which includes I.Q., pretest knowledge, pretest understanding, and pretest attitudes. Environment (E), the third component of the B-P-E paradigm, is represented in the model by content opportunity and students' perceptions of classroom environment. Content opportunity includes overlap of lessons with outcome measures and overlap of homework with outcome measures. Perceptions of the environment are influenced by teacher characteristics (their behavior and personality), and student background (their heredity, family environment, peer environment, and community environment). The above discussion indicates that the Mediation model clearly defines each of the components of the B-P-E paradigm.

Hunt proposed four characteristics for the B-P-E paradigm and these were presented at the beginning of this section. If the Mediation model is to meet the requirements of the paradigm, it should possess these characteristics, that is, it should be interactive, developmental, reciprocal, and have practical value. The Mediation model is interactive in that it considers the influence on outcome of four factors simultaneously. Also, according to Walberg, it is the interaction of teacher characteristics and student background which leads to the formation of perceptions of the environment in the classroom. The model is not developmental as laid out by Walberg, but by applying the model at different age levels a developmental trend could be studied. According to Walberg's discussion of perceptions of the environment, a reciprocal characteristic is included because perceptions include the influence of the student on the environment.
and the influence of the environment on the student. The reciprocal relationship is a result of the students' influence on each other and on the teacher, and the teacher's influence on the students. The final characteristic of a B-P-E paradigm is that it should be practical. The Mediation model is practical because the model is organized in such a way as to allow application to the school setting.

The above discussion has shown that the Mediation model meets the requirements of a B-P-E paradigm. Therefore, it is appropriate for use in educational research and can be evaluated in the present study. The factors in the Mediation model which are considered in this research report are outlined below.

Aptitude and perception of the environment were the major factors from the Mediation model which were studied. Content opportunity was not studied because such data would be extremely difficult to collect unless teacher activities were controlled by the researcher. In addition, student grades were used as the outcome measure, and it was assumed that teachers test their students (in secondary school) only on what they have been taught, therefore content opportunity should be high and relatively consistent for all students.

Aptitude was evaluated using attitude measures and personality variables as outlined in Walberg's (1977) model. It is clear, as indicated by the model, that Walberg uses a very broad definition of aptitude. The traditional measure of aptitude, I.Q. was not collected in this study. Attitude variables were considered part of aptitude because they were included in Walberg's model as part of aptitude. Personality variables were included as part of aptitude because they were suggested
by Walberg and would be included in the following definition of aptitude by Cronbach (1967): Aptitude is a complex of personal characteristics that accounts for an individual's end state after a particular educational treatment, i.e. that determines what he learns, how much he learns, or how rapidly he learns (p. 23).

Walberg's model calls for the use of a measure of students' perceptions of the classroom environment, but the present study did not test students in the classroom. Students were tested in groups at their school (see Chapter 2 for details), and measures of their perceptions of the school environment were obtained. It was thought that because perceptions of the school environment are highly influenced by the students' classroom experiences they were appropriate for testing the Mediation model. Although perceptions of the environment may be viewed as representing the influence of teacher characteristics and student background characteristics, the present investigation included measures of the students' background in order to consider the influence of this factor independent of student perceptions.

Although the present investigation was not a precise test of the Mediation model, the variables did permit an approximate test. Hunt's B-P-E paradigm and Walberg's Mediation model, therefore, form the theoretical perspective used in this research.

Empirical Research

Empirical research in education, in the past ten years, has increased in both volume and sophistication of methodology. Because of the massive number of studies in the area this review is selective, concentrating
on studies which have broad implications for the variables being considered. The review is divided into four major sections: biographical variables, personality and attitudinal variables, type of school (coeducational and single-sex), and educational environment.

**Biographical Variables**

Biographical variables are generally considered in studies which have as their major concern other sets of measures. The major biographical variables in educational research appear to be socioeconomic status, sex, and age. The research relevant to these variables will be reviewed below. In addition, the effects on academic performance of birth order and family size will be reviewed.

**Socioeconomic status.** Socioeconomic status (SES) has received much attention in educational research because of its relationship with achievement and cognitive ability. In general, research has shown that achievement and ability are lower among low SES groups. Backman and Secord (1968) report that SES shows a positive relationship with academic performance, and this relationship is maintained, although reduced, when the effects of intelligence are partialled out. Bain and Anderson (1974) indicate that individual choices to attend college are related to SES such that people from lower SES backgrounds are less likely to decide to attend college. But, Bain and Anderson also note that this relationship is modified by the SES level of the school they attend, resulting in more decisions by low SES persons in high SES schools to attend college.

**Sex.** In their review of the literature on sex differences and educational achievement Minton and Schneider (1980) indicate that it has
been consistently shown that boys earn lower grades than girls with the discrepancy decreasing toward the end of high school. They review a longitudinal study by Alexander and Eckland (1974) which uses a national sample. Alexander and Eckland controlled for academic ability and SES and showed that females in secondary school received higher grades and had more favorable academic self-concepts than males. This is an important finding because the present investigation studies the effects on academic performance of SES, sex, and self-concept. Entwistle (1972) recommends that when data are analyzed separate analyses be performed for males and females because personality variables are strongly influenced by sex.

Age. After reviewing the relevant research Entwistle (1972) concludes that there is considerable evidence that age moderates the relationship between personality and academic achievement. The research Entwistle reviewed indicates that before the age of 14, there exists a positive relationship between academic achievement and both extraversion and stability. After the age of 14 the relationship changes such that extraversion and, to a lesser extent stability, becomes negatively correlated with academic achievement. Entwistle notes that similar changes in correlations have been demonstrated with Cattell's 16 Personality Factors. Later studies have confirmed Entwistle's conclusion cross-culturally in non-western societies (Honess & Kline, 1974; Mehrryan, Khajavi, Razaveh, & Hosseini, 1973; Orpen, 1976), although the age at which the change in the direction of the correlation occurs is later (up to the age of 18) and is more prominent in females.

Sibling structure. The study of sibling structure considers the importance of such variables as family size, sex of siblings, and birth
order. A number of researchers (Bowen & Child, 1976; Cicirelli, 1976; Farley, 1975; Sutton-Smith & Rosenberg, 1970) have demonstrated that a child's position in the sibling structure affects school achievement.

**Personality and Attitudinal Variables**

The study of the relationship between academic performance and both personality and attitudes has produced conflicting results, but, in general, research has shown that there is a relationship with the direction of the relationship dependent on the individual variable. Edwards (1977) presented results indicating that personality variables can account for 27.35% of the variance in grade point average; even when a standardized aptitude test was used in the prediction of grade point average, the personality variables contributed significantly to the variance accounted for.

The present study focuses on the role of the following personality variables: need for achievement, need for affiliation, self-concept of ability, masculinity-femininity, and anxiety. Two attitudinal variables, attitude toward teachers and attitude toward school, are also discussed in this section.

**Need for achievement.** Johnson (1970) notes that the relationship between need for achievement and academic performance has frequently been investigated using projective measures. He concludes that "for the most part these studies show a low and often nonsignificant relationship between the two variables" (p. 106). However, Schneider and Green (1977) observe that nonsignificant relationships tend to be found when projective measures of need for achievement are used, but when self-report measures are used need for achievement is a more reliable predictor of
academic achievement. In research related to this question Schneider and Green obtained a significant correlation between need for achievement and school grades.

The relationship between classroom learning and need for achievement is not a simple one. Mitchell (1961) factor analyzed a number of measures of achievement motivation (another term reflecting need for achievement) and obtained six factors, thereby indicating the concept is not unidimensional. Backman and Secord (1968) suggest that all of the dimensions derived by Mitchell cannot be expected to be related to academic achievement. Domino (1970) confirmed the hypothesis that all dimensions of need for achievement are not correlated to the same extent with academic achievement. His results showed that scores on the Achievement-via-Independence scale of the California Psychological Inventory were more highly correlated (in a positive direction) with grades than were scores on the Achievement-via-Conformity scale of the California Psychological Inventory.

Need for affiliation. Schneider and Green (1977) hypothesized that need for affiliation acts as a moderator of the relationship between academic performance and need for achievement. Need for affiliation and need for achievement were viewed as being conflicting needs. Schneider and Green's results confirmed their hypothesis by demonstrating that when students are high on both of these needs academic performance is lower than when need for affiliation is low and need for achievement is high.
Self-concept of ability. A number of reviewers (Backman & Secord, 1968; Johnson, 1970; Shavelson, Huener & Stanton, 1976) and researchers (e.g., Grabe 1976a; Kubiniec, 1970) have concluded that self-concept is positively related to academic achievement. Researchers suggest that self-concept is an important variable in educational research and may be critical in the prediction and explanation of educational outcomes. For example, Shavelson et al. indicate that research in education using the self-concept variable has increased and this increase may be due to a re-emphasis on noncognitive factors in considering educational outcomes.

The self-concept develops as a result of the interaction of the self with others. Grabe (1976a) suggests that self-concept is related to how congruent a person's perceptions of his/her environment are with the perceptions of other people in that environment. Thus, self-concept is very much tied to the environment in which one functions. House (1975) studied a specific form of self-concept called Self-Concept of Abilities. She proposes, "that a student's perception of the classroom climate contributes to a self-concept of academic ability and thereby affects achievement indirectly through the student's self-concept" (p. 245). As a result of her study House concluded that self-concept of ability was related to the learning environment.

Masculinity-femininity. Schneider (1973) reviewed the research on the relationship between masculinity and academic performance for males and females. He notes that most of the studies have employed the Femininity scale of the California Psychological Inventory (CPI), which is a bipolar measure ranging from high masculinity to high femininity. Schneider indicates that, in general, males who score high on a masculinity scale
do less well in school than males who score low. He proposes that this lowered performance may, in part, be attributed to the fact that schools are feminine in orientation, requiring the mastery of skills generally labelled as feminine. Schneider points out that studies of college students have failed to produce the relationship between masculinity and academic performance found in high schools. Abrash and Schneider (1973), reviewing the same set of studies as Schneider, note that the college studies have more frequently used single-sex institutions, whereas the high school studies have used coeducational schools. They suggest that the demands on "masculinity" would be different in single-sex and coeducational settings, and this could explain the different results. Abrash and Schneider tested males in a coeducational and a single-sex high school. In agreement with their hypothesis they were able to show that low masculine males had higher grade point averages than high masculine males in a coeducational school, but no difference was found between high and low masculine males in the single-sex school.

Schneider (1973) states that the research investigating the relationship between masculinity in females and academic performance is largely exploratory. Of the research available Schneider cites the results of three studies which indicate that high masculine females perform at a lower level than their low masculine counterparts, and he cites two studies not supportive of these results.

**Anxiety.** It is important to distinguish between trait and state anxiety. State anxiety arises because of a particular situation in which people find themselves. Most research in education has been directed at a particular form of state anxiety generally referred to as
test anxiety. Trait anxiety is more generalized in that it indicates the general tendency of people towards higher levels of anxiety and is the type of anxiety of interest in this study. Very little research has been conducted on the relationship between trait anxiety and academic performance (Backman & Secord, 1968). Backman and Secord note that for college students anxiety has generally not been related to academic achievement.

Attitudes. Banretti-Fuchs (1972) investigated the relationship between a variety of educational attitudes and academic achievement. He classified students as high, moderate, or low achievers by comparing their grade point average with their IQ. If the students' grade point averages were appreciably greater than their IQs they were classified as high achievers, whereas if the students' grade point averages were less than their IQs they were classified as low achievers. Banretti-Fuchs showed that in comparison with moderate and low achievers high achievers have more favorable attitudes towards school.

Marjoribanks (1976) reports a study in which academic achievement was predicted by cognitive ability (using measures of verbal and nonverbal reasoning) and attitudes. Academic achievement was measured by standardized tests in five subject areas. Attitudes were measured using an instrument with 10 scales, including some which measured the importance of doing well in school, attitudes towards school, and attitudes towards class. Marjoribanks used multiple regression analyses to predict academic achievement and was able to show that attitudes accounted for variance in academic achievement even after the variance associated with cognitive ability had been removed.
Type of School

The differential effects of attending a coeducational or single-sex school have not been extensively studied, and empirical results which are available tend to conflict with each other. Schneider and Coutts (1977) point out that studies conducted in Great Britain (Dale, 1969, 1971, 1974) and Australia (Feather, 1974) indicate that coeducation better serves the educational needs of the student; on the other hand, research in New Zealand (Jones, Shallcross, & Dennis, 1972) and the United States (Kolesnick, 1969, Winchell, Fenner, & Shaver, 1974) suggests that single-sex schools are better for educational purposes. We will look briefly at these two opposing sets of studies.

The study by Jones et al. (1972) indicates that students in single-sex schools spend more time studying and are more likely to value scholarship and academic recognition than are students in coeducational schools. In a study of fear of success Winchel et al. (1974) showed that females in coeducational schools were more likely to write fear of success stories than females in single-sex schools. Further evidence of the possible negative effects of coeducation is presented by Schneider and Coutts when they discuss the arguments of researchers (for example, see Kolesnick, 1969) who suggest that the negative effects of coeducation are clearly shown by the lower achievement in males in elementary and secondary schools, the greater disciplinary problems of males, and the evidence that males and females differ in their rate of maturation, specific aptitudes, interests, and goals.

Finally, a study by Ormerod (1975) indicates that females and males take different courses in coeducational schools, but the difference is
reduced in single-sex school for females where girls are more likely to take science and math courses than they are when enrolled in coeducational schools. Ormerod suggests that this difference occurs because girls in coeducational schools are more likely to choose courses consistent with their sex-roles. He also suggests that the teaching of mathematics and science courses in single-sex female schools is more acceptable to females because examples and methods of teaching are directed at the needs of females, whereas in coeducational schools they are directed at the needs of male students.

In opposition to the above negative effects of coeducation are the results from an extensive series of studies by Dale (1969, 1971, 1974) reported by Schneider and Coutts (1977). Dale provides evidence indicating that students and teachers who had experienced both single-sex and coeducational schools preferred coeducation, and that the environment of coeducational schools was more pleasant. Dale also indicates that the more congenial atmosphere of the coeducational school does not impair the academic progress of either sex. Further support for the positive effects of coeducation comes from a study by Feather (1974) in which he reports general support for the findings of Dale using the Rokeach Value Survey.

Schneider and Coutts (1977) conducted a large scale Canadian study of the educational orientation of students in single-sex and coeducational schools. They conclude that "the picture which emerges does support the view that the coeducational high school provides a generally healthier academic climate than the single-sex high school" (p. 29). They suggest that the differences which exist between the two types of school may be
due to differences in the learning and social climates of coeducational and single-sex schools.

The results discussed above indicate clearly that there are differences between single-sex and coeducational schools in terms of their influence on the student. The present investigation will allow for the examination of some of these differences.

**Educational Environment**

The study of educational environments has increased markedly in the past 10 years. Prior to 1968 only one questionnaire instrument was available for measuring educational environments. Today there are at least five major instruments which measure school and classroom environments (Silbergeld, Koenig, & Manderschied, 1976; Steele, House, & Kerins, 1971; Stern, 1970; Trickett & Moos, 1973; Walberg, 1969). The majority of the research into educational environments has used the Learning Environment Inventory, which measures classroom environment, and the High School Characteristics Index, which measures school environment.

Educational environment scales have been designed to measure either classroom or school environments, and as a result studies investigate only one of the two. But, the two environments are related because the classroom is a subset of the school. Therefore, results from the research into classroom environments are reviewed even though this study used a measure of school environment.

Researchers have suggested a number of ways in which information about classroom environments can assist educators and researchers. Trickett and Moos (1973) suggest that the study of educational environments can assist in determining the differential effects of various settings.
on different students. Pace and Stern (1958) point out that the study of educational environments can be used in planning for and monitoring change which is needed in the system. And Walberg and Anderson (1974) note that differences in educational treatments may be reflected in changes in perceptions of the environment before other changes, including fluctuations in grades, are noted.

**Learning Environment Inventory.** The Learning Environment Inventory (LEI) has probably been the most actively researched environmental scale and was developed by Walberg (1969). The LEI is based on a model, developed by Getzels and Thelen (1960), which views the classroom as a social system. The LEI contains 98 items describing the classroom climate. Subjects respond on a four-point scale ranging from agree to disagree. There are 14 scales in the inventory, and when factor-analyzed, two major climate factors are produced: cognitive press and non-cognitive press (Walberg, 1969).

Walberg, Anderson, and their associates have produced most of the research that has been conducted with the LEI (for a review see Anderson & Walberg, 1974). The majority of these studies used as subjects 3700 secondary school students in 144 classes in the United States. The data were collected as part of an evaluation of the Harvard Project Physics which is a course in physics developed for secondary school students. In these studies a set of six standardized measures of learning were used: understanding science, physics achievement, science processes, science interest, physics activities, and physics interest.

Most of the studies conducted by Walberg, Anderson and their associates are based on the same sample of subjects. Their conclusions therefore
must be viewed with some caution, particularly with regard to generalizability. The general conclusions, presented below, are taken from a review by Anderson and Walberg (1974). In their review, Anderson and Walberg conclude: (a) Perceptions of a learning environment can be measured reliably. (b) Perceptions of the classroom environment can be predicted and manipulated by a number of variables descriptive of the student. (c) And, most relevant to the present study, measures of a learning environment are valid predictors of learning. Anderson and Walberg also conclude that the LEI is a valid measure of educational environment because students are the best judge of the environment in which they work, because cues, particularly instructional and social, are directed at them, and because it is a qualitative measure, allowing high levels of inference.

After reviewing several studies which used the LEI Anderson and Walberg state that scales measuring Cohesion, Environment, Satisfaction, Cliqueness, Friction, Disorganization and Apathy account for a substantial proportion of the variance in learning measured by the six learning criteria discussed earlier. The first three of these scales show a positive correlation with learning and the last four show a negative correlation. Anderson and Walberg also report the results of 11 studies which show the LEI accounts for between 13% and 45% (median = 30%) of the variance in various measures of learning. They compare these results to those for IQ which indicate a range of 7% to 16% of variance accounted for in classroom learning.

Walberg and Ahlgren (1970) reported one of the few studies which investigated, in one study, personality variables, biographic characteristics,
learning measures, and perceptions of the environment. Their results showed that canonical correlations between the scales of the LEI and sets of personality, biographic, and learning variables were significant and ranged from .61 to .83. Walberg and Ahlgren also used multiple regression to predict each scale of the LEI using the variable sets outlined above. These results showed a larger percentage of significant multiple correlations between each of the LEI scales and the biographic variables than between the LEI scales and the personality and learning variables. They unfortunately do not show the relationship between the learning measures and the personality or biographical variables, nor between individual learning measures and the full set of environment scales.

**High School Characteristics Index.** Stern (1970) reviewed research employing the High School Characteristics Index (HSCI) which was developed by Pace and Stern (1958). A subset of the scales from the HSCI was used in the present study to measure four broad aspects of the school environment, and these are discussed in detail in Chapter 2. This inventory has not been as widely researched as the LEI, but it has a strong theoretical base in the personality theory of Murray (1938).

Murray proposed that a person's behavior is a function of the combination of needs and presses. In defining press Pace and Stern state that: "just as needs are inferred from the characteristic modes of response of an individual, so press are reflected in the characteristic pressures, stresses, rewards, conformity demanding influences of the college culture" (p. 270).
Scales from the HSCI have been shown to be correlated with biographical variables and a measure of academic adjustment. Stern notes that a series of studies by Herr (1962, 1963, 1965), at a single high school, has shown HSCI responses to be related to father's occupation, grade level, grade point average, and sex of student. Stern indicates that the relationship between the HSCI and the biographical variables used by Herr may be due to selective exposure to particular subculture groups such as defined by the students' socioeconomic status. Mitchell (1968b) also produced evidence of a relationship between the HSCI and biographic variables. A study by Hansen and Warner (1970) showed that the HSCI was related to a measure of academic adjustment.

The HSCI has been shown to be correlated with measures of personality. Stern reports on a study which showed correlations between scales of the HSCI and the personality scales of the Activities Index (Herr, Knight, & Hansen, 1966). In another study by Mitchell (1968b) scales from the California Psychological Inventory were correlated with scales from the HSCI.

Stern (1970) obtained data on the HSCI which was collected by different researchers from different parts of the United States. He factor analyzed these data, and reports on two factor analyses of the HSCI by Kight and Herr (1966) and one by Mitchell (1968a). The Stern analysis used 947 cases from 12 schools, and the Kight and Herr analyses were based on 725 and 348 cases in only 2 schools. The largest sample was used by Mitchell, consisting of 2819 students in 11 different schools. Mitchell's analysis produced four interpretable factors, three of which were replicated in the other three analyses and one which was
replicated only in Stern's analysis. These factor analyses suggest an underlying factor structure does exist for the HSCI and that it can be replicated.

Because Mitchell's results are based on the most adequate sample and have good replicability, they were used in selecting a subset of scales for the present study. Mitchell's factors were labelled Strong Intellectual Orientation, School Activities, Negative Attitudes Towards the Environment, and Strong Environmental Control (a more complete description of the factors appear in Chapter 2). Mitchell also presents separate factor analyses of the HSCI scales for each of the 11 schools in his study and was able to replicate his factors in all but a couple of cases. Where the four factors were not replicated the School Activities factor became part of the Strong Intellectual Orientation factor.

Summary

The research reviewed has suggested that every one of the 20 variables considered is related to academic performance. This section summarizes the results of the research with each variable and suggests a direction (where possible) for the relationship between classroom learning and the variable.

Four biographical variables were discussed. SES is positively related to academic performance such that persons in higher SES groups display higher levels of academic achievement. Females receive higher grades than males with the discrepancy decreasing in senior high school. Age was shown to moderate the relationship between personality and academic performance. The research suggested that sibling structure affects academic achievement.
Research relevant to five personality variables was reviewed along with research on attitudes about school and teachers. When self-report measures of need for achievement are used, low positive relationships with academic performance are noted. Research on need for affiliation does not clearly indicate a relationship with academic performance, although there is some evidence suggesting a negative relationship between them.

Self-concept of ability shows a positive relationship with learning. Very little information is available on the relationship between anxiety and academic achievement, but a negative correlation was indicated. Results of studies using the masculinity-femininity variable are consistent with those for sex differences. That is, students with high masculine scores receive poorer grades than those with high feminine scores. Positive attitudes about school and teachers are generally associated with higher levels of academic performance.

The issue of the effect of coeducational and single-sex education was considered briefly. The results clearly showed that students favored coeducational schools but were inconsistent as to the effects of type of school on academic performance.

The last set of variables reviewed were the measures of educational environment, including the LEI and the HSCI. Research with the LEI clearly indicates that perceptions of the classroom environment are related to academic performance. It was also noted that the median amount of the variance accounted for by the LEI was 30%. Research using the HSCI has established that correlations exist between perceptions of the school environment and personality variables, biographical variables and academic adjustment.
Objectives and Hypotheses

The purpose of the study, as noted at the beginning of the introduction, was to investigate the effects on classroom learning of both person and environmental variables. It was to be accomplished by predicting academic performance using a sample of variables selected from three major sets: biographical, personality and attitudinal, and environmental. The theoretical perspective and literature review suggested four specific objectives through which this purpose could be studied. They are listed below.

1. Determine the relative importance of the variables and the variable sets. Previous research concentrated on single variables or small sets of variables, and determining the relative importance of variables was impossible because of the varied conditions under which studies were conducted.

2. Test whether or not the Mediation model, which was discussed in the section dealing with the theoretical perspective, is a valid model for the explanation of short-term educational outcomes.

3. Determine for males and females if different variables are effective predictors of academic performance.

4. Determine if the best predictors of academic performance are different for students in coeducational and single-sex schools.
Hypotheses. The four objectives were achieved by studying (a) the variables as sets, (b) the variables all together, and (c) the variables individually. Each method of studying the variables provided different information about the relationship between them and academic performance. Hypotheses were developed to predict the relationships expected with each method, and these are listed below:

1. The biographical, personality and attitudinal, and environmental variable sets will each account for a statistically significant percentage of variance in average grades. The personality and attitudinal variable set, and the environmental variable set will account for a similar amount of variance. The biographical variable set will account for the smallest percentage of variance. The percentage of variance accounted for by each of the variable sets will vary for both sexes and the two types of school.

2. The personality and attitudinal variables, and environmental variables will be among the most important predictors of average grades when all the variables are studied together. The biographical variables will not be among the most important predictors because their influence will be accounted for by the environmental variables (see the section on the Mediation model). Different variable will be among the most important predictors for males and females and students from the two types of school.

3. When the variables are analyzed individually a positive correlation is predicted between academic achievement and the following variables: SES, need for achievement, self-concept of ability, and femininity; a negative correlation is predicted between academic achievement
and the following variables: need for affiliation, and negative attitudes towards teachers and school. Sibling structure variables and environmental variables will show a significant correlation with academic achievement, although the directions of the relationships for individual variables are difficult to predict. Some differences in correlational results are predicted for males and females and for students from coeducational and single-sex schools.
CHAPTER II

METHOD

Sample

Subjects

Data were collected as part of a larger study in which 2,348 male and female students were tested in grades 10 and 12. Students were required to have a consent form signed authorizing their schools to release their grades to the researchers. Those who were 18 years of age, or older, signed their own consent forms; younger students were required to obtain parental consent. Permission to obtain grades was obtained from 71.6% (1,681) of the students tested, and this percentage ranged from 42.0 to 97.9 across the 11 schools in the study.

The number of subjects for whom grades were available in each school, grade, and from each sex varied considerably in the original sample, and steps were taken to reduce this potential source of bias as much as possible. In order to have a large enough sample with which to work, all subjects for whom grades were available were kept in the coeducational sample. Some students in the single-sex sample were eliminated to better balance the groups. The final sample contained 1,415 students. The number of subjects in each school, grade, and from each sex is presented in Table 1.

The mean age for students was 16.3 (range 14 to 21); it was 15.4 for grade 10 students and 17.5 for grade 12 students. SES was measured
TABLE 1

Number of Subjects from Each School, Grade and Sex

<table>
<thead>
<tr>
<th>School&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Male Grade 10</th>
<th>Male Grade 12</th>
<th>Female Grade 10</th>
<th>Female Grade 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeducational</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>15</td>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>83</td>
<td>32</td>
<td>65</td>
<td>21</td>
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<td>6</td>
<td>34</td>
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<td>55</td>
<td>31</td>
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<tr>
<td>7</td>
<td>65</td>
<td>58</td>
<td>90</td>
<td>61</td>
</tr>
<tr>
<td>Single-sex male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>52</td>
<td>52</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>52</td>
<td>52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-sex female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
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<td>52</td>
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<td>25</td>
<td></td>
<td>52</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>School numbers were arbitrarily assigned.
using the Blishen scale (1968) which ranges from 25.4 (low status) to 76.9 (high status). The mean SES for all subjects was 43.8 (range 26 to 76); it was 42.6 for coeducation schools, 44.7 for male single sex schools, and 45.6 for female single-sex schools.

Schools

Students were from 11 schools located in five cities in the province of Ontario. The cities ranged in population from 50,000 to 2,000,000. Ten of the schools were from separate school boards, and one was from a public school board. Separate school boards are part of a religious school system (Roman Catholic). They are supported to the grade 10 level by public taxes, but at the grade 11, 12, and 13 level they are operated as private schools. As Table 1 indicates four of the schools were coeducational, three were single-sex male, and four were single-sex female.

Instruments

Biographical Variables

Subjects were asked to indicate, on the data collection instrument, their sex, age, number of brothers, number of sisters, birth order, and father's occupation. Their father's occupation was used to determine their SES level using the Blishen scale (Blishen, 1961).

Personality and Attitudinal Variables

Five personality scales and two attitudinal scales were administered. Reliability coefficients were calculated for each of the scales (including the environmental scales) using the data collected for the study. The reliability coefficients calculated were coefficient alpha and the KR-20
coefficient which is a special case of coefficient alpha for dichotomous variables (Nunally, 1970). These coefficients are a measure of the internal consistency of the items in a scale. Reliability coefficients were calculated using data from all subjects who had completed a particular scale and not just from subjects used in the major analyses presented later in the Results chapter. Using all possible data points gave a more accurate indication of the reliability of the scales. The coefficients are presented in Table 2.

Need for achievement and need for affiliation. Scales measuring need for achievement (nAch) and need for affiliation (nAff) were taken from the Personality Research Form (PRF), Form A (Jackson, 1967). They, along with the other 12 scales in the PRF, were created using personality constructs proposed by Murray (1938). The constructs were redefined and modified by Jackson prior to his work on the PRF. These scales focus on normal rather than psychopathological functioning. They use a true-false format, and items are scored in the direction of the scale name. Each scale is made up of 20 items, and the items for nAch and nAff appear in Appendix A and Appendix B, respectively.

A person scoring high on nAch aspires to accomplish difficult tasks, responds positively to competition and would be described by trait adjectives such as striving, industrious, ambitious, and competitive. Persons scoring high on nAff enjoy being with friends and people in general, make efforts to win friendships and would be described by trait adjectives such as neighbourly, loyal, friendly, sociable, and good willed. A full description of characteristics associated with these scales can be found in Appendices A and B.
### TABLE 2

Reliability Coefficients for Personality and Attitude Scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Alpha/KR-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>2087</td>
<td>.69</td>
</tr>
<tr>
<td>Affiliation</td>
<td>2087</td>
<td>.71</td>
</tr>
<tr>
<td>Femininity</td>
<td>2087</td>
<td>.69</td>
</tr>
<tr>
<td>Self-Concept of Ability</td>
<td>2087</td>
<td>.81</td>
</tr>
<tr>
<td>Anxiety</td>
<td>2087</td>
<td>.74</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>2087</td>
<td>.65</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>2087</td>
<td>.73</td>
</tr>
</tbody>
</table>

**Note.** Coefficients were calculated using data collected for this study.
Jackson (1974) reported KR-20 reliability coefficients of .73 and .72 for nAch and nAff, respectively, on two different samples (Form AA used for reliabilities). Test-retest reliability coefficients for nAch and nAff were .75 and .80, respectively. Table 2 shows that the complete sample KR-20's are .69 and .71 for nAch and nAff, respectively.

Masculinity-femininity. The scale selected for measuring masculinity-femininity was the Femininity scale from the California Psychological Inventory (CPI) developed by Gough (1957). Scales in the CPI use a true-false format and are scored in the direction of their name. The scales were designed for use with normal subjects, that is, subjects who are not psychiatrically disturbed. The Femininity scale has 38 items.

Feminine interests are indicated by a high score on this scale, and a low score indicates masculine interests. A female scoring high on femininity would be described as possessing stereotypically feminine characteristics, such as being appreciative, gentle, and accepting of others. A male scoring low would be described as possessing more stereotypically masculine characteristics, such as being outgoing, hardheaded, manipulative, and opportunistic in dealing with others. In a later paper, Gough (1968) notes that males scoring high on Femininity would be described as appreciative, complaining, meek, self-denying, and worrying. A female scoring low on this scale would be described as coarse, pleasure seeking, self-centered, and touchy. More complete descriptions of subjects scoring high and low on the Femininity scale are presented in Appendix C along with the items in the scale.

Only test-retest reliability coefficients for the Femininity scale are presented in the Manual for the CPI. These reliability coefficients
for high school students are .65 (N = 125) for females and .59 (N = 101) for males. Retesting occurred one year after initial testing and so the moderate coefficients suggest a fairly stable scale. The KR-20 coefficient from the complete set of data in this study is .69.

**Self-concept of ability.** The Self-Concept of Ability scale was adapted from one developed by Binder (1965). The subjects rate themselves on a five point scale for each of four items relating to present and future success at school. The alpha coefficient for this scale is .81. The items used in the Self-Concept of Ability scale appear in Appendix D.

**Anxiety.** The Anxiety scale was selected from the Multiple Affective Adjective Check List (MAACL) developed by Zukerman and Lubin (1965). Subjects were provided with a list of adjectives and they checked those which applied to themselves. Scoring was accomplished by counting one point for checking adjectives which indicate anxiety and one for not checking adjectives which do not indicate anxiety. There are 21 adjectives in the scale, and these are listed in Appendix E.

The Anxiety scale of the MAACL was designed to measure state anxiety rather than trait anxiety. It was also originally designed for use with clinical samples. The authors suggest that the scale may be administered using instructions which ask the subject how he "generally feels" rather than asking "how he feels today" which was the original instruction given. Using the general instructions a close approximation to trait anxiety is obtained. Results presented in the Manual (Zukerman & Lubin, 1965) show a correlation of .58 between the MAACL Anxiety scale, using general instructions, and the Taylor Manifest Anxiety Scale when college
students were tested. Correlations between this scale and the Walsh Anxiety Scale and the Maslow Security Scale are reported as .49 and -.69, respectively. These results suggested that the use of the general instructions with the Anxiety scale from the MAACL would result in an acceptable measure of trait anxiety.

The Manual reports a split-half reliability coefficient of .72 using college students and a test-retest correlation of .68 following a seven day interval. The data collected for the present study produced an alpha coefficient of .74. A note of caution is necessary with the Anxiety scale. The scale correlates -.48 with the Edwards Social Desirability Scale and -.25 with the Crowne-Marlowe Social Desirability Scale (Zukerman & Lubin, 1965). Although both of these correlations are significant, Zukerman and Lubin suggest they are low and note that the Edwards Social Desirability Scale has over half of its items taken from the Taylor Manifest Anxiety Scale, suggesting that it may reflect a large anxiety component.

Attitude toward teachers. The Attitude Toward Teachers scale was adapted from the Criticism of Education scale developed by Moore and Holtzman (1965). Three of the items in the Criticism of Education scale were dropped because they did not apply to teachers, and the remaining items were rewritten to more evenly balance items in negative and positive directions. The items in the Attitude Toward Teachers scale appear in Appendix F. Subjects respond to the items on a four point scale ranging from strongly agree to strongly disagree.

A high score on the scale indicates a negative attitude towards teachers, and low score indicates a positive attitude. For the original
scale, that is the Criticism of Education scale, it was suggested by Moore and Holtzman that high scorers are likely to be hostile towards education and school teachers.

The alpha coefficient for the Attitude Toward Teachers scale was .73.

Attitude toward school. The Attitude Toward School scale was constructed by selecting items from the High School Attitude Scale (Remmers, 1967). Remmers' scale is a 17 item Thurstone-type scale with items ranging from, "A high school education is worth a million dollars to any young person" to "High school teachers are parasites on the community." Five items were selected from the positive end of the scale and two items were selected from the negative end of the scale for use in the Attitude Toward School scale, and these appear in Appendix G. Subjects were asked to respond to each item on a four point scale, ranging from strongly agree to strongly disagree. A high score on the scale indicates a negative attitude towards school, and a low score indicates a positive attitude.

Little information on the reliability of Remmers' High School Attitude Scale is available, and what is available cannot be used to reflect the properties of the present scale because it used a different scoring system. The alpha coefficient for the Attitude Toward School scale was calculated to be .65.
Environmental Variables

High School Characteristics Index. Eight scales were selected from the HSCI (Stern, 1970). As discussed in the introduction, the HSCI was developed to measure environmental stress as defined by Murray (1938). The full Index has 30 scales, with 10 items each, and uses a true-false format; the subjects check true if an item applies to their school and false if it does not apply. The scales represent different aspects of the school environment, and their names reflect opposite ends of bipolar dimensions. Selection of the eight scales used in this study was based on Mitchell's (1968a) factor analysis of the 30 scales. Mitchell's analysis produced four factors, and two scales from each factor were selected for this study. Each scale loaded high on one factor and low on the other three.

Strong Intellectual Orientation was the first factor extracted by Mitchell. This factor is represented by the Achievement and the Humanities and Social Sciences scales of the HSCI. Achievement is defined as striving for success through personal effort. Humanities and Social Sciences is defined as "the symbolic manipulation of social objects or artifacts through empirical analyses, reflection, discussion, and criticism" (Stern, 1970, p. 316).

The second factor is labelled School Activities. School Activities is represented by the Affiliation-Rejection scale and the Play-Work scale. Affiliation-Rejection is described by the terms gregariousness, group-centered, friendly versus social detachment, social independence, or unsociableness. The Play-Work scale reflects pleasure-seeking versus persistently purposeful and task oriented behavior.
The Abasement-Assurance and Objectivity-Projectivity scales are used to represent Mitchell's third factor, Negative Attitude Toward the Environment. Abasement-Assurance is defined by the terms self-depreciating and self-devaluation versus certainty, self-confidence or self-glorification. Detached, impersonal thinking versus autistic or egocentric perceptions of the environment describe the poles of the Objectivity-Projectivity scale.

The fourth factor is labelled Strong Environmental Control, and the Deference-Restiveness and Impulsiveness-Deliberation scales were selected to represent it. Deference-Restiveness is defined as respect for authority, submission to perceived superiors versus noncompliancy, resistance or defiance. Impulsiveness-Deliberation is defined by rash and impetuous behavior versus care or reflectiveness. A more complete description of the environmental scales and their items may be found in Appendix H.

The results from the eight scales taken from the HSCI were factor analyzed. Following a principal components analysis three factors were selected because they had eigenvalues greater than one. A principal axis factor analysis was performed for the three factors and they were rotated to simple structure using the Varimax criterion which maintains orthogonality between the factors. The full results of this analysis are presented in Appendix I. The results of this analysis show that Mitchell's Negative Attitude Toward the Environment and Strong Environmental Control factors were replicated. His other two factors, Strong Intellectual Orientation and School Activities, collapsed into one factor. However, Mitchell (1968a) reported that this occurred occasionally when he factor analyzed results for individual schools in his study. Thus, data from
the present sample, in part, confirm the factor analytic results of Mitchell and indicate that the scales selected represent the main dimensions of the 30 scales in the HSCI.

Reliability coefficients were calculated for each of the scales. These coefficients, along with those reported by Stern (1970), are presented in Table 3. The results show that KR-20 coefficients calculated from data collected for use in this study are somewhat lower than those reported by Stern. The coefficients for the present data range from .25 to .73, and for Stern's results they range from .35 to .77.

Procedure

As noted earlier the data for this study were collected as part of a larger study which included a number of other scales and test items. The data were collected in the spring of 1973 and 1974. Ninety-five percent of the testing was conducted by two male researchers, and the remaining five percent of the testing was done by a male and a female research assistant. Testing was carried out at the students' school in groups ranging in size from 25 to 200.

At the beginning of the testing session the researcher introduced himself or herself and stated that the purpose of the research was to investigate the relationship between certain attitudes and interests of students and their reactions to school. Students were told that their participation was voluntary. They were also told to proceed with all questions at their own pace and that instructions for each section appeared in the test booklet. Full testing instructions appear in Appendix J. A description of how to complete the answer sheets was
<table>
<thead>
<tr>
<th>Variable</th>
<th>KR-20 from present study</th>
<th>KR-20 from Stern (1970)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abasement-Assurance</td>
<td>.64</td>
<td>.69</td>
</tr>
<tr>
<td>Achievement</td>
<td>.43</td>
<td>.65</td>
</tr>
<tr>
<td>Affiliation-Rejection</td>
<td>.73</td>
<td>.72</td>
</tr>
<tr>
<td>Deference-Restiveness</td>
<td>.25</td>
<td>.38</td>
</tr>
<tr>
<td>Humanities and Social Science</td>
<td>.51</td>
<td>.70</td>
</tr>
<tr>
<td>Impulsiveness-Deliberation</td>
<td>.31</td>
<td>.35</td>
</tr>
<tr>
<td>Objectivity-Projectivity</td>
<td>.73</td>
<td>.77</td>
</tr>
<tr>
<td>Play-Work</td>
<td>.47</td>
<td>.62</td>
</tr>
</tbody>
</table>
provided. Instructions relevant to individual scales appear in the relevant appendices along with the scale items.

Before the testing began students were assured that the test results would remain confidential and individual results would not be made available to anyone, including their school or the Ministry of Education.

The data were analyzed at a number of computer installations. Most of the analyses were performed using version 7.2 of the Statistical Package for the Social Sciences, SPSS (Nie, Hull, Jenkins, Streinbrenner & Bent, 1975; Nie & Hull, 1978).
CHAPTER III

RESULTS

Results will be presented in three sections defined by the statistical analyses employed. The first section will present the results of analyses which calculated the proportion of variance which each of the three sets of variables accounts for in the criterion measure, average grade. The three sets of variables are biographical, personality and attitudinal, and perceptions of the school environment. The second section, and probably the most important, will present the results of the regression analyses using all of the variables. It is these results which will indicate most clearly whether there is support for the theoretical perspective presented in the introduction. The third section will present zero-order correlation coefficients indicating the relationship between average grade and each of the variables separately.

The results are also broken into subsections by the type of school studied and the sex of the students. Two types of schools, coeducational and single-sex, were studied, and for each school data were collected from males and females. All results will be presented separately for each of these four analysis groups.
Percentage of Variance Analyses

The purpose of this section was to determine what percentage of the variance in average grade was accounted for by each of the three sets of independent or predictor variables. The percentage of variance accounted for was determined by calculating a multiple regression equation using each set of variables by itself to predict average grade.

The squared multiple correlation coefficient indicates the proportion of variance accounted for and is converted to a percentage for presentation in the text. Table 4 presents a summary of the proportion of variance results. If a variable set accounts for a significant proportion of the variance in average grade those variables from the set which add 1.0% to the variance accounted for are presented in the text.

Coeducational Schools

Coeducational males. Biographical variables account for a nonsignificant percentage of the variance in average grade for males attending coeducational schools. The percentage of variance accounted for by the other two variable sets is significant.

The personality and attitudinal variables account for 37.4% of the variance in the criterion. The most important personality and attitudinal variables are Self-Concept of Ability, Need for Achievement, Attitude Toward School and Need for Affiliation. The five personality variables account for 35.5% of the variance and the two attitudinal scales account for 7.9% of the variance in average grade.

The scales measuring perceptions of the school environment account for 11.1% of the variance in grades for males from coeducational schools.
<table>
<thead>
<tr>
<th>Variable Set</th>
<th>Coeducational students</th>
<th>Single-sex students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Biographical</td>
<td>.029</td>
<td>.044</td>
</tr>
<tr>
<td></td>
<td>F(5,262) = 1.569</td>
<td>F(4,287) = 3.281*</td>
</tr>
<tr>
<td>Personality &amp; Attitudinal</td>
<td>.374</td>
<td>.406</td>
</tr>
<tr>
<td></td>
<td>F(7,306) = 26.102***</td>
<td>F(7,344) = 33.612***</td>
</tr>
<tr>
<td>Personality</td>
<td>.355</td>
<td>.399</td>
</tr>
<tr>
<td></td>
<td>F(5,308) = 33.916***</td>
<td>F(5,346) = 45.909***</td>
</tr>
<tr>
<td>Attitudinal</td>
<td>.079</td>
<td>.061</td>
</tr>
<tr>
<td></td>
<td>F(2,311) = 13.307***</td>
<td>F(2,344) = 11.417***</td>
</tr>
<tr>
<td>Environmental</td>
<td>.111</td>
<td>.091</td>
</tr>
<tr>
<td></td>
<td>F(8,331) = 5.189***</td>
<td>F(8,356) = 4.468***</td>
</tr>
<tr>
<td>All Variables</td>
<td>.444</td>
<td>.453</td>
</tr>
<tr>
<td></td>
<td>F(20,229) = 9.157***</td>
<td>F(20,260) = 10.759</td>
</tr>
</tbody>
</table>

* p < .05 / ** p < .01 / *** p < .001
The most important environmental variables are Abasement and Affiliation.

Coeducational females. The biographical variables account for 4.4% of the variance in average grade for coeducational girls, but this is only marginally significant. Number of sisters and age are the most important biographical variables.

Personality and attitudinal variables account for 40.6% of the variance in average grade. The most important variables are Self-Concept of Ability, Need for Achievement, Femininity, and Need for Affiliation. The personality variables account for 39.9% of the variance, and the attitudinal variables account for 6.2%.

Measures of perceptions of the school environment account for 6.1% of the variance in average grade. The most important environmental variables are Abasement and Play.

Single-Sex Schools

Single-sex males. Biographical variables account for a nonsignificant percentage of variance in the average grades of males attending single-sex schools. The percentage of variance results presented for the other variable sets are statistically significant.

Personality and attitudinal variables account for 47.4% of the variance in the criterion, and the most important variables are Self-Concept of Ability, Need for Achievement, Anxiety, Attitude Toward Teachers, and Femininity. The five personality variables account for 45.5% of the variance, and the two attitudinal scales account for 10.9% of the variance.

The environmental variables account for 12.7% of the variance in average grade. The most important environmental variables are Objectivity and Humanities.
Single-sex females. Biographical variables and measures of the students' perceptions of their school environment account for nonsignificant proportions of variance in average grades for females attending single-sex schools.

The only variable set which accounts for a significant percentage of variance for females in single-sex schools is the personality and attitudinal variables. These scales account for 47.4% of the variance in average grade. The scales measuring Self-Concept of Ability and Need for Achievement are the most important in the personality and attitudinal set. The personality scales account for 41.6% of the variance, and the attitudinal scales account for 3.4% of the variance.

Patterns

The most unexpected result in this section is that the biographical variables account for no significant amount of variance in three of the four analyses. Only for female students attending coeducational schools do the biographical variables account for a significant proportion of variance.

A careful study of the amount of variance accounted for by personality and attitudinal variables in the four analyses reveals an effect similar to an interaction in an analysis of variance. In coeducational schools females have a higher percentage of variance accounted for than males, while in single-sex schools males show a higher percentage of variance accounted for than females. The difference between coeducational and single-sex females is slight but the difference between coeducational and single-sex males is large, equal to 10.0%. The same pattern, as above, is present when only personality variables are studied, but the pattern is different when the two attitudinal scales are studied.
The pattern in the data for the attitudinal scales is that male single-sex students have a higher percentage of variance accounted for than coeducational males, while coeducational females have a higher percentage of variance accounted for than females in single-sex schools. For both coeducational school and single-sex school students the males have a higher percentage of variance accounted for by the attitudinal scales than do the females, although the difference between males and females for single-sex school students is much greater.

The percentage of variance accounted for by the environmental variables is very similar for males in both coeducational and single-sex schools. For females, the coeducational school results show a much higher percentage of variance accounted for by the environmental variables than the single-sex school results. The amount of variance accounted for in both male samples is higher than in the two female samples.

Regression Analyses

The previous section, which presented the percentage of variance results, indicated the relative importance of the variable sets. The present section is designed to indicate which of the individual variables are most important in predicting average grade. The analytical technique selected for this purpose was stepwise regression. Regression analysis was particularly well suited for this analysis because it can analyze large numbers of variables which are intercorrelated.

A very important assumption underlies the selection of stepwise regression, and the manner in which it was used in this study. The stepwise regression procedure selects a set of variables which best
predicts the criterion variable. It therefore must be assumed that those variables which best predict average grade are the ones which are most important theoretically and practically for understanding the factors affecting grades. Of course, all of the predictor variables were selected because either theory or previous research had shown them to be related to grades; therefore, each is, to some extent, important in understanding the factors which influence the grades of students. Moreover, the reader is cautioned not to infer that the presence of a strong relationship between average grade and an independent variable implies that the students' average grades are caused by the independent variable. Causal relationships can only be determined using experiments designed to specifically test cause and effect relationships.

Double cross-validation was employed with the regression analysis. This procedure was originally suggested by Mosier (1951) and has been recommended by Kerlinger and Pedhazur (1973) "as the most rigorous approach to the validation of results from regression analysis in a predictive framework" (p. 284). Double cross-validation basically involves splitting the total sample in half, obtaining regression equations on each half and cross-validating each regression equation on the other half of the sample. If the cross-validation results show only minimal shrinkage in the amount of variance accounted for, then the two half-samples may be recombined to create one large sample on which the final regression analysis can be performed.

Four major steps (noted briefly above) were involved in the regression analyses. The first step was to divide the samples of subjects into equal halves. This was accomplished by randomly dividing the subjects
into two groups (referred to as half-samples) while maintaining the same proportion of subjects in each group from each sex and for each grade as existed in the complete sample.

The second step was to use stepwise regression (see Darlington, 1968; Kerlinger & Pedhazur, 1973; Mosteller & Tukey, 1977; Nie et al. 1975) to determine the set of variables which best predicts average grade for each half-sample. It was decided that variables which, when entered into the regression equation, added significantly to $R^2$ would be selected as the best predictors at this point in the analysis. Thus, for each half-sample a best set of predictors was selected, and a regression equation was calculated for each half-sample using only the selected variables.

The third step completed the cross-validation procedure. It involved using the regression equations calculated at the end of step 2 to predict average grades for students in the half-sample not used to calculate the equation. That is, in step 2 a regression equation was calculated for half-sample 1 and for half-sample 2. In step 3 the regression equation calculated for half-sample 1 was used to predict average grades in half-sample 2, and the regression equation calculated for half-sample 2 was used to predict average grades in half-sample 1. For each regression equation calculated in step 2 and tested in step 3 there was a creation sample (the half-sample with which the equation was calculated) and a test sample (the half-sample with which the equation was tested). The equation calculated with half-sample 1 had half-sample 1 as its creation sample and half-sample 2 as its test sample. The equation calculated with half-sample 2 had half-sample 2 as its creation sample and half-sample 2
1 as its test sample. The predicted scores were correlated with the actual scores for each creation and test sample. The validity of a regression equation was indicated by the difference between the correlation coefficients (predicted values correlated with actual values) for the creation and test samples. If the difference, or shrinkage in the correlation coefficient, was less than or equal to .10 the results were considered valid.

Recall that the purpose of performing the cross-validation was not to determine if the half-sample regression equations were in themselves valid, but rather to determine if regression analysis with these data was valid. If it were shown that regression analysis was valid, then the two half-samples would be recombined for the final analysis. If the validation procedure showed the regression procedure not to be valid, then no further analyses would be performed.

The fourth and final step in the regression analysis, if the cross-validation results were positive, would involve recombining the half-samples and performing the final stepwise regression analysis on the larger combined sample. The final step would involve a stepwise regression analysis to determine the relative importance, in statistical terms, of each of the variables in the study. Again, this would require the selection of a best set of predictors. The criterion for selecting a variable as one of the best predictors at this step of the analyses was that when entered into the regression equation it added at least 1.0% new variance to that which had been accounted for.

Two major statistics derived from the regression analysis will be presented. The first is $R^2$ which, as noted earlier, represents the
proportion (or percentage) of variance accounted for by the variables in regression analysis. As variables are entered into a regression equation they add to the value of $R^2$. It is therefore possible to determine how much unique variance a variable accounts for when added to the regression equation by examining the increase in $R^2$. The more unique variance a variable adds the more important that variable is in prediction.

The second major statistic that will be presented is the beta weight which is often referred to as a partial regression coefficient (Kerlinger & Pedhazur, 1973, p. 69). It indicates the relative size and direction of the relationship between the criterion variable and a predictor variable while controlling for the influence of all other variables in the regression equation. Therefore, the beta weights will change as the variables in the regression equation change. For this reason, after selecting the set of best predictor variables using all variables a new equation will be calculated using only those variables selected. The result will be regression weights which are relevant to the set of variables selected and not to the full set of variables.

Interpretation of the beta weights has been described as a risky business by a number of writers (Darlington, 1968; Kerlinger & Pedhazur, 1973; Mosteller & Tukey, 1977). The interpretation problem results mainly from their lack of stability as new variables are added to the regression equation. Most writers suggest, though, that if the beta weights remain relatively constant as new variables are added to the equation, their interpretation is less risky. By comparing beta weights when all variables are in the regression equation to the beta weights when only the selected variables are in the equation we will have an indication of their stability and thus whether they are interpretable.
Beta weights and the $R^2$ increase both indicate the relative importance of variables in a regression equation. While beta weights change as new variables enter an equation the $R^2$ increase will not change as new variables enter. Because the beta weights change as variables enter the regression they are a more dynamic indicator of relative importance.

Coeducational Students

Coeducational males. The cross-validation results, presented in Table 5, for males attending coeducational schools indicates that the shrinkage of the correlation coefficient is small. For the first half-sample the correlation between predicted and actual scores dropped from .67 to .56 when the equation was applied to the creation and test samples, respectively. This represents a drop of .11. For the second half-sample the drop is from .65 to .55, a drop of .10. Shrinkage is not considered serious (even though it is slightly greater than .10 for the first half-sample), and the next step in the analysis, recombining the samples, can be carried out.

Table 6 presents the complete regression results for the males attending coeducational schools. The full set of 20 variables account for 44.4% of the variance in average grade. Seven variables each add at least 1.0% to the variance accounted for, and together they account for 41.2% of the variance in average grade.

The seven variables were used in a new analysis, and these results are presented in Table 7. Self-Concept of Ability accounts for 30.1% of the variance in average grade and is the first variable selected by the regression procedure. Abasement adds 2.5% to the variance accounted for. SES and Need for Affiliation each add approximately 2.0% to the
TABLE 5
Correlation Coefficients from Cross-Validation Analyses

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample</th>
<th></th>
<th>Test.</th>
<th>Shrinkage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Creation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coeducational students</td>
<td>1</td>
<td>.67</td>
<td>.56</td>
<td>.11</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>.65</td>
<td>.55</td>
<td>.10</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>1</td>
<td>.60</td>
<td>.56</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>.67</td>
<td>.61</td>
<td>.06</td>
</tr>
<tr>
<td>Single-sex students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>1</td>
<td>.70</td>
<td>.63</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>.73</td>
<td>.66</td>
<td>.07</td>
</tr>
<tr>
<td>Females</td>
<td>1</td>
<td>.63</td>
<td>.58</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>.70</td>
<td>.59</td>
<td>.11</td>
</tr>
</tbody>
</table>
### Table 6

Stepwise Regression Results for Male Coeducational Students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>Standard error</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.301</td>
<td>.498</td>
<td>.013</td>
<td>77.139</td>
</tr>
<tr>
<td>Abasement</td>
<td>.325</td>
<td>-.159</td>
<td>.025</td>
<td>4.115</td>
</tr>
<tr>
<td>SES</td>
<td>.344</td>
<td>-.175</td>
<td>.003</td>
<td>10.797</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>.364</td>
<td>-.097</td>
<td>.013</td>
<td>2.763</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.380</td>
<td>.162</td>
<td>.011</td>
<td>8.048</td>
</tr>
<tr>
<td>Age</td>
<td>.397</td>
<td>-.148</td>
<td>.031</td>
<td>7.546</td>
</tr>
<tr>
<td>Humanities</td>
<td>.412</td>
<td>-.083</td>
<td>.022</td>
<td>1.976</td>
</tr>
<tr>
<td>Birth order</td>
<td>.417</td>
<td>.058</td>
<td>.045</td>
<td>0.954</td>
</tr>
<tr>
<td>Femininity</td>
<td>.423</td>
<td>.087</td>
<td>.011</td>
<td>2.660</td>
</tr>
<tr>
<td>Deference</td>
<td>.428</td>
<td>-.073</td>
<td>.023</td>
<td>2.025</td>
</tr>
<tr>
<td>Achievement (HSCI)</td>
<td>.432</td>
<td>-.081</td>
<td>.023</td>
<td>1.582</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.435</td>
<td>.058</td>
<td>.013</td>
<td>0.952</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>.437</td>
<td>-.061</td>
<td>.013</td>
<td>0.864</td>
</tr>
<tr>
<td>Play</td>
<td>.439</td>
<td>.070</td>
<td>.026</td>
<td>1.236</td>
</tr>
<tr>
<td>Affiliation (HSCI)</td>
<td>.441</td>
<td>-.062</td>
<td>.024</td>
<td>0.735</td>
</tr>
<tr>
<td>Number of sisters</td>
<td>.443</td>
<td>.042</td>
<td>.031</td>
<td>0.584</td>
</tr>
<tr>
<td>Objectivity</td>
<td>.443</td>
<td>.047</td>
<td>.022</td>
<td>0.359</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>.444</td>
<td>.040</td>
<td>.014</td>
<td>0.255</td>
</tr>
<tr>
<td>Impulsion</td>
<td>.444</td>
<td>-.013</td>
<td>.023</td>
<td>0.059</td>
</tr>
<tr>
<td>Number of brothers</td>
<td>.444</td>
<td>-.011</td>
<td>.028</td>
<td>0.041</td>
</tr>
</tbody>
</table>

Note. $F(20, 229) = 9.157; \quad R = .667; \quad$ Standard error $= .541.$
TABLE 7

Stepwise Regression Results from the Most Important Predictors for Male Coeducational Students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>b weight</th>
<th>Standard error</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.301</td>
<td>.503</td>
<td>.117</td>
<td>.013</td>
<td>85.008</td>
</tr>
<tr>
<td>Abasement</td>
<td>.325</td>
<td>-.183</td>
<td>-.058</td>
<td>.016</td>
<td>13.199</td>
</tr>
<tr>
<td>SES</td>
<td>.344</td>
<td>-.163</td>
<td>-.008</td>
<td>.022</td>
<td>10.108</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>.364</td>
<td>-.124</td>
<td>-.027</td>
<td>.011</td>
<td>6.051</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.380</td>
<td>.171</td>
<td>.033</td>
<td>.010</td>
<td>10.302</td>
</tr>
<tr>
<td>Age</td>
<td>.397</td>
<td>-.131</td>
<td>-.076</td>
<td>.029</td>
<td>6.771</td>
</tr>
<tr>
<td>Humanities</td>
<td>.411</td>
<td>-.124</td>
<td>-.045</td>
<td>.019</td>
<td>5.914</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.104</td>
</tr>
</tbody>
</table>

**Note.** $F(7,242) = 24.181$; $R = .642$; Standard error = .542.
variance. Need for Achievement, age, and Humanities each add approximately 1.5% new variance to that accounted for.

As noted earlier, interpretation of the beta weights depends on how stable they are. Comparing the beta weights in Table 7, in which the seven selected variables are entered, with those in Table 6, in which all variables are entered, gives an indication of the stability of the weights. The beta weight for Humanities changes by .04 from when it is in the 20 variable equation to when it is in the 7 variable equation, and this is the largest change in a beta weight. The small change suggests that the beta weights for the seven selected variables are relatively stable.

The beta weights, in agreement with $R^2$ values, indicate that Self-Concept of Ability is by far the most important predictor, and Abasement is the second most important predictor. The relative importance of the other variables, as indicated by the beta weights, is different from that indicated by the $R^2$ values. The direction of the relationship between the predictor and criterion variables is also of interest and is indicated by the beta weights. Self-Concept of Ability and Need for Achievement have positive beta weights indicating a positive relationship with average grade. Abasement, SES, age, Need for Affiliation, and Humanities are all negatively related to average grade.

Coeducational females. Correlations obtained in the cross-validation analyses are presented in Table 5. For half-sample 1 the shrinkage in the correlation coefficient is .04, and for half-sample 2 the shrinkage is .06. The decrease in the correlation coefficient resulting from cross-validation is well within the limits set earlier, and so the half-samples are recombined to allow for the main regression analysis.
With all 20 variables in the regression equation 45.3% of the variance in average grade is accounted for (see Table 8). A total of four variables add at least 1.0% to the variance accounted for in the criterion. Table 9 presents the regression analysis using only the four selected variables.

Self-Concept of Ability is the first variable entered into the regression equation and accounts for 31.2% of the variance. Femininity adds 5.1% to the variance and Need for Achievement adds 2.2%. The last variable entered, Play, adds 1.3% to the variance accounted for and brings the total variance accounted for by these four variables to 39.8%.

The beta weights may be considered stable because the greatest change in a weight from when there are 20 variables in the equation to when there are 4 variables in the equation is .02, for the variable Play. The beta weights indicate an order of importance slightly different from that indicated by the $R^2$ values. The difference for beta weights is that Need for Achievement is the second most important variable, and Femininity is the third most important variable. Self-Concept of Ability, Need for Achievement and Femininity are positively related to average grade, and Play is negatively related to average grade.

**Comparison.** Both males and females in coeducational schools have Self-Concept of Ability and Need for Achievement in the variables selected as most important. On a broader level of comparison the males have two biographical variables, SES and age, as major variables, but females have no biographical variables selected. Both males and females have personality variables and measures of the environment in the selected group of best predictors. The four variables selected as best predictors
<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>Standard error</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.342</td>
<td>.505</td>
<td>.013</td>
<td>80.877</td>
</tr>
<tr>
<td>Femininity</td>
<td>.363</td>
<td>.141</td>
<td>.010</td>
<td>7.665</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.385</td>
<td>.171</td>
<td>.011</td>
<td>9.151</td>
</tr>
<tr>
<td>Play</td>
<td>.398</td>
<td>-.098</td>
<td>.026</td>
<td>2.353</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>.406</td>
<td>.112</td>
<td>.012</td>
<td>4.104</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>.411</td>
<td>-.071</td>
<td>.014</td>
<td>2.024</td>
</tr>
<tr>
<td>Achievement (HSCI)</td>
<td>.417</td>
<td>.096</td>
<td>.022</td>
<td>2.540</td>
</tr>
<tr>
<td>Humanities</td>
<td>.424</td>
<td>-.087</td>
<td>.019</td>
<td>2.537</td>
</tr>
<tr>
<td>Birth order</td>
<td>.428</td>
<td>.143</td>
<td>.040</td>
<td>6.554</td>
</tr>
<tr>
<td>Number of sisters</td>
<td>.436</td>
<td>-.093</td>
<td>.028</td>
<td>3.204</td>
</tr>
<tr>
<td>Age</td>
<td>.440</td>
<td>-.081</td>
<td>.029</td>
<td>2.650</td>
</tr>
<tr>
<td>Number of brothers</td>
<td>.443</td>
<td>-.080</td>
<td>.028</td>
<td>2.508</td>
</tr>
<tr>
<td>Abasement</td>
<td>.449</td>
<td>-.060</td>
<td>.021</td>
<td>0.775</td>
</tr>
<tr>
<td>SES</td>
<td>.450</td>
<td>-.044</td>
<td>.002</td>
<td>0.067</td>
</tr>
<tr>
<td>Objectivity</td>
<td>.451</td>
<td>.042</td>
<td>.019</td>
<td>0.358</td>
</tr>
<tr>
<td>Affiliation (HSCI)</td>
<td>.452</td>
<td>-.041</td>
<td>.022</td>
<td>0.335</td>
</tr>
<tr>
<td>Deference</td>
<td>.452</td>
<td>.021</td>
<td>.021</td>
<td>0.194</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>.453</td>
<td>-.022</td>
<td>.012</td>
<td>0.112</td>
</tr>
<tr>
<td>Impulsion</td>
<td>.453</td>
<td>.015</td>
<td>.021</td>
<td>0.092</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.453</td>
<td>.010</td>
<td>.009</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Note. $F(20, 260) = 10.759; \quad R = .673; \quad$ Standard error = .514.
### TABLE 9

Stepwise Regression Results from the Most Important Predictors for Female Coeducational Students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>b weight</th>
<th>Standard error</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.312</td>
<td>.501</td>
<td>.116</td>
<td>.013</td>
<td>85.554</td>
</tr>
<tr>
<td>Femininity</td>
<td>.363</td>
<td>.146</td>
<td>.029</td>
<td>.009</td>
<td>9.755</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.385</td>
<td>.173</td>
<td>.034</td>
<td>.011</td>
<td>10.241</td>
</tr>
<tr>
<td>Play</td>
<td>.398</td>
<td>-.113</td>
<td>-.046</td>
<td>.019</td>
<td>5.832</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-2.229</td>
</tr>
</tbody>
</table>

**Note.** $F(4,276) = 45.602; \ R = .631; \ \text{Standard error} = .523.$
for females account for only 1.3% less variance than the seven selected for males.

**Single-Sex Schools**

**Single-sex males.** Cross-validation results obtained from the data for males attending single-sex schools indicate that a regression equation obtained for these data would be valid. The shrinkage in the correlation coefficient when the regression equations are applied to half-samples on which they were not calculated is .07 for both half-samples (see Table 5). The small shrinkage allows for the recombining of the two half-samples for further analyses.

Table 10 presents the stepwise results obtained when the full set of 20 independent variables are used to predict average grade. The set of 20 variables account for 52.0% of the variance in average grade. A smaller set of eight variables account for 49.2% of the variance with each variable adding at least 1.0% to the variance accounted for.

The eight variables selected above were used in a regression equation by themselves, and these results appear in Table 11. Self-Concept of Ability is shown as the first variable entered, accounting for 38.7% of the variance, and Need for Achievement, entered second, adds 3.7% to the variance accounted for. Need for Affiliation, Attitude Towards Teachers, Humanities, Abasement, Play, and Femininity each add between 1.0% and 1.4% to the variance accounted for.

The beta weights are fairly similar for the regression analyses with 8 variables and with 20 variables, except for the variable Need for Affiliation. When Need for Affiliation is considered with the full set of 20 variables the beta weight is only -.013, but when it is considered with the eight selected variables the beta weight is -.125. This suggests that what variance Need for Affiliation accounts for is shared with the 12 variables not selected for the final analysis.
<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>Standard error</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.387</td>
<td>.481</td>
<td>.013</td>
<td>81.201</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.424</td>
<td>.224</td>
<td>.012</td>
<td>15.228</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>.438</td>
<td>-.013</td>
<td>.013</td>
<td>4.068</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>.451</td>
<td>-.227</td>
<td>.014</td>
<td>12.908</td>
</tr>
<tr>
<td>Humanities</td>
<td>.464</td>
<td>-.113</td>
<td>.023</td>
<td>4.522</td>
</tr>
<tr>
<td>Abasement</td>
<td>.472</td>
<td>.117</td>
<td>.023</td>
<td>5.927</td>
</tr>
<tr>
<td>Play</td>
<td>.482</td>
<td>.171</td>
<td>.023</td>
<td>8.681</td>
</tr>
<tr>
<td>Femininity</td>
<td>.492</td>
<td>.101</td>
<td>.011</td>
<td>3.897</td>
</tr>
<tr>
<td>Affiliation (HSCI)</td>
<td>.501</td>
<td>-.152</td>
<td>.022</td>
<td>5.667</td>
</tr>
<tr>
<td>Age</td>
<td>.510</td>
<td>-.096</td>
<td>.030</td>
<td>3.702</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.513</td>
<td>.057</td>
<td>.012</td>
<td>1.245</td>
</tr>
<tr>
<td>Deference</td>
<td>.515</td>
<td>-.039</td>
<td>.025</td>
<td>.617</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>.516</td>
<td>-.050</td>
<td>.014</td>
<td>.716</td>
</tr>
<tr>
<td>Objectivity</td>
<td>.517</td>
<td>.048</td>
<td>.020</td>
<td>.494</td>
</tr>
<tr>
<td>SES</td>
<td>.518</td>
<td>.038</td>
<td>.003</td>
<td>.600</td>
</tr>
<tr>
<td>Number of brothers</td>
<td>.519</td>
<td>-.035</td>
<td>.031</td>
<td>.445</td>
</tr>
<tr>
<td>Birth order</td>
<td>.519</td>
<td>.033</td>
<td>.043</td>
<td>.368</td>
</tr>
<tr>
<td>Number of sisters</td>
<td>.520</td>
<td>-.018</td>
<td>.033</td>
<td>.116</td>
</tr>
<tr>
<td>Impulsion</td>
<td>.520</td>
<td>.015</td>
<td>.023</td>
<td>.084</td>
</tr>
<tr>
<td>Achievement (HSCI)</td>
<td>.520</td>
<td>-.012</td>
<td>.021</td>
<td>.046</td>
</tr>
</tbody>
</table>

Note. $F(20,226) = 12.244$; $R = .721$; Standard error = .546.
TABLE 11

Stepwise Regression Results from the Most Important Predictors for Male
Single-Sex Students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta</th>
<th>b</th>
<th>Standard error</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.387</td>
<td>.501</td>
<td>.118</td>
<td>.012</td>
<td>95.740</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.424</td>
<td>.218</td>
<td>.047</td>
<td>.011</td>
<td>17.311</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>.438</td>
<td>-.125</td>
<td>-.031</td>
<td>.012</td>
<td>7.182</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>.451</td>
<td>-.217</td>
<td>-.047</td>
<td>.012</td>
<td>14.351</td>
</tr>
<tr>
<td>Humanities</td>
<td>.464</td>
<td>-.135</td>
<td>-.058</td>
<td>.021</td>
<td>7.252</td>
</tr>
<tr>
<td>Abasement</td>
<td>.492</td>
<td>.153</td>
<td>.052</td>
<td>.020</td>
<td>6.716</td>
</tr>
<tr>
<td>Play</td>
<td>.482</td>
<td>.118</td>
<td>.046</td>
<td>.020</td>
<td>5.501</td>
</tr>
<tr>
<td>Femininity</td>
<td>.492</td>
<td>.106</td>
<td>.023</td>
<td>.011</td>
<td>4.901</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td>-.2.117</td>
<td></td>
</tr>
</tbody>
</table>

Note. $F(8,238) = 28.826; \ R = .702; \ Standard \ error = .547.$
Self-Concept of Ability has the largest beta weight, and Need for Achievement has the second largest. The third largest beta weight is associated with Attitude Toward Teachers. The remaining variables are ordered as follows according to their beta weights: Abasement, Humanities, Need for Affiliation, Play, and Femininity. Variables which have positive beta weights are Self-Concept of Ability, Need for Achievement, Abasement, Play, and Femininity. Need for Affiliation, Attitude Toward Teachers, and Humanities have negative beta weights.

**Single-sex females.** The correlation between predicted and actual scores for the second half-sample is .70 for the creation sample and only .59 for the test sample. The difference between these two correlations is .11 which is slightly greater than .10, established as the approximate cut-off for proof of validity. For half-sample 1 the difference between creation and test sample correlation coefficients is .047, well below the criterion of acceptability. Because only one difference is slightly greater than .10 recombining the half-samples is a reasonable step.

The combined half-samples were analyzed, and the stepwise regression results appear in Table 12. The results indicate that the full set of 20 variables accounts for 45.0% of the variance in the criterion. Only three variables add at least 1.0% to the variance accounted for, and these account for 41.6% of the variance in average grade. The three selected variables were further analyzed by themselves.

The results of the analysis with the three selected variables is presented in Table 13. The most important variable is Self-Concept of Ability accounting for 38.5% of the variance in average grade. Need for Achievement adds 2.0% to the variance accounted for, and Age adds 1.1%.
<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>Standard error</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.385</td>
<td>.580</td>
<td>.011</td>
<td>144.225</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.405</td>
<td>.152</td>
<td>.011</td>
<td>9.962</td>
</tr>
<tr>
<td>Age</td>
<td>.416</td>
<td>-.117</td>
<td>.028</td>
<td>6.625</td>
</tr>
<tr>
<td>Femininity</td>
<td>.421</td>
<td>.074</td>
<td>.010</td>
<td>2.645</td>
</tr>
<tr>
<td>Birth order</td>
<td>.427</td>
<td>.055</td>
<td>.040</td>
<td>1.145</td>
</tr>
<tr>
<td>Humanities</td>
<td>.431</td>
<td>-.059</td>
<td>.020</td>
<td>1.487</td>
</tr>
<tr>
<td>Attitude Toward Teachers</td>
<td>.436</td>
<td>-.130</td>
<td>.013</td>
<td>4.427</td>
</tr>
<tr>
<td>Objectivity</td>
<td>.440</td>
<td>-.104</td>
<td>.019</td>
<td>2.387</td>
</tr>
<tr>
<td>SES</td>
<td>.442</td>
<td>-.052</td>
<td>.002</td>
<td>1.335</td>
</tr>
<tr>
<td>Impulsion</td>
<td>.444</td>
<td>-.059</td>
<td>.020</td>
<td>1.670</td>
</tr>
<tr>
<td>Deference</td>
<td>.447</td>
<td>-.043</td>
<td>.022</td>
<td>.857</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.448</td>
<td>.042</td>
<td>.010</td>
<td>.781</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>.449</td>
<td>.026</td>
<td>.012</td>
<td>.262</td>
</tr>
<tr>
<td>Number of Sisters</td>
<td>.449</td>
<td>.022</td>
<td>.027</td>
<td>.189</td>
</tr>
<tr>
<td>Play</td>
<td>.449</td>
<td>.033</td>
<td>.023</td>
<td>.352</td>
</tr>
<tr>
<td>Affiliation (HSCI)</td>
<td>.450</td>
<td>-.030</td>
<td>.016</td>
<td>.252</td>
</tr>
<tr>
<td>Abasement</td>
<td>.450</td>
<td>-.021</td>
<td>.023</td>
<td>.098</td>
</tr>
<tr>
<td>Affiliation</td>
<td>.450</td>
<td>-.011</td>
<td>.014</td>
<td>.057</td>
</tr>
</tbody>
</table>

Note. Number of brothers and Achievement (HSCI) did not enter the equation.

$F(18,302) = 13.736; \quad R = .671; \quad$ Standard error = .588.
TABLE 13

Stepwise Regression Results from the Most Important Predictors for Female Single-Sex Students

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R^2$</th>
<th>Beta weight</th>
<th>b weight</th>
<th>Standard error</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Concept of Ability</td>
<td>.385</td>
<td>.553</td>
<td>.128</td>
<td>.011</td>
<td>142.692</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>.405</td>
<td>.155</td>
<td>.348</td>
<td>.010</td>
<td>11.340</td>
</tr>
<tr>
<td>Age</td>
<td>.416</td>
<td>-.104</td>
<td>.065</td>
<td>.027</td>
<td>5.768</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1.214</td>
</tr>
</tbody>
</table>

Note. $F(3,317) = 75.239; \ R = .644; \ \text{Standard error} = .591.$
The beta weights are similar for the three selected variables when they are entered by themselves and when they are entered into the regression equation along with the other 17 variables. The consistency in the beta weights makes it possible to be more confident in their interpretation. The beta weights indicate the same order as the $R^2$ values with Self-Concept of Ability and Need for Achievement most important and Age third most important. The former two variables also show a positive relationship with average grade and the latter one shows a negative relationship.

**Comparison.** Self-Concept of Ability and Need for Achievement are shown to be the most important predictors of average grade for males and females in single-sex schools. For males three scales measuring perceptions of the school environment are shown to be important, but for females none of the environmental scales is selected. A larger amount of variance is accounted for with male subjects (49.2% for males versus 41.6% for females) but eight variables are required for males whereas for females only three variables are required. In both cases Self-Concept of Ability accounts for the largest proportion of variance.

**Patterns**

Self-Concept of Ability and Need for Achievement were selected as part of the best set of predictors in all four regression analyses. Abasement, Need for Affiliation and Humanities were selected as best predictors for male students in both coeducational and single-sex schools. For females only Self-Concept of Ability and Need for Achievement were selected as most important in both school types. Age was shown to be important for males in coeducational schools and for females in single-sex schools. The variable Play was one of the selected predictors for male
single-sex school and female coeducational school students. The only variables which appeared in only one analysis were SES for males in coeducational schools and Attitude Toward Teachers for males in single-sex schools.

The analyses for males selected more variables as the best predictors than did the analyses for females. Even with the full set of 20 variables results for females showed a lower percentage of variance accounted for.

Regression results for males from coeducational schools contain variables from all three sets, biographical, personality and attitudinal, and environmental, but neither of the attitudinal scales are present. Females from coeducational schools and males from single-sex schools have in their regression equations only variables from the personality and attitudinal and environmental variable sets. For females from single-sex schools none of the environmental variables appear to be important for predicting grades.

The patterns presented above will be discussed in detail in Chapter 4. The section which follows presents the results of special analyses using Self-Concept of Ability.

Self-Concept of Ability

The results presented above indicate very clearly that Self-Concept of Ability is a major predictor of average grade. But, the importance of Self-Concept of Ability may be due to the fact that it is always selected first by the stepwise regression procedure. If a variable always enters first it will appear to account for a large proportion of variance because all the variance it shares with other variables is assigned to it. Establishing if a variable accounts for a large amount of unique
variance can be determined by entering it into a regression equation as the last variable. In this way variance it shares with other variables will already have been accounted for, and so whatever new variance it accounts for can be considered unique to it.

In order to determine if Self-Concept of Ability was accounting for a large amount of shared variance or a large amount of unique variance, it was entered last in a number of analyses. The results of these analyses appear in Table 14. The results show that when Self-Concept of Ability is entered after the other 19 variables in the study it adds between 16.0% and 36.2% to the variance accounted for. When Self-Concept of Ability is added after the personality variables it adds between 17.5% and 27.8% to the variance accounted for. These results clearly indicate that Self-Concept Ability explains a considerable amount of unique variance in average grade.

Correlational Analyses

Table 15 presents zero-order correlation coefficients for average grade correlated with each of the independent variables. These correlations are presented separately for the four groups of subjects in the study.

The correlation results are presented for two reasons. First, they allow the testing of the hypotheses presented in the introduction regarding zero-order correlations for each of the variables. Second, the beta weights from the regression analysis do not clearly show the relationship between the variables and average grade because shared variance may be removed. The correlations provide an opportunity to look at how each variable is related to average grade when it stands alone.
<table>
<thead>
<tr>
<th>Variables Entered</th>
<th>Without Self-Concept of Ability</th>
<th>With Self-Concept of Ability&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Unique Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Coeducational students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All variables</td>
<td>.250</td>
<td>.442</td>
<td>.192</td>
</tr>
<tr>
<td>Personality variables</td>
<td>.117</td>
<td>.334</td>
<td>.217</td>
</tr>
<tr>
<td>Personality &amp; attitudinal variables</td>
<td>.163</td>
<td>.350</td>
<td>.187</td>
</tr>
<tr>
<td>Female Coeducational students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All variables</td>
<td>.280</td>
<td>.444</td>
<td>.160</td>
</tr>
<tr>
<td>Personality variables</td>
<td>.220</td>
<td>.395</td>
<td>.175</td>
</tr>
<tr>
<td>Personality &amp; attitudinal variables</td>
<td>.224</td>
<td>.406</td>
<td>.182</td>
</tr>
<tr>
<td>Male Single-sex students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All variables</td>
<td>.296</td>
<td>.488</td>
<td>.192</td>
</tr>
<tr>
<td>Personality variables</td>
<td>.199</td>
<td>.448</td>
<td>.249</td>
</tr>
<tr>
<td>Personality &amp; attitudinal variables</td>
<td>.235</td>
<td>.462</td>
<td>.227</td>
</tr>
<tr>
<td>Female Single-sex students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All variables</td>
<td>.180</td>
<td>.442</td>
<td>.362</td>
</tr>
<tr>
<td>Personality variables</td>
<td>.134</td>
<td>.412</td>
<td>.278</td>
</tr>
<tr>
<td>Personality &amp; attitudinal variables</td>
<td>.146</td>
<td>.417</td>
<td>.271</td>
</tr>
</tbody>
</table>

<sup>a</sup>Self-Concept of Ability entered last.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeducational students</th>
<th>Single-sex students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>18**</td>
<td>-10</td>
</tr>
<tr>
<td>Number of sisters</td>
<td>02</td>
<td>-18***</td>
</tr>
<tr>
<td>Number of brothers</td>
<td>-02</td>
<td>-07</td>
</tr>
<tr>
<td>SES</td>
<td>00</td>
<td>-03</td>
</tr>
<tr>
<td>Birth order</td>
<td>04</td>
<td>-06</td>
</tr>
<tr>
<td>Self-Concept of Ability</td>
<td>55***</td>
<td>59***</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>29***</td>
<td>42***</td>
</tr>
<tr>
<td>Attitude Toward Teachers 2%</td>
<td>-24***</td>
<td>-17**</td>
</tr>
<tr>
<td>Attitude Toward School</td>
<td>-24***</td>
<td>-06</td>
</tr>
<tr>
<td>Femininity</td>
<td>15**</td>
<td>15**</td>
</tr>
<tr>
<td>Need for Affiliation</td>
<td>-13**</td>
<td>-06</td>
</tr>
<tr>
<td>Anxiety</td>
<td>-02</td>
<td>-10*</td>
</tr>
<tr>
<td>Objectivity</td>
<td>21***</td>
<td>13*</td>
</tr>
<tr>
<td>Abasement</td>
<td>-24***</td>
<td>-17**</td>
</tr>
<tr>
<td>Deference</td>
<td>-11*</td>
<td>01</td>
</tr>
<tr>
<td>Humanities</td>
<td>-04</td>
<td>00</td>
</tr>
<tr>
<td>Play</td>
<td>15*</td>
<td>-10*</td>
</tr>
<tr>
<td>Affiliation (HSCI)</td>
<td>-02</td>
<td>-06</td>
</tr>
<tr>
<td>Achievement (HSCI)</td>
<td>05</td>
<td>15**</td>
</tr>
<tr>
<td>Impulsion</td>
<td>-07</td>
<td>-05</td>
</tr>
<tr>
<td>Number of Subjects</td>
<td>250</td>
<td>281</td>
</tr>
</tbody>
</table>

* p < .05  ** p < .01  *** p < .001
Coeducational Schools

Coeducational males. The only biographical variable to show a significant correlation with average grade is age and this relationship is negative. The remaining four biographical variables show a very low correlation with the criterion.

Of the seven personality and attitudinal variables all but Anxiety are significantly correlated with average grade. Self-Concept of Ability has the highest correlation coefficient, .55. Need for Achievement is positively correlated with the criterion, and Attitude Toward Teachers and Attitude Toward School are negatively related to the criterion. These correlations are, in absolute value, in a range from .20 to .30. Femininity which has a positive and Need for Affiliation which has a negative correlation with correlation average grade have coefficients less than .20.

Four scales measuring perceptions of the school environment are significantly correlated with the criterion variable. Objectivity shows a positive correlation and Abasement shows a negative correlation. Both of these coefficients are greater than .20. The remaining two significant correlations are less than .20 with Play being negatively correlated and Deferense being positively correlated with average grade.

Coeducational females. Number of sisters is the only statistically significant correlation coefficient for the biographical variables with females attending coeducational schools and this correlation is negative. All other correlation coefficients for biographical variables are not significant.
Five of the personality and attitudinal variables are significantly correlated with the criterion. Need for Achievement and Self-Concept of Ability have relatively high positive coefficients (greater than .40). The remaining statistically significant correlation coefficients are less than .20. Attitude Toward Teachers and Anxiety have negative coefficients and Femininity has a positive coefficient.

Objectivity, Achievement, Play and Abasement are significantly correlated with average grade. The former two variables produce positive correlations and the latter two produce negative correlations. All four significant correlations are less than .20.

**Single-Sex Schools**

**Single-sex males.** SES is positively correlated with average grade for males in single-sex schools. Correlations for the remaining biographic variables are not statistically significant.

Self-Concept of Ability and Need for Achievement are positively correlated with average grade, and both correlations are greater than .40. The two attitudinal scales are negatively correlated with the criterion, and the coefficients are approximately .25. Femininity is positively correlated with average grade and the coefficient is only slightly less than .20.

Objectivity and Deference are significantly correlated with the criterion. Objectivity has a positive correlation coefficient greater than .20, and Deference has a negative coefficient less than .20.

**Single-sex females.** Only four of the 20 independent variables are significantly correlated with average grade for females attending single-sex schools. Age has a negative correlation coefficient and is the only
biographical variable to have a significant correlation coefficient. None of the environmental variables is significantly correlated with average grade. The scales measuring Self-Concept of Ability and Need for Achievement are positively correlated with the criterion, and Attitude Toward Teachers is negatively correlated.

**Patterns**

The variables Self-Concept of Ability, Need for Achievement and Attitude Toward Teachers are significantly correlated with average grade for the four groups of subjects. Femininity and Objectivity are significantly correlated with the criterion in three of the analyses, but not for females attending single-sex schools.

For each of the four subject groups only one biographical variable had a statistically significant correlation and it is not consistently the same variable. The coeducational students show more significant correlations with the environmental variables than do the single-sex students. Personality and attitudinal variables have the highest correlation coefficients for each of the four subject groups.
CHAPTER IV

DISCUSSION

The major findings may be summarized as follows: Students' average grades can be predicted using biographical variables, personality and attitudinal variables, and environmental variables. Self-Concept of Ability and Need for Achievement were the best individual predictors of average grade. The personality and attitudinal variables were the best set of predictors, and students' perceptions of their school environment represented the second most important set of predictors. Biographical variables were only marginally effective in predicting average grade.

The variables selected as best predictors were shown to be somewhat different for males and females. Across school types there was little difference in the variables selected for males, but the variables selected as best predictors for females were different for students from coeducational schools, and for those from single-sex schools. The results from the percentage of variance analyses and the regression analyses generally support Walberg's (1977) Mediation model (see introduction).

The general results summarized above are discussed in greater detail in the four sections which follow. The first section discusses the relative importance of variables in predicting average grades, one of the objectives of the study, and how the results support or contradict the hypotheses. This section is mainly concerned with relationships between variables as indicated in the three types of analyses, percentage of variance, regression, and correlation. The second section considers
the three remaining objectives which pertain to the validity of the Mediation model and the effects of sex and type of school. The third section presents the implications of the results. The final section discusses the future analyses which are required if a clearer picture of the determinants of students' grades is to be obtained.

The reader should note that in the first two chapters the terms academic performance and classroom learning were used interchangeably. In the results chapter the data were used to predict the average grades of students. It should be clear that the average grades of students is the operational definition of academic performance and classroom learning. During the discussion reference to average grade is made when results are discussed, and reference to academic performance and classroom learning is made when the results are generalized beyond the study.

Hypotheses and Relative Importance of Variables

The hypotheses may be summarized as indicating: (1) the relationship between variable sets and academic performance; (2) the relationship of the full set of 20 variables to the criterion; and (3) the relationship of individual variables to academic performance. These hypotheses were studied using three analytical techniques, percentage of variance, stepwise regression, and correlation, and are discussed below. This section also discusses the relative importance of the variables in predicting average grades, one of the objectives of the study. The three remaining objectives are discussed in a separate section but will draw on the conclusions developed in this section.
Percentage of Variance Findings

It will be recalled from the results section that the personality and attitudinal variables accounted for most of the variance in average grade, with the environmental variables accounting for a much smaller percentage of the variance, and biographical variables accounting for almost none of the variance. These results fail to support the hypotheses for the sets of variables. It was predicted that environmental variables would account for approximately the same amount of variance as the personality and attitudinal variables. Also, it was predicted that the biographical variables would account for a small, but statistically significant, percentage of variance.

The fact that the biographical variables accounted for almost none of the variance in average grade was surprising because the review of the literature suggested that each of the selected biographical variables is related to academic performance. Further, it was expected that SES would be a major variable within this set, but this proved not to be the case. These results suggest that students' backgrounds, as measured by the variables in the study, are not significant in determining success in school at the secondary level.

Two possible explanations of why the biographical variables were not important should be considered. It may be argued that the biographical variables analyzed were not the ones most likely to predict academic performance. But, as noted above, each of the selected biographical variables has been shown to be related to academic performance in other relevant research. In addition, other variables, such as number of books in the home, education of parents, and scholastic encouragement,
which might be related to academic performance are also related to SES, yet SES was not shown to be a useful predictor of average grade.

An alternative explanation is that the groups which were analyzed were very homogenous with respect to the selected variables. This argument is contradicted by the data, presented in the Method, which showed that a full range of SES levels and age levels were present.

As hypothesized, the personality and attitudinal variables accounted for a substantial percentage of variance in average grade. The range in percentage of variance accounted for was from 37.4% to 47.4% with the lower value obtained for male students in coeducational schools and the higher value obtained for male students in single-sex schools. The percentage of variance was very close for the two female groups: 40.6% for those in coeducational schools and 42.1% for those in single-sex schools. It is interesting to note that in coeducational schools more variance was accounted for by personality and attitudinal variables with female students than male students, while in single-sex schools more variance was accounted for with male students. This interaction suggests that not only are there differences between males and females in terms of predictability using these variables, but also that there are differences between types of school, particularly for males.

The above pattern was further studied by breaking down the analyses so as to look separately at personality and attitudinal variables. The results showed that the same pattern, as obtained for the full set, was obtained when only the personality variables were studied although the percentage of variance accounted for dropped, as would be expected. The results with the attitudinal scales were somewhat different in that the
amount of variance accounted for by the attitudinal variables was different for all four analyses. The males, generally, showed higher variance accounted for, and single-sex school male students showed the highest amount. For females, the single-sex students showed the lowest amount of variance accounted for. Again there was an interaction between sex and type of school, but in this case, coeducational males and females were more similar than single-sex male and female students.

In general, then, it would appear that the grades that males in single-sex schools receive are more highly influenced by their attitudes towards teachers and school than are the grades of females in single-sex schools and males and females in coeducational schools. The grades of females in single-sex schools are the least influenced by their attitudes towards school and teachers. The grades of males and females in coeducational schools are influenced to a relatively moderate degree by their attitudes, although the grades of males do appear to be slightly more influenced than those of females.

Studies with the Learning Environment Inventory (LEI) have clearly shown that measures of students' perceptions of the classroom environment are highly related to academic performance. It was noted in the Introduction that over a number of studies the median variance accounted for in academic performance by measures of the environment was 30.0% (Anderson & Walberg, 1974). The High School Characteristics Index (HSCI) which measures perceptions of the school environment rather than perceptions of the classroom environment, was expected to show the same large amount of variance accounted for as the LEI. In fact, the scales from the HSCI accounted for only about 10.0% of the variance in average grade in three
of the four analyses and accounted for a nonsignificant proportion of variance when results from females attending single-sex schools were analyzed. The results, therefore, do not totally support the hypothesis that the students' perceptions of their school environment are highly related to academic outcome.

The low amount of variance accounted for by the measures of school environment raises questions about results obtained with the LEI in the Walberg and Anderson studies (see review in Anderson and Walberg, 1974). However, the first question to answer before questioning the Walberg and Anderson results, is whether or not the LEI and HSCI should produce comparable results. Both scales are purported to measure perceptions of the environment of an academic setting. The HSCI was created to measure press in the school environment. The LEI, after being factor analyzed, was shown to have two major factors, cognitive press and noncognitive press. Because both instruments measure press and both measure press in academic environments, it seems reasonable to assume that they should be measuring similar constructs. Therefore, it may be concluded that the results in this study do not support those of Walberg and Anderson in terms of the amount of variance that environmental variables account for.

Failure to replicate the Walberg and Anderson results may be due to differences in the criterion measures used. Walberg and Anderson used a set of standardized tests developed specifically to test academic performance and related activities in one subject area, physics. The present study used, as a criterion measure, the students' average grades for all the courses they were enrolled in. If it can be shown that the two different
criterion measures do produce different results, research is needed to
determine which type of measure is most suited for the study of educational
outcome.

An interesting finding with the environmental variables is that for
females in single-sex schools the environmental variables accounted for
a nonsignificant proportion of variance. On the other hand, for the
males in both coeducational and single-sex schools and for females in
coeducational schools practically the same amount of variance was accounted
for. This would suggest that the academic performance of females in
single-sex schools is less influenced by the school environment than is
the academic performance of students in the other groups.

Regression Findings

Only the four final regression equations, which contained the
variables selected as the best predictors, will be discussed. These
equations indicated that the major purpose of the research was achieved
in that students' grades were predicted using the selected variables.
Although the final regression results could not be replicated the cross-
validation procedure employed suggested that regression results were
valid for these data. Discussion of the regression results will begin
with consideration of broad structural features in the data and then
will turn to specific patterns as shown by the separate variables contained
in the equations.

It was shown that the regression equation for males attending single-sex
schools accounted for the largest proportion of variance. The amount of
variance accounted for with males in coeducational schools and females
in single-sex schools was about equal, but substantially lower than for
males in single-sex schools. The results for females attending coeducational schools showed the lowest proportion of variance accounted for, but this was only slightly lower than for males in coeducational schools and females in single-sex schools. Why one group of students, males in single-sex schools, should have greater predictability of their grades is unclear at this point, but it does suggest a unique difference between this group and the others.

Another structural feature in the regression results was the number of variables that accounted for at least 1.0% of the variance in average grade. The pattern here was very clear. The final regression equation for males in coeducational schools contained seven variables and for males in single-sex schools it contained eight. For females the final regression equation contained four and three variables for coeducational and single-sex school students, respectively. Consistently, males have a larger number of variables in their final regression equations than females.

A final structural feature to look at is how the three variable groups were represented in each of the equations. The biographical variables were not included in equations for female coeducational students and male single-sex students. Two biographical variables were in the regression equation for males in coeducational schools and one was in the equation for females in single-sex schools. This suggests, as did the results of the percentage of variance analyses, that biographical variables are not major predictors of average grades.

The personality variables were present in all four equations, but only one of the attitudinal measures appeared and this was in the equation
for males attending single-sex schools. This result suggests that of
the variables in the personality and attitudinal set the personality
variables were the most important in predicting how well a student
performed in school.

The scales measuring perceptions of the school environment were
represented in three of the four analyses; they did not appear in the
equation for females attending single-sex schools. However, only one of
the scales was in the equation for females in coeducational schools,
suggesting that for females academic performance is not strongly influenced
by the school environment. The environmental scales were most prominent
in the equations for males, suggesting that the academic performance of
males, in both single-sex and coeducational schools, is influenced by
how they perceive the school environment.

Two variables, Self-Concept of Ability and Need for Achievement,
were present in all four regression equations. The obvious conclusion
is that these variables are powerful predictors of students’ average
grades. This result also indicates that similar major factors affect
the grades students receive, regardless of sex or type of school. It
must also be noted that Self-Concept of Ability was the first variable
selected in all four analyses and that in all cases it accounted for the
largest amount of variance. Even when Self-Concept of Ability was
entered last into a regression equation using all 20 variables, it
accounted for more variance than any of the other individual variables.

It was noted earlier that the number of variables in the final
regression equation was higher for the analyses using males. As might
be expected, the greatest similarity of variables in equations was for
males. Males in both types of school had their average grades predicted by, in addition to Self-Concept of Ability and Need for Achievement, the variables Need for Affiliation, Abasement, and Humanities. This result shows that the two groups of males are somewhat similar regarding which factors determine their grades, but there are also some interesting differences between these two groups.

The results showed that the biographical variables SES and age were important predictors for males attending coeducational schools, but none of the biographical variables was present for males attending single-sex schools. The indication is that the students' backgrounds are more influential for males attending coeducational schools. The results also showed that the variables Attitude Toward Teachers and Play were important predictors for males in single-sex schools. These two variables indicate the attitude of the student towards his teacher and whether he perceives the environment in his school as play or work oriented; both variables reflect feelings about the school. These two variables, and the environmental scale Abasement, mentioned earlier, suggest that the academic performance of males in single-sex schools is influenced by how they feel about school in general. A final point worth noting about males in single-sex schools is that Femininity was an important variable in the prediction of average grade. Femininity was not a major predictor for males in coeducational schools and so one must wonder what it is about the students in male single-sex schools which makes Femininity a major predictor of their grades.

Females from the two types of school had only the variables Self-Concept of Ability and Need for Achievement present in both their final regression
equations. Femininity and Play were the other two variables in the equation for females attending coeducational schools. For female attending single-sex schools, age was the only other variable in the regression equation. These results suggest that the two groups of female subjects have different factors influencing their grades, but the small number of variables in their equations makes it impossible to clearly establish a pattern of differences. What is similar to both female groups, as was pointed out earlier, is that they both have a relatively small number of variables in their regression equations. One possible conclusion is that for females their personalities are the best predictors of their academic performance rather than what takes place around them. This would imply that the differences between coeducational and single-sex schools have relatively little influence on the performance of females in school.

**Correlational Findings**

As noted in the results section, correlation results were presented in order to allow for the study of the effects of individual variables. The literature review in the introduction suggested the direction of the relationship between most variables and average grade. In this section we will discuss whether the hypothesized results were obtained. In general, the variables were not as highly correlated (that is, not as many statistically significant correlations) with average grade as had been predicted and, in fact, a good number of variables showed no statistically significant correlation for any of the four analyses.

The biographical variables showed very little correlation with average grade. Age was negatively correlated with average grade in two
of the analyses. Number of sisters was correlated with the criterion for females attending single-sex schools and SES was correlated at a marginally significant level for males in single-sex schools. The pattern, as was evident in earlier sections of the discussion, is that the biographical variables were not, in general, correlated with academic performance, and this general finding contradicts the hypotheses regarding the biographical variables.

Although the results of this research cannot be used to conclude that biographical variables are not good predictors of academic performance this does appear to be the case with the variables selected for use in this study. Additional large sample studies which use other biographical variables are needed in order to confirm the lack of relationships found in the present research. It may be that in large sample studies biographical variables cannot be measured with sufficient detail to produce the results found with small sample studies.

The personality and attitudinal variables produced correlations much more in accordance with the hypotheses. As predicted, Self-Concept of Ability and Need for Achievement were positively correlated with average grade for all four analysis groups. Femininity showed a positive correlation for all analyses but the one with females from single-sex schools. It was hypothesized that Need for Affiliation would be negatively correlated with average grade, but this only occurred for males attending coeducational schools. The results showed that only for females attending coeducational schools was anxiety significantly correlated (in the negative direction) with average grade, and this correlation was only marginally significant.
The hypothesis that the scales measuring attitudes would be negatively correlated with average grade was generally supported. In the four analyses Attitude Toward Teachers was significantly correlated with average grade in a negative direction. Attitude Toward School was significantly correlated with the criterion for males in both school types and the correlation was negative as predicted. The reader should recall that the attitude scales measure negative, rather than positive, attitudes. Therefore, the negative correlation indicates that students with negative attitudes receive lower grades, and students with positive attitudes receive higher grades.

The results of previous research with the HSCI led to the prediction that the HSCI scales used in this study would be significantly correlated with average grade. However, they were also expected to be correlated with a number of the personality variables and this might account for why they appeared to have little predictive power for average grades in the regression results. That is, their influence in the regression results might have been minimal because of shared variance. But the correlation results confirmed the regression results suggesting that the environmental variables were not powerful predictors.

For females from single-sex schools none of the correlations for scales measuring perceptions of the school environment was significant. For males from single-sex schools only two environmental scales, Objectivity and Deference, were significantly correlated with average grade. For males and females in coeducational schools the results were more in line with the prediction of significant correlations. Objectivity, Abasement, and Play were significantly correlated with average grade for coeducational
students. Also, Deference was significantly correlated with the criterion for males in coeducational schools, and Abasement was significantly correlated for females in coeducational schools.

The direction of the relationship between average grade and the HSCI scales was consistent across analyses when significant results were obtained. Objectivity and Play were positively correlated with average grade. Abasement and Deference were negatively correlated with the criterion. The two variables which were significantly correlated in only one of the four analyses were Achievement (positively correlated) and Humanities (negatively correlated).

In general, the correlation results were consistent with the results from the other analyses in the study. However, an important difference was the presence of significant correlations for the attitude scales even though these scales were relatively absent in the regression results. This suggests that the variance associated with the attitude scales is shared with the other variables in the regression equations.

Objectives

The objective of determining the relative importance of the variables was implicitly discussed along with the hypotheses in the preceding section. The remaining three objectives are discussed in this section. Briefly, they are: (a) to test the Mediation model, (b) to determine if there are sex differences, and (c) to determine if there are type of school differences.
Mediation Model

The Mediation model (Walberg, 1977) suggests that four major factors influence outcome in an educational setting: aptitude, content opportunity, teacher characteristics, and student background. Four points should be recalled from the Introduction: Content opportunity data were not collected for this research. The combined influence of teacher characteristics and student background was studied using scales measuring perceptions of the environment. Aptitude data consisted of personality and attitude scales. And, a selection of student background variables was collected. It was argued, in the introduction, that the present research constituted a partial test of the Mediation model.

The results concerning the Mediation model will be discussed using two of the three analytical techniques employed in the study. First, will be a discussion of how the percentage of variance results relate to the Mediation model. Second, will be a discussion of the Mediation model using the regression results.

The percentage of variance results provide only minimal support for the Mediation model. In agreement with the model were results with the personality and attitudinal variables; they were highly related to academic outcome. The model also predicts that environmental and biographical variables are related to academic outcome, but the results do not support this prediction. In fact, in one of the analyses (for females from single-sex schools) not one of the eight scales measuring perceptions of the school environment contributed a significant amount of variance. Also, in three of four analyses biographical variables contributed no significant amount of variance. In the one analyses in which the amount of variance added was significant, the amount was very small (less than 5.0%)
The regression equation calculated for each group was probably the best method for testing the Mediation model because all three types of variables were considered in one analysis with the statistical properties of the variables determining their importance. In all of the regression analyses the personality and attitudinal variables were the most important predictors of educational outcome. The scales measuring perceptions of the school environment represented the second best set of predictors, but were not present in one of the analyses. The biographical variables were only marginally present in the regression results which would be expected if their influence was shared with the environmental variables as the model predicts; however, these variables were also shown to be unimportant in the variance accounted for results.

Thus, the regression and percentage of variance results provide only minimal support for the Mediation model. The results did show that educational outcome could be predicted by personality and attitudinal variables and measures of the students' perceptions of their educational environment. But, it had been predicted that the influence from these two variable sets would be somewhat equal, and this hypothesis was not supported by the results. Also, the environmental variables were totally absent from the results for females attending single-sex schools and nearly absent for females attending coeducational schools. The percentage of variance and correlation results showed that the biographical variables were not good predictors of educational outcome.

The failure to obtain stronger support for the Mediation model may be due to two factors, improper selection of variables to represent the components of the model and the general impreciseness of the model. It
is fairly safe to assume that the personality and attitude variables did not suffer from improper selection, although prediction might have improved if additional personality variables had been used and if a measure of academic aptitude had been employed. The failure of the environmental scales to better predict academic performance may have been due to specific difference between the HSCI and the LEI (which was used in the development of the Mediation model). It was argued earlier that such differences were not expected and on theoretical grounds should not exist. Finally, the biographical variables employed may not have represented the best selection possible, but as argued earlier, stronger results than those obtained should have been present if the model was to be fully supported.

The other explanation for not obtaining results more supportive of the Mediation model is that the model is not precise enough. Walberg (1977) did not make specific statements about the relative importance of the various components in the model; therefore the hypothesis presented, in this study, that the components should contribute equally to prediction may have been unrealistic. Also, Walberg did not clearly specify the exact variables which should be used to test the model, but rather gave only general guidelines. Therefore, it was impossible to determine sets of variables which would best test the model. Research, such as presented here, will help to more clearly define the model, thereby making its testing and modification more efficient.

Sex Differences

The difference in results for males and females were not considerable, although they are rather interesting. First, it should be pointed out
that there were two variables selected as important predictors for males
and females; Self-Concept of Ability and Need for Achievement.

One important difference between males and females was the number
of variables selected in the final regression equations. The two male
samples had seven and eight variables in the equations, whereas the
female samples had four and three variables. This result suggests that
the average grade of female students can be predicted using a smaller
set of variables than that for males. Such a result would be most
useful in future studies wherein data collection might be limited by
time and expense.

A major sex difference detected in the results was the relative
lack of importance of the environmental variables for predicting the
grades of females, and conversely, the relative importance of environmental
variables for predicting grades of the males. This result suggests that
males are more influenced in their academic performance by factors which
are external to them, whereas females apparently are little influenced
by these external factors. It should be noted that for both males and
females personality variables, or internal factors, were important in
predicting academic performance. One important consequence for females
of not being influenced by external factors is that their performance is
less affected by the type of school they attend whereas the performance
of males may be greatly influenced by the type of school.

Type of School Differences

There were no clear differences between the results obtained with
single-sex and coeducational schools. What did appear were a number of
instances in which either the results for male single-sex school students
or for female single-sex school students stood out from the results of the other groups. Also, some interactions between type of school and sex of student were outlined in earlier parts of the discussion.

There were three cases where the results obtained for males attending single-sex schools were particularly unique. One of these appeared in the percentage of variance results wherein the variables for male single-sex school students accounted for a substantially larger percentage of the variance than that accounted for by the variables for the other three groups. A second distinctive feature for the male single-sex school students was the presence of one of the attitude scales in the final regression equations. A third interesting point regarding the males in single-sex schools was the presence of the largest number of environmental variables in the regression analysis, suggesting that these subjects were the most influenced by external factors.

In contrast to the major importance played by environmental variables in predicting average grades for males in single-sex schools was the result that the environmental variables had no significant influence on the average grades of females in single-sex schools. This sex difference was not present in the coeducational school results.

The results of the comparisons between the two types of school provide little information about the nature of the differences. However, there is evidence that there are different effects on academic performance associated with the two school types.
Implications

As was noted by Hunt (1975), a B-P-E paradigm, which this study represents, serves practical needs as well as theoretical needs. The discussion to this point has been directed at the theoretical perspective outlined in the introduction. Practical implications of the research findings are discussed in this section.

The results clearly indicate that the academic performance of male and female students is influenced by students' needs or desires to achieve and their self-concepts of ability. However, a relationship between two variables does not imply a causal link between them. In order to discuss the implications of the results we will assume first that a cause-effect relationship is in one direction and then in the other.

Assuming that a need to achieve and a good self-concept contribute to higher grades, it is clear that programs designed to encourage the development of these two factors are necessary. Increasing students' need to achieve can be accomplished by showing them the additional rewards, both short term and long term, which are associated with higher levels of achievement in school. Programming should be designed to clearly show the final outcomes of success in school so students know that the results of their efforts are of value to them.

Coupled with increasing the need to achieve is the need for students to maintain good academic self-concepts. This might be best accomplished by ensuring that students avoid serious failure in school activities. In order to avoid serious failure, the students' capabilities need to be
assessed, so that they are not placed in programs with a high risk of failure. This does not imply that students should be assured of success in whatever they try, rather it implies that students should be encouraged to work at what they are likely to succeed at. A second point in maintaining a good self-concept of ability is to ensure that students are aware that their successes should be relative to their own abilities and not to those of their peers or high status role-models.

On the other hand, rather than high levels of need for achievement and self-concept of ability causing high grades, it may be that high grades cause high levels of need for achievement and self-concept of ability. If grades are the cause of high levels of the two variables, then a grading system which assists in building these characteristics should be employed. Such a grading system could take the form of academic levels, much smaller than the school year which is presently used, within which students would work. Students would try to achieve the best performance possible at each level and then would move to the next level. The student would progress through each level until the desired performance was reached.

A second finding from this research was that the grades that males receive are more influenced by how they perceive the school environment than are the grades that females receive. This suggests that the educational environment for males is more important in influencing their success, thus teachers and school administrators (particularly in coeducational and single-sex male schools) should be aware of the environmental press in their schools. In this way, when the environment is such that it discourages good performance steps can be taken to change it. For
example, the results showed that Objectivity was positively correlated with average grade. When Objectivity becomes low in a school, it means that students do not feel they are being treated objectively by the staff; such a feeling apparently can result in lowered levels of performance. If teachers become aware that Objectivity press is low they can take steps to increase its level or to eliminate activities which are causing it to be low. That is, teachers can attempt to ensure that "credit is given where credit is due."

The results also indicated that females are not influenced by the school environment to the extent that males are. Females appear to be mostly influenced by personality variables. This result was particularly evident for females attending single-sex schools. The implications of this result are quite interesting. If female students have personality characteristics which are related to academic success their academic performance would be facilitated by attending single-sex schools where their perceptions of the environment have little impact on their performance. However, if females do not possess personality characteristics associated with academic success they might have better success in coeducational schools where the environmental press has some effect on performance, assuming the press in coeducational schools is toward academic success.

**Future Directions**

The present results suggest at least two areas in which future research activities should be aimed. First, further analyses with the data used in this study can provide additional information about the factors affecting educational outcome. Second, research efforts should
be undertaken to further study the Mediation model and to study influences on academic performance using analytical techniques which indicate cause and effect relationships.

The analyses did not permit a consideration of curvilinear relationships between average grade and the predictor variables. They also did not introduce interaction terms, representing interactions between the various independent variables, into the regression equations. Further analyses could investigate these two procedures to obtain additional results from the available data. The use of curvilinear relationships and interaction terms in regression analysis has been suggested by Kerlinger and Pedhazur (1973).

The full set of 20 independent variables was large and at times awkward to work with both in the analyses and in the discussion of results. The problem was enhanced when groups of variables added little variance to that accounted for in the criterion. In the future two techniques could be employed to reduce these problems. During the initial stages of the analysis those variables which empirically appeared to be only minimally related to the criterion can be eliminated. The second, and possibly better solution, would be to form composite measures of some of the variables. That is, using factor analysis or other techniques, one could combine a number of these relatively unimportant measures to produce composite variables.

A question which arose during the research was whether the students' perceptions of their environment were best studied using their responses to the HSCI directly or indirectly. Because performance of students in school may be related to satisfaction in the setting, it might be better
to study perceptions of the environment indirectly, that is, in relation to other students. A very simple method of doing this would be to use as a measure the deviation from the school average of each student's score on the environmental scales. The greater the deviation from the average the less consistent the student's view would be with that of his/her peers.

A fourth method of re-analyzing the data would be to consider the factors affecting students within different levels of average grade. That is, students who receive high grades in school may be influenced by factors different from those influencing students who receive low grades. If differences were found this could complicate intervention procedures, but such complication might avoid negative effects for students who most need help — those with low grades.

The regression analysis techniques used in this study were unable to show consistently clear differences between males and females and between the two school types. Differences and similarities were indicated, but firm conclusions were not possible. The analytical technique, regression, was probably a major factor in the inability to derive firm conclusions of this type. Further analyses using other techniques, such as multivariate analysis of variance, might provide more precise results in terms of type of school and sex differences.

New research needs to be undertaken to clarify which variables best fit the Mediation model. Also, new research could indicate additional components which might make the Mediation model more reflective of the influences on educational outcome and might lead to better prediction of outcome allowing for more appropriate intervention. It is certainly
It is possible that different components of the model exert different amounts of influence at various ages.

Further development of the Mediation model would be assisted by experimental research. The present study indicated the importance of environmental factors for males and the importance of need for achievement and self-concept of ability in predicting educational outcome. But, causal statements about the direction of the influence of these factors cannot be made without properly designed experimental research. Therefore, new research efforts should be designed to examine the directions of the relationships established in this research.
APPENDICES
APPENDIX A

Need for Achievement: Personality Research Form

(Jackson, 1969)

Descriptors

High scorer. Aspires to accomplish difficult tasks; maintains high standards and is willing to work toward distant goals; responds positively to competition; willing to put forth to attain excellence.

Defining trait adjectives. striving, accomplishing, capable, purposeful, attaining, industrious, achieving, aspiring, enterprising, self-improving, productive, driving, ambitious, resourceful, competitive.

Instructions

Below are a series of statements. Read each one, decide how you feel about it, and then mark your answer on the separate answer sheet. If you agree with a statement or feel that it is true about you, fill in the space under T (true). If you disagree with a statement or feel that it is not true about you, fill in the space under F (false). Be sure to BLACKEN in the complete space for each item.

Items

1. I enjoy doing things that challenge me.

2. I get disgusted with myself when I have not learned something properly.

3. When people are not going to see what I do, I often do less than my very best.

4. I enjoy working on a problem after others have given up.

5. I have rarely done extra studying in connection with my work.

6. I would rather do any easy job than one involving obstacles which must be overcome.

7. I often set goals which are difficult to reach.

8. I try to work just hard enough to get by.

9. My goal is to do at least a little bit more than anyone else has done before.

10. I work because I have to, and for that reason only.
11. Self improvement means nothing to me unless it leads to immediate success.

12. I really don't enjoy hard work.

13. I prefer to be paid on the basis of how much work I have done rather than on how many hours I have worked.

14. People have always said that I am a hard worker.

15. I don't mind working while other people are having fun.

16. It doesn't really matter to me whether I become one of the best in my field.

17. Sometimes people say I neglect other important aspects of my life because I work so hard.

18. I am sure people think I don't have a great deal of drive.

19. I enjoy work more than play.

20. It is unrealistic for me to insist on becoming the best in my field of work all of the time.
APPENDIX B

Need for affiliation: Personality Research Form

(Jackson, 1969)

Descriptors

High scorer. Enjoys being with friends and people in general; accepts people readily; makes efforts to win friendships and maintain associations with people.

Defining trait adjectives. neighborly, loyal, warm, amicable, good-natured, friendly, companionable, genial, affable, cooperative, gregarious, sociable, affiliative, good-willed.

Instructions

Below are a series of statements. Read each one, decide how you feel about it, and then mark your answer on the separate answer sheet. If you agree with a statement or feel that it is true about you, fill in the space under T (true). If you disagree with a statement or feel that it is not true about you, fill in the space under F (false). Be sure to BLACKEN in the complete space for each item.

Items

1. I believe that a person who is incapable of enjoying the people around him misses much in life.

2. I pay little attention to the interests of people I know.

3. Trying to please people is a waste of time.

4. Loyalty to my friends is quite important to me.

5. I am considered friendly.

6. Most of my relationships with people are business-like rather than friendly.

7. I enjoy being neighborly.

8. After I get to know people, I decide that they would make poor friends.

9. I try to be in the company of friends as much as possible.

10. Usually I would rather go somewhere alone than go to a party.

11. To love and be loved is of greatest importance to me.
12. I have relatively few friends.
13. I seldom go out of my way to do something just to make others happy.
14. Most people think I am warm-hearted and sociable.
15. I truly enjoy myself at social functions.
16. When I see someone I know from a distance, I don't go out of my way to say "Hello".
17. I spend a lot of time visiting friends.
18. I want to remain unbothered by obligations to friends.
19. I go out of my way to meet people.
20. I am quite independent of the people I know.
APPENDIX C

Femininity Scale: California Psychological Inventory

(Gough, 1957)

Descriptors (From CPI manual)

High scorers. Appreciative, patient, helpful, gentle, moderate, persevering, and sincere: as being respectful and accepting of others; and as behaving in a conscientious and sympathetic way.

Low scorers. Outgoing, hard-headed, ambitious, masculine, active, robust, and restless: as being manipulative and opportunistic in dealing with others; blunt and direct in thinking and action; and impatient with delay, indecision, and reflection.

Descriptors (From Gough, 1968)

High scoring males. Appreciative, complaining, feminine, formal, meek; nervous, self-denying, sensitive, weak, worrying.

High scoring females. Conscientious, discreet, generous, gentle, helpful, mature, self-controlled, sympathetic, tactful, warm.

Low scoring males. Adventurous, aggressive, clear-thinking, daring, impulsive, masculine, outgoing, pleasure-seeking, show-off, strong.

Low scoring females. Coarse, dissatisfied, lazy, masculine, pleasure seeking, restless, robust, self-centered, touchy, tough.

Instructions

Below are a series of statements. Read each one, decide how you feel about it, and then mark your answer on the separate answer sheet. If you agree with a statement or feel that it is true about you, fill in the space under T (true). If you disagree with a statement or feel that it is not true about you, fill in the space under F (false). Be sure to BLACKEN in the complete space for each item.

Items

1. I am very slow in making up my mind.
2. I think I would like to work as a building contractor.
3. I think I would like the work of a dress designer.
4. I become quite irritated when I see someone spit on the sidewalk.
5. It is hard for me to start a conversation with strangers.
5. I must admit that I enjoy playing practical jokes on people.
6. I get very tense and anxious when I think other people are disapproving of me.
7. A windstorm terrifies me.
8. I think I would like the work of a clerk in a department store.
9. I get excited very easily.
10. I like to boast about my achievements every now and then.
11. I think I would like to work as a garage mechanic.
12. I like adventure stories better than romantic stories.
13. I prefer a bath to a shower.
14. The average person is not able to appreciate art and music very well.
15. The thought of being in an automobile accident is very frightening to me.
16. At times I feel like picking a fist fight with someone.
17. Sometimes I have the same dream over and over.
18. I think I am stricter about right and wrong than most people.
19. I think I would like to drive a racing car.
20. I like to be with a crowd who play jokes on one another.
21. I am somewhat afraid of the dark.
22. I think I could do better than most of the present politicians if I were in office.
23. I always try to make the best school grades that I can.
24. I am inclined to take things hard.
25. I would like to be a soldier.
26. I like to go to parties and other affairs where there is lots of loud fun.
27. I very much like hunting.
29. In school I am sometimes sent to the principal for fooling around.

30. I think I would like the work of a librarian.

31. Sometimes I feel that I am about to go to pieces.

32. I would like to be a nurse.

33. If I were a reporter I would very much like to report news of the theatre.

34. I like mechanics magazines.

35. I want to be an important person in the community.

36. I must admit I feel sort of scared when I move to strange place.

37. I am pretty sure I know how we can settle the international problems we face today.

38. If I get too much change in a store I always give it back.
APPENDIX D

Self-Concept of Ability

Instructions

The questions below are presented in multiple choice format. Select the choice (answer) with which you agree and fill in that choice on the separate answer sheet. Mark only one choice for each question. ANSWER EVERY QUESTION.

Items

1. How do you rate yourself in school ability compared with those in your grade at school?
   A. I am among the best
   B. I am above average
   C. I am average
   D. I am below average
   E. I am among the poorest

2. What kinds of grades do you think you are capable of getting?
   A. between 80-100%
   B. between 70-79%
   C. between 60-69%
   D. between 50-59%
   E. below 50%

3. Do you think you have the ability to graduate from university?
   A. definitely yes
   B. probably yes
   C. uncertain
   D. probably no
   E. definitely no
In order to become a doctor, lawyer, or university professor, work beyond three years of university is necessary. How likely do you think it is that you could complete such advanced work?

A. very likely
B. somewhat likely
C. uncertain
D. somewhat unlikely
E. most likely
APPENDIX E

Anxiety Scale: Multiple Affective Adjective Check List

(Zuckerman & Lubin, 1965)

Instructions

On your answer sheet is a list of adjectives. Read all of the adjectives and fill in the spaces beside the adjectives that you believe describe you. Some of the words may sound alike, but it is important that you mark all of the words that describe you. Work quickly.

Adjectives scored plus one for anxiety if checked:

afraid
desperate
gloomy
gource
panicky
shaky
tense
terrified
upset
worrying

Adjectives scored plus one for anxiety if not checked:

calm
cheerful
contented
happy
joyful
loving
pleasant
secure
steady
thoughtful
APPENDIX F

Attitude Toward Teachers Scale

Instructions

For each of the following items, there are several possible answers or choices. Select the choice (answer) with which you agree and mark that choice on the separate answer sheet. Mark only one choice for each question. Remember, it is important that you answer every item.

Items

1. Students can be expected to like their teachers.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

2. Most teachers are too rigid and narrow minded.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

3. Most teachers have special favorites instead of showing equal fairness toward all students.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

4. Most teachers understand the needs and interests of their students.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree
5. The illustrations, examples, and explanations given by most teachers are too dry or technical.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

6. Teachers do not give students enough freedom in selecting their own topics for themes and reports.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

7. The main reason students cheat is because of the ridiculous assignments most teachers make.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree
APPENDIX G

Attitude Toward School Scale

Instructions

For each of the following items, there are several possible answers or choices. Select the choice (answer) with which you agree and mark that choice on the separate answer sheet. Mark only one choice for each question. Remember, it is important that you answer every item.

Items

1. High school develops self-reliance.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

2. A high school education is worth a million dollars to any young person.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

3. A high school education will help one to be a good citizen.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

4. It helps one to get a job if he has a high school diploma.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree
5. I would rather go to high school than stay at home.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

6. My classes are very interesting,
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree

7. I can learn more working on a job than in high school.
   A. strongly agree
   B. generally agree
   C. generally disagree
   D. strongly disagree
APPENDIX H

High School Characteristics Index

(Stern, 1970)

Instructions

Below are statements about high school life. The statements may or may not be characteristic of your high school because high schools differ from one another in many ways. You are to decide which statements are characteristic of your high school and which are not. Your answers should tell us what you believe is true about your high school rather than what you might personally prefer. You won't know the answers to many of these statements because there may not be any really definite information on which to base your answer. Your response will simply mean that in your opinion the statement is probably true or probably false about your high school.

Do not omit any items.

As you read each statement mark T on the answer sheet when you think the statement is generally TRUE or characteristic of your high school, is something which occurs or might occur, is the way people tend to feel or act. Mark F when you think the statement is generally FALSE or not characteristic of your high school, is something which is not likely to occur, is not the way people typically feel or act.

Scales

Abasement - Assurance

Descriptors

Self-depreciation and self-evaluation as reflected in the ready acknowledgement of inadequacy, ineptitude, or inferiority, the acceptance of humiliation and other forms of self-degradation versus certainty, self-confidence, or self-glorification.

Items

1. Students are seldom kept waiting when the office sends for them.
2. Teachers seldom make you feel you're wasting their time in the classroom.
3. Those in charge are not very patient with students.
4. There is a lot of apple-polishing and buttering-up of teachers around here.
5. Students are made to take the blame for things whether they did them or not.

6. Students don't argue with the teacher, they just admit that they were wrong.

7. When you get into trouble with one teacher around here, the other teachers soon know about it.

8. The teachers very often make you feel like a child.

9. Teachers are very interested in student ideas or opinions about school affairs.

10. You need permission to do anything around here.

Achievement

Descriptors

Surmounting obstacles and attaining a successful conclusion in order to prove one's worth, striving for success through personal effort.

Items

1. Popularity, pull and bluff get students through many courses.

2. Most teachers give a lot of home work.

3. Examinations here really test how much a student has learned.

4. Few students try hard to get on the honor roll.

5. In this school there are very few contests in such things as speaking, chess, essays, etc.

6. Students generally manage to pass even if they don't work hard during the year.

7. There are awards or special honors for those who do the best work or get the best grades.

8. Pupils seldom take part in extra projects in Science, English, History, etc.

9. There is a lot of competition for grades.

10. Most students around here expect to go on to college.
Affiliation

Descriptors

Gregariousness, group-centered, friendly, participatory, associates with others versus social detachment, social independence, self-isolation, or unsociableness.

Items

1. There is a lot of school spirit.

2. It is easy to make friends in this school because of the many things that are going on that anyone can participate in.

3. Students seldom get out and support the school athletic teams.

4. There are many parties or dances sponsored by the school.

5. Many projects are assigned in which small groups of students work together (either in or out of school).

6. Open houses or carnivals are held each year and everyone has to help out with them.

7. Most students get together often in particular soda fountains or snack bars.

8. There are very few clubs and student group activities to which students may belong.

9. Few students stay around after school for different activities or sports.

10. There is little interest in school clubs and social groups.

Reference — Restiveness

Descriptors

Respect for authority, submission to the opinions and preferences of others perceived as superior versus noncompliance, insubordination, rebelliousness, resistance, or defiance.

Items

1. Most students look up to their teachers and admire them.

2. Teachers seldom get annoyed when students disagree with them during classroom discussion.

3. Students seldom make fun of teachers or the school.
4. If students apologize for a wrong-doing, teachers are more willing to help them.

5. Students feel free to disagree with their teachers openly.

6. Students rarely express opinions different from the teachers.

7. Students almost always wait to be called on before speaking in class.

8. Teachers refer to other teachers by their first names in the presence of students.

9. Teachers go out of their way to make sure that students address them with due respect.

10. Students here frequently refer to their teachers by their first names or nicknames.

**Humanities and Social Science**

**Descriptors**

The symbolic manipulation of social objects or artifacts through empirical analysis, reflection, discussion, and criticism.

**Items**

1. This school offers many opportunities for students to get to know important works of art, music, and drama.

2. Few students would be interested in an educational film about writers and poets.

3. Students seldom read books which deal with political and social issues.

4. Student groups seldom meet to discuss current social problems and issues.

5. There are copies of many famous paintings in the school halls and classrooms.

6. When students get together, they seldom talk about classical music or art.

7. Teachers frequently urge students to consider the influence of history on current issues.

8. Most students are not interested in television programs dealing with social and political problems.
9. Many teachers and students are concerned with literary, musical, artistic, or dramatic activities outside the classroom.

10. Classes in history, literature, and art are among the best liked here.

**Impulsiveness - Deliberation**

**Descriptors**

Rash, impulsive, spontaneous, or impetuous behavior versus care, caution, or reflectiveness.

**Items**

1. Students frequently do things on the spur of the moment.

2. New ideas are met with immediate enthusiasm in this school.

3. Students often start things without thinking about how they will develop or where they may end.

4. Students frequently speak up in class without worrying about what they're going to say.

5. Students who tend to say or do the first thing that occurs to them are likely to have a hard time here.

6. Students frequently do things together here after school without planning for them ahead of time.

7. There is much shouting and yelling in the halls and cafeteria.

8. In most classes there is very little joking and laughing.

9. Students are always coming up with new fads and expressions.

10. Teachers insist that much time be spent in planning activities before doing them.

**Objectivity - Projectivity**

**Descriptors**

Detached, nonmagical, unprejudiced, impersonal, thinking versus autistic, irrational, paranoid, or otherwise perceptions and suspicion.

**Items**

1. Everyone has the same opportunity to get good marks because the tests are marked very fairly.
2. The principal and teachers are usually understanding if a student does something wrong and will give him the benefit of the doubt.

3. Many teachers seem moody and hard to figure out.

4. If students do their work well they get a good mark, whether or not the teacher likes them.

5. If a student thinks out a report carefully teachers will give him a good mark, even if they don't agree with them.

6. Teachers always seem to think students are up to something and make the worst of even small happenings.

7. There always seems to be a lot of little quarrels going on.

8. No one needs to be afraid of expressing a point of view that is unusual or not popular in this school.

9. Some teachers treat questions in class as if the students were criticizing them personally.

10. Students are sometimes punished without knowing the reason for it.

**Play - Work**

**Descriptors**

Pleasure seeking, sustained pursuit of amusement and entertainment versus persistently purposeful, serious, task-oriented behavior.

**Items**

1. There is a lot of student enthusiasm and support for the big school events.

2. New jokes and funny stories get around the school in a hurry.

3. Every year there is a carnival, picnic, or field day.

4. Having a good time comes first with most students here.

5. Students here don't do much except go to classes, study, and then go home again.

6. Most students take their school work seriously.

7. It's easy to get a group together for games, going to movies, etc., after school.

8. There are lots of dances, parties, and other social activities.

9. Everyone has a lot of fun at this school.
10. Students really get excited at an athletic contest.
APPENDIX I

Results From Principal Axis Factor Analysis of Eight High School Characteristics Index Scales Following Varimax Rotation

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Eigenvalues

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Eigenvalues from P.C.A.

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APPENDIX J

Pretesting Instructions to Students

Introduce self.

We have asked you here today to participate in some research that is being funded by the Ontario Department of Education. The purpose of it, in general, is to investigate the relationship between certain attitudes and interests of students and their reaction to school.

Please understand that your participation in this study is voluntary. That is, you don't have to participate if you don't want to. However, we do hope that all of you are interested. We are conducting this research with the view toward improving the quality of education in Ontario. We will treat the information that you provide us as highly confidential. Nobody other than members of the research team will have access to it.

Before I pass out the envelopes let me say a few words about their contents. Inside of each envelope is a letter typed on yellow stationary which is addressed to your parents. Please take this letter home to your parents or guardian, have one of them sign it, and then return it to your homeroom teacher. This only applies if you are less than 18 years old. If you are less than 18, then in order for us to be able to gather information from your school records, the law requires that we obtain permission from your parents. As the letter indicates, the information the study requires is your school grades. If you would take the letter home and have one of your parents sign it, we would appreciate it. Remember, if you are 18 this is not necessary.
Also inside of the envelope are three questionnaires, labelled Part I, Part II, and Part III. Notice that Part I is to be answered on the questionnaire booklet itself. Parts II and III, however, must be answered on the separate IBM answer sheets which also are enclosed. Please use the pencil that we have put in the envelope.

Now before I pass out the envelopes, several points probably should be mentioned. First, it is very important that you answer all of the questions. For some of the questions it may be difficult to make a choice, but in order for us to be able to analyze your results, you must answer every item. For example, if you don't answer an item on the IBM answer sheet, the computer will reject the answer sheet. Also, with regard to the IBM answer sheet, the instructions indicate that you should fill in or blacken in the answer you select. Please do not circle or check the answer -- blacken it in. If you wish to change an answer, erase it completely. On several items you are requested to rank order your preferences. For example, the question might say "rank from 1 to 5". This means you have to assign a different number to each thing being ranked, that is, give a 1 to one thing, a 2 to another, a 3, a 4, and a 5.

The questionnaires are rather lengthy. Please work rapidly because we must be done by __________. Some students do have difficulty finishing.

When you are done ...

If you have any questions at any time, just raise your hand. Are there any questions now?
As soon as I pass out the envelopes you may begin.
### APPENDIX K

Correlation Coefficients for Male (above the diagonal, N = 250) and Female (below the diagonal, N = 281) Coeducational Students

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<th>Number of brothers</th>
<th>Number of sisters</th>
<th>Birth order</th>
<th>Femininity</th>
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APPENDIX K (contd.)

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APPENDIX K (contd.)

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Note: Decimals omitted.  *p < 05     **p < 01     ***p < 001.
### APPENDIX L

Correlation Coefficients for Male (Above the diagonal, N = 247) and Female (below the diagonal, N = 321) Single-sex Students

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Single-sex Students

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APPENDIX L (contd.)

Correlation Coefficients for Male (Above the diagonal, N = 247) and Female (below the diagonal, N = 321)

Single-sex Students

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Note: Decimals omitted. *p < .05  **p < .01  ***p < .001.
FOOTNOTES

1. The dependent measure was the students' average grade based on the courses they were enrolled in at their respective schools. The average grade should be a reflection of what the student had learned during the year and therefore should be a measure of academic performance and classroom learning.

2. The data analyzed were part of a larger study. The theoretical perspective was selected in order to assist in the organization of the data analysis. Although the perspective was not selected before the data were collected it was selected before the data were analyzed. Because the data were collected before the theoretical perspective was developed they do not perfectly fit the perspective, however it was felt that the approximation was close enough to warrant its use with these data.

3. The data for the Schneider and Coutts study were collected as part of a larger investigation which included the present study.

4. The data were analyzed using the computer facilities of the University of Windsor (and IBM 360/365 installation), Carleton University (a Xerox Sigma 9 Installation), and Queen's University (a Boroughs 6700 installation). Thanks are extended to the latter two computer departments for providing their services for work on this thesis from the University of Windsor.
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VITA AUCTORIS

Brian A. Grant was born on February 1, 1953, in Cornwall, Ontario. He graduated from Cornwall Colligiate and Vocational School in June, 1971. In October, 1975, he graduated from Carleton University with a Bachelor of Arts Degree (Honours). Since September, 1976, he has been enrolled in the Master's program in social psychology at the University of Windsor. At the present time, he is also enrolled in the Doctoral program of the Psychology Department, Queen's University at Kingston, Ontario.

Brian A. Grant is married to the former Margaret Thompson.