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An ecological perspective of science and math academic achievement among African American students

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An ecological perspective of science and math academic achievement among African American students

by

Endya Bentley Stewart

A dissertation submitted to the graduate faculty in partial fulfillment of the requirements to the degree of

DOCTOR OF PHILOSOPHY

Major: Education (Curriculum and Instructional Technology)

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Ames, Iowa

2000

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For the Graduate College
DEDICATION

Every letter, every word, every page of this dissertation is dedicated to my husband. Without him, I would not be where I am today or who I am today.

Thank you...Eric.
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ABSTRACT

Using data from the National Education Longitudinal Study of 1988 (NELS:88), path analytic procedures were performed to test an ecological model of the effects of family, individual and school characteristics on the academic achievement of African American students. A distinctive feature of this study is the inclusion of school computer use in the model. The study results show that several of the family influence variables directly or indirectly affected 12th grade academic achievement. Furthermore, most of the individual influence variables were directly related to 12th grade achievement. Two surprising findings from this study were the insignificant effects of family income and school computer use on 12th grade achievement. Overall, the findings support the notion that family, individual, and school characteristics are important predictors of academic success among African American students.
CHAPTER ONE. INTRODUCTION

Over the past couple of decades, the percentage of African American youth who have completed high school has increased substantially (Luster & McAdoo, 1996). Despite many obstacles, African American youth succeed in school, but far too little is known about the factors that contribute to this success. As a place to start, rather than focusing on minority students considered “at-risk,” research might better inform policy and practice if variables possibly impacting the academic success of minority students are identified and factors associated with their success modeled.

Although for decades research has addressed academic achievement in African Americans, the reasons underlying this achievement are not well understood (Slaughter & Epps, 1987). Distressingly, developmental research with minority groups continues to be scarce (Hagen & Conley, 1994). Moreover, research conducted with minority groups has often been problematic (Graham, 1989; Ogbu, 1981; Scott-Jones & Nelson-LeGall, 1986). Most early research in this area used simple comparisons of African American versus White groups. This approach not only ignored the important process and context variables that hindered or enhanced development within and
across each ethnic group, but also masked the competencies of many children (Jenkins, 1989; Powell, 1989; Scott-Jones, 1984).

Few studies have relied solely on the African American experience to explain the phenomenon of African American student achievement. Most of the research on African American families fails to recognize the positive role that African American families play in the development of their children (Luster and McAdoo, 1994). Much of the research on African American families and children has focused on problem outcomes (e.g., school failure) and differences between African American and White families and children (e.g., achievement test scores). This focus on failure may contribute to the generation of faulty and inaccurate images of African American families in the literature and media (McAdoo, 1990; Slaughter-Defoe, Nakagawa, Takanishi, and Johnson, 1990). For example, Rawles (1995) found that the media contributed to the overall stereotyped negative images regarding African Americans held by the majority of the American populace.

While a handful of studies have focused on African American students, they have been limited both geographically and in terms of sample size. In a review of empirical
literature on motivation in African Americans, Graham (1994) outlined several such studies. Studies limited geographically included Nuttall (1964) who researched the need for achievement among African American adults raised in either the northern or southern United States, and Gurin (1971) who researched college students in the South. Studies limited by sample size included Durand and Shea (1974) who researched entrepreneurial business activity (as it relates to achievement) for 29 males and females; Schroth (1976) who researched academic motivation among 60 African American male and female college freshman and seniors; and Epps, Katz, Perry, and Runyon (1971) who researched math performance (as it relates to achievement) for 86 college freshmen.

The present study is more rigorous methodologically (I use a nationally representative sample of African American students) and analytically (I examine multiple factors of achievement simultaneously). In this study, I am interested in determining the ecological factors (i.e., characteristics of the person and of the environment) that contribute to the academic achievement of African American students. Factors such as family characteristics, school use of computers, and individual motivation are examined in this study. Of particular interest are the roles that families and school
computer use play in the pursuit of academic success. This study is intended to contribute to the understanding of the direct and indirect impacts of individual, family, and school characteristics on academic achievement among African American youths living in two-caregiver families.

A unique factor of the present study is that it examines the effect of school computer use on academic achievement while controlling for family and individual influences. It is important to understand the influence that technology plays in the development of academic achievement, especially with respect to the use of computer technology that may not be present in many African American homes. For example, Project Micro, in working with African American children in the southern United States, has shown that minority and low income students can learn higher-order thinking skills using computers (Edwards, 1988). Moreover, there have been few large-scale national studies conducted on the subject of computer use and secondary school education. For this reason, there is a need for more up-to-date research on this important educational issue.

For minority students, research has traditionally focused solely on their background characteristics. That is, attempts have been made to predict or explain minority students'
academic achievement from background characteristics of their families (i.e., socioeconomic status or home possessions as indicators of affluence); the students themselves (e.g., ethnicity or gender); and from characteristics ascribed to them (typically ability, self-esteem, locus of control, and motivation) (Burlew, 1979; Curry, Hotchkiss, Picou, Scritchfield, Stahura, & Salome, 1978; Flaugher, 1971a, 1971b; Frye & Coe, 1980; Heussenstam & Hoepfner, 1971; Johnsen & Medley, 1978; Lloyd, 1967; Suchman, 1968). As mentioned in the above paragraphs, academic achievement is affected by a myriad of factors. These issues will be elaborated in the latter pages of this study.

**Importance of the Study**

To date, researchers have paid very little attention to understanding the ways in which computer use affects African American students' academic achievement. Furthermore, no studies have modeled the simultaneous contexts of familial, individual, and school influences on academic achievement in African American students. This study is timely in that it recognizes the importance of family and computer use variables in the changing landscape of American education. Furthermore,
another factor that makes this research important is the longitudinal nature of the study.

Potentially the most important contribution of this study is that positive roles of African American families in the educational development of their children can be displayed. Given that past research has tended to overlook positive aspects of family life among African Americans, I believe that this is an especially important aspect of the current study.
CHAPTER TWO. BACKGROUND

Theoretical Foundation

Several researchers claim that academic ability is largely influenced by the environment (Brooks-Gunn, Klebanov, & Duncan, 1996; Bushweler, 1995; Madhere, 1995; Wangler, 1995). For example, in a study with 3,745 African American and White high school seniors it was found that IQ tests, used to assess academic ability, were primarily measures of literacy, which is socially constructed (Madhere, 1995). Various explanations for academic achievement for students from ethnic minority groups have emphasized the environmental and cultural differences these children bring to school. Meanwhile, ethnic minority researchers have argued that a knowledge base placing development in a broad ecological context is essential for the development of culturally-sensitive research targeting children and adolescents (Harrison, Wilson, Pine, Chan, & Buriel, 1990; McLoyd, 1990). Bronfenbrenner (1979) has conceptualized such a model. He developed an ecological framework that identifies the interconnected systems that influence human development. Bronfenbrenner's ecological model requires behavior and development to be examined as a joint function of the
characteristics of the person and of the environment. The former includes both biological and psychological attributes (e.g., an individual's genetic heritage and personality). The latter encompasses the physical, social, and cultural features of the immediate settings in which human beings live (e.g., family, school, and neighborhood), as well as the still broader contemporary and historical contexts in which these settings are embedded (e.g., the society and times into which an individual is born) (Moen, Elder, & Luscher, 1995).

According to an ecological model of human development, academic achievement among children and adolescents is influenced not only by factors such as teaching practices and social processes in their immediate classroom environments, but also by aspects of their family environments. In the ecological model, the family is conceptualized as a context that directly influences child and adolescent behavior by contributing to the development of competencies that increase the likelihood of academic success. The family also plays a major role in linking factors such as social class to adolescent academic competence (Bronfenbrenner, 1989; Garbarino, 1982). Factors, such as family financial resources and parental educational attainment, that contribute to social class status also affect family relationships and parental
involvement in school activities; these family processes in turn are linked to youths' academic success (Bronfenbrenner, 1989; Garbarino, 1982).

The development of theoretical models that incorporate family and family-school contexts (Bronfenbrenner, 1979; Comer, 1988; Hawkins & Weis, 1985) has provided a conceptual foundation for better understanding the complex parental influences on children's adjustment. The most pedagogically effective instruction occurs when the role demands and cognitive functioning in the classroom are compatible with, or built upon, those in the home. To the degree that the activities and experiences in these two settings reinforce each other while facilitating mutual trust, mutual goals, and personal autonomy, the child will show a greater proficiency with the basic skills (academic knowledge and social skills) that schools are expected to teach (Bronfenbrenner, 1979).

Review of the Literature

In the following pages, literature regarding variables that directly and indirectly influence academic achievement (e.g., family, individual, and school influences) will be presented. After a brief discussion of academic achievement, literature on family influences and involvement in education
will be examined. Due to the extensive amount of literature on families, this topic has been divided into clusters of similar information.

**Academic Achievement**

Since the seminal works of Atkinson (1964), Maslow (1962), and McClelland, Atkinson, Clark, and Lowell (1953), educators have been intensely interested in the study of achievement. In a general sense, achievement refers to the traditional indices of the degree to which a student has encountered success in school. These may include school grades, grade point average, rank in class, scores on standardized achievement and aptitude tests, and other scaled indicators used within the school setting to document and report levels of academic progression.

It is generally accepted that academic achievement is a function of the direct and indirect effects of many factors. Much research has been conducted on variables predictive of academic achievement. Researchers that have sought to discover factors associated with high academic performance have examined an array of variables such as social behavior (e.g., DeBaryshe, Patterson, & Capaldi, 1993; Wentzel, 1993), academic self-concept (e.g., Marsh, 1984, 1992; Skaalvik &
Hagtvet, 1990), learning strategies (e.g., Andreassen & Salatas-Waters, 1989; Pintrich & DeGroot, 1990), academic engagement (e.g., Deverensky, Hart, & Farrell, 1983; Gamoran & Nystrand, 1991), parenting styles (e.g., Baumrind, 1991; Steinberg, Elmen, & Mounts, 1989; Steinberg, Lamborn, Dornbush, & Darling, 1992), and academic motivation (e.g., Eccles, Adler, & Meece, 1984; Grolnick, Ryan, & Deci, 1991; Keeves, 1986; Schiefele, Krapp, & Winteler, 1992; Skinner, Wellborn, & Connell, 1990; Wentzel, 1989; Wong & Csikszentmihalyi, 1991).

Furthermore, several studies have linked differential effectiveness of schooling to social class, race, gender, and other demographic conditions (Eagle, 1989; Kozol, 1991; Ornstein & Levine, 1989; Powell, Farrar, & Cohen, 1985; Reyes & Stanic, 1988; Stanic, 1991; Stanic & Reyes, 1986; White, 1982; Wilson & Allen, 1987). Some authors have suggested a connection between quantity and quality of student inputs (Banks, 1988; Barr & Dreeben, 1983; Dossey, Mullis, Lindquist, & Chambers, 1988; Wilson & Allen, 1987; Winfield, 1984), nature and degree of parental encouragement and support for academic endeavors (Banks, 1988; Kifer, 1977), comparative impact of peer influences (Fordham, 1988; Fordham & Ogbu, 1986; McCandless, 1990), and school effectiveness
characteristics that are related to student progress (Brophy, 1990; Engman, 1989; Winfield, 1991).

Educational Involvement of Parents

The family is the basic institution through which children learn who they are, where they fit into society, and what kinds of futures they are likely to experience. It is generally accepted that the family is an important factor in student academic development and achievement. Much attention has been paid to the relationship between families and education, particularly during the past twenty years (Clark, 1988; Coleman, 1987; Cookson & Persell, 1985; Craft, Raynor & Cohen, 1980; Fehrmann, Keith & Reimers, 1987; Henderson, 1987; Hoover-Dempsey, Bassler & Brissie, 1987; Lareau, 1989; Mercy & Steelman, 1982; Rich, 1985; Scott-Jones, 1988; Sewell & Hauser, 1975; Sewell, Hauser, & Featherman, 1976; Teachman, 1987; Walberg, 1984). In particular, the home environment may influence the extent of persistence and achievement of an individual in any particular endeavor. The search to define and delineate specific family-related constructs and the nature of these effects has long been a focus of educational and sociological researchers.
Educational researchers, sociologists, and psychologists have suggested that parental involvement in youths' schooling is a pivotal process through which parents influence academic success (Heyns, 1978). Typically, parental involvement includes attendance at teacher conferences and involvement in school activities, such as open houses and social activities. Through such participation, parents demonstrate the importance they attach to schooling and academic achievement. Intermittent contact with teachers, and direct involvement with children outside of the school setting, also serve a monitoring function that allows parents to receive feedback about their children's academic performance and self-regulatory skills (Catterall, 1988; Craft, Raynor & Cohen, 1980; Kurtz & Barth, 1989; Walberg, 1984).

Parents' behavior with or on behalf of their children is a major domain of influence on children's school success. Parents should provide verbal encouragement or positive interactions regarding school work (Epstein, 1984; Marjoribanks, 1983). Parent monitoring and responsiveness (e.g., providing feedback and reinforcement on homework, monitoring out-of-school activities), parent-child interactions (e.g., reading with child, discussing school progress), and parent involvement in school (e.g.,
participating in school activities) all have been shown to be positively associated with school achievement and success (Christenson, Rounds, & Gorney, 1992; Clarke-Stewart, 1988; Dauber & Epstein, 1993; Feitelson & Goldstein, 1986; Muller & Kerbow, 1993; Scott-Jones, 1984; Stevenson & Baker, 1987). The way parents interact with their children may be the most important factor of all in their children's achievement (Walberg, 1981).

Parents are instrumental to the academic success of students. Most research on the subject assumes that parent involvement in education is a positive element that should be encouraged (Baker & Stevenson, 1986; Bauch, 1988; Chavkin, 1989; Chavkin & Williams, 1989; Clark, 1988; Coleman, 1987, 1988, 1991; Comer, 1986; Craft, Raynor & Cohen, 1980; Epstein, 1983, 1984, 1986, 1988; Fehrmann, Keith & Reimers, 1987; Hoover-Dempsey, Bassler, & Brissie, 1987; Kurtz & Barth, 1989; Muller, 1993; Reynolds, 1989; Stevenson & Baker, 1987; Swap, 1990; Walberg, 1984). Parents not only influence what the child brings to the school setting when he or she begins school but also can influence how well the child acquires school-related skills throughout the school years and can influence other behaviors, such as study habits, that are likely to affect the child's achievement and attainment.
In the first 18 years of life, students spend 87% of their waking time outside of school under the supervision of their parents. How parents direct this large investment of time for their children can reap considerable benefits for students' academic performance (Walberg, 1983). As reported in previous studies, parental beliefs and attitudes about schooling have the potential to wield great influence in their children's academic lives (Eccles & Harold, 1996; Epstein, 1990; Zill & Nord, 1994). Thus, the environment of the home becomes a powerful influence on out-of-school factors and may have direct influence on in-school activities.

In a study by Keith, Keith, Bickley and Singh (1992), parental involvement was shown to have a strong direct effect on achievement (.287). In their study, parental involvement had four indicators. These included measures of parental aspirations for children, family monitoring of homework and family rules, parent-student discussions of school activities, and parental participation in school activities. Achievement was measured by a series of standardized tests in reading, math, science, and social studies. Furthermore, the study of Singh, Bickley, Trivette, Keith, Keith, and Anderson (1995) indicated that among four components of parental involvement—parental aspirations, parent/child communications regarding
school, the home environment, and parental participation in school activities—parental aspirations had the strongest effect on academic achievement.

**Socioeconomic (SES) Factors of Families**

During the past years, a fair amount of agreement has developed among educational researchers and sociologists that educational achievement and educational attainment can be predicted rather successfully by social background characteristics of families of origin (Benbow, Arjmand, & Walberg, 1991; Conell, Aber, & Spencer, 1994; Epstein, 1987a, 1987b; Epstein & Scott-Jones, 1988; Griffen, 1990; Gross, 1993; Powell, 1990; Scott-Jones, 1984; Slaughter & Epps, 1987; Tangri & Moles, 1987). The family background factors studied typically include parental occupation, education, and income. Some studies also include such compositional variables as marital status (intact two-parent families versus families containing one parent), number of children, number of adults in the household, and whether or not the mother works outside the home (Christenson, Rounds, & Gorney, 1992; Luster & McAdoo, 1994; Updegraff, 1996).

A number of studies have suggested that parents of higher SES are more involved in their children’s education than
parents of lower SES and that greater parental involvement fosters more positive student attitudes toward school, improves homework habits, reduces absenteeism and dropping out, and enhances academic achievement (Astone and McLanahan, 1991; Epstein, 1987a, 1987b; Fehrmann, Keith, and Reimers, 1987; Lareau, 1987; Muller, 1993; Stevenson and Baker, 1987).

Social class, as measured by socioeconomic status indicators, is a powerful predictor of achievement. Social class has been a major factor in many of the studies of educational achievement and educational outcomes (Anyon, 1981; Cookson & Persell, 1985; Edelman, 1987; Lareau, 1987, 1989; Zill, Collins, West, & Hausken, 1995). Several empirical works view socioeconomic origin as a key variable driving educational attainment (DiMaggio, 1982; Duncan, Featherman & Duncan, 1972; Floud, 1961; Hauser, 1971; Lareau, 1989; Sewell & Hauser, 1975). Also, the Coleman Report (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, & York, 1966) concluded that the single most important variable in determining a child’s academic achievement was the educational and social background of the child’s family.

Mercy and Steelman (1982, p. 532) reported that “persons reared in socioeconomically advantaged families surpass their disadvantaged counterparts on ability tests.” Furthermore,
Scott-Jones (1984) provided an overview of SES studies, noting that family socioeconomic characteristics generally are found to relate significantly to educational performance variables, while family composition variables and other status measures of social background provide mixed results. In his research, Franklin (1995) revealed that students' socioeconomic backgrounds strongly influenced the "quality" of their efforts in academic pursuits and their perceptions of cognitive development.

On the other hand, several studies that have investigated the influence of SES on the educational achievement and attainment of African American adolescents have found that socioeconomic background of students' families explains relatively little of the variation in achievement. Slaughter and Epps (1987) reported that in some studies of African American youth, SES had no relationship with achievement when high school grades were the achievement indicator. Studies that use high-school grades or rank in class as indicators of achievement have generally found that SES is unrelated to African American students' academic performance (e.g., DeBord, Griffin, & Clark, 1977; Epps, 1969; Howell & Freese, 1979; Kerckhoff & Campbell, 1977; Porter, 1974; Portes & Wilson, 1976; Thomas, 1979). The relationship between SES, ability,
and achievement test performance is usually weak but positive and statistically significant (Epps, 1969; Howell & Freese, 1979).

Epps and Jackson (1985) examined the relationship of SES, ability, and selected school variables to achievement test scores and grades of African American high-school seniors in two nationally representative samples: the National Longitudinal Study of 1972 sample, and the 1980 High School and Beyond sample. Their findings suggest that much of the family influence on grades and achievement of high school students is indirect.

In addition to background factors that measure a family’s financial situation, social status, and race, some researchers have investigated the influence of other family resources—particularly those related to educational activities. These resources are items common in most homes (e.g., magazines, newspapers, books, typewriters) and parental involvement in the child’s development (awareness of and reward for intellectual attainment, use of English at home, and involvement with school). These factors, which may vary from family to family and from community to community, also influence student achievement (Greeley, 1982; Shea & Hanes, 1977; Walberg & Tsai, 1985).
Parental Education and Student Achievement

Family resources include income, time, human capital, and psychological capital resources. Human capital would be represented by parental education, as well as parental employment and occupation. Reams of studies report parental education being associated with child outcomes (Bronfenbrenner, 1979; Featherman & Hauser, 1987; Furstenberg, Brooks-Gunn, & Morgan, 1987; Gottfried, 1984; Wachs & Gruen, 1982; Werner & Smith, 1982).

Investigations of National Assessment of Educational Progress (NAEP) results reinforced the impact of parents' level of education. Several researchers discovered that students with well-educated parents had significantly higher achievement than did students with less well-educated parents (Anick, Carpenter, & Smith, 1981; Mullis, Owen, & Phillips, 1990).

Benbow, Arjmand, and Walberg (1991) posited that, among mathematically talented students, family characteristics such as parental educational level, and educational encouragement were effective in predicting academic achievement. These authors contended that the home environment has a positive impact on cognitive achievement when it focuses and mobilizes the individual and provides a nurturing environment (Benbow,
Arjmand, & Walberg, 1991). Furthermore, Gross (1993) reported that the postsecondary experiences (e.g., parents’ educational level) of minority parents had strong effects on the participation and career choices of their children.

**Family Influences on African American Youth**

Generally speaking, investigations of the influence of social background (including ability) on African American students’ achievement have found that such “surface” family characteristics provide very little help in explaining variations in achievement. Family socioeconomic characteristics are usually found to be positively and significantly related to educational aspirations and expectations, but the strength of the relationships is modest and leaves much room for additional inquiry into the processes by which families encourage their children to develop high educational aspirations and expectations.

The fact that education is highly valued among African American families is not at issue. The experiences of African Americans in American society have convinced the majority of parents that their children’s chances for occupational success and a comfortable lifestyle are extremely limited if they are
not able to attain considerably more education than their parents.

Clark (1983) studied family socialization patterns that differentiated low-income African American families with high-achieving high-school seniors from those with low-achieving high-school seniors. In high-achievers’ homes there was frequent dialogue between parents and children; parents encouraged academic pursuits and were warm and nurturing toward their children. These parents also established achievement norms, monitored their children’s achievement, and reinforced appropriate achievement behaviors. They taught their children problem-solving and social skills that were necessary to succeed in school. These parents continued to teach their children throughout their school years; they believed that parents should accept some of the responsibility for their children’s education. The parents wanted their children to be college educated. Parents of high-achieving adolescents were raised in highly organized families with clearly defined status hierarchies and an environment of communication and mutual support. Conversely, family disorganization and the lack of family-school interaction, along with parental feelings of hopelessness and powerlessness, resulted in poor academic achievement for the
offspring of African American low-income parents. The family can be a protective mechanism, but it may also be a source of vulnerability if family patterns do not reinforce the skills necessary for African American students to do well in school.

Using the National Longitudinal Study of 1972 sample and the 1980 High School and Beyond sample, Epps and Jackson (1985) found that SES predicted achievement test scores among African American males nearly as well as did measured ability scores. Among African American females, SES was not related to achievement, nor was it related to students’ grades. Moreover, achievement was likely to be higher among students with the following characteristics: high ability, enrollment in an academic track, high grades, and high educational aspirations. As Slaughter and Epps (1987) conclude, these results suggest that family influence operates indirectly on achievement by directly influencing aspirations, choice of school, choice of academic or vocational/general courses, and specific school-related behaviors such as encouraging completion of homework and supervising school attendance.

Prom-Jackson, Johnson, and Wallace (1987) report in their article a retrospective study of a sample of high achieving young minorities, from a low-income background, who were identified as academically talented during their elementary
school years. They were subsequently selected and placed in private and public schools with high-quality academic programs. The study examined the family background and student characteristics that relate to their high-school achievement measured by their grade point average (GPA) in English and mathematics. The results of this study indicate that the development of academically talented students in low-income African American families occurs under various home environmental conditions. Academically talented youth come from families whose parents have varying levels of education. They come from small, large, and average size families, and from both single-parent and two-parent households. Since this was a retrospective study, consideration must be given to the predominant household patterns in the past two decades when assessing this pattern. The proportion of subjects from large relative to small families and from two- and single-parent homes is consistent with the pattern that existed in the United States in the past several decades.

Conell, Aber, and Spencer (1994, p. 503) reported that African American's familial support, "experience...of their own sense of control over their success and failure in school, and their feelings of self-worth and emotional security with others...regulates their 'actions' in school, regardless of
their family's economic conditions." African American adolescents are concerned about whether their parents view them as academically able. DeSantis, Ketterlinus, and Youniss (1990) found that African American adolescents cared about their parents' opinion of their academic ability.

In their article, Brody, Stoneman, and Flor (1995) test a family process model that links family financial resources and parental educational attainment to academic competence during early adolescence. The sample included 90 rural African American youths between the ages of 9 and 12 and their mothers and fathers. Rural African American community members participated in the development of the self-report instruments and observational research methods. Parental educational attainment was linked with family financial resources and with parental involvement with the adolescent's school. Greater family financial resources were associated with more supportive and harmonious family interactions and with lower levels of interparental conflict. Maternal involvement with the child's school, family processes, and family financial resources were linked directly with academic competence and mediated by the development of youth self-regulation. Consistent with the ecological model (Bronfenbrenner and Crouter, 1982) that guided their study, they construe parental
education and family financial resources as distal variables that indirectly affect academic competence through their impact on family processes and parents' involvement in their children's schools. The family process and parent involvement constructs serve as proximal variables, because they predict that they are more directly linked to youths' academic competence.

**Family Structure**

Prom-Jackson, Johnson, and Wallace (1987) examined the family structure of low income, academically talented minority youth to determine if type of family configuration resulted in significantly different academic achievement for students from those families. Factorial analysis of variance (ANOVA) for family structure revealed that the majority of students selected for special academic programs based on their GPA were from homes with two parents present.

McCartin and Meyer (1988) also found support for the positive impact of family structure on academic achievement. Their results yielded an overrepresentation of students from two parent homes in the high GPA category. McCartin and Meyer (1988) investigated the influence of family structure and stability on the academic achievement and aspirations of
adolescents aged 14-19 years. The students from families with two natural parents exceeded the expected frequency in the high GPA category and were considerably below expected frequency in the low GPA category. Furthermore, a substantial proportion of students from families with two biological parents present had planned to pursue further education. The results of this study gives valuable support to the hypothesis that family structure influences academic achievement of children.

According to Updegraff (1996), it is the mother and the father together who are able to create an environment for facilitating the development and the maintenance of the child’s educational and occupational aspirations. Updegraff has further argued that such an environment created by both parents does play an important role in the academic achievement of students.

Self motivation

While parental influences may be a powerful indicator of student academic achievement, there are other factors that directly or indirectly impact students' academic success. One important factor is self motivation.
It is believed that student achievement is influenced by what goes on in the school and home environments. However, a theory of school learning would be incomplete without taking into account student's personal efforts toward achievement. Student motivation can be measured by responses to questions regarding the amount of time spent on homework as well as the amount of academic coursework. Keith and colleagues (Keith, 1988a, 1988b; Keith & Benson, 1992; Keith & Cool, 1988) have operationalized amount of time spent on homework and taking academic courses as indicators of academic achievement.

According to Keith and Benson (1992, p. 86), instructional time (i.e., amount of coursework) is critical to theories of school learning. They added that "time spent on academic courses has a greater influence on achievement that time spent on nonacademic courses." Here academic courses referred to coursework in English, mathematics, physical science, biological science, social science, and foreign language. Achievement was measured by grades in these courses. For their study, using data collected from students responding to each of three waves of the High School and Beyond survey (N=12,142), they found that coursework in the subject areas outlined above had the strongest direct effect on high school grades; even more so than ability. This was
true whether students were White, African American, Hispanic, Asian American, or Native American.

Reynolds (1991) also investigated the relationship between student motivation and academic achievement. He concluded from his study of 3,116 eighth graders that academic motivation exerted small direct and indirect effects when geographic, home, peer, and school variables were included in his model.

Several other researchers have found that individual motivation positively influences academic performance (Eccles, Adler, & Meece, 1984; Grolnick, Ryan, & Deci, 1991; Keeves, 1986; Schiefele, Krapp, & Winteler, 1992). Indeed, this line of inquiry has generated a considerable amount of research in the field of education and has been used extensively to better understand important educational outcomes (Wentzel, 1989; Wong & Csikszentmihalyi, 1991). In particular, Luster and McAdoo (1996) found that individual motivation positively and significantly predicted academic achievement in a sample of low SES African Americans.

School Computer Use

Educational technology is a prevalent tool for learning in today's classroom. Innovative uses of this technology will
probably transform both teaching and learning processes (Olive, 1992). The use of technology radically transforms the ways in which knowledge is created, managed, and disseminated. Students with knowledge about and access to computers are able to use personal productivity tools such as word-processors, spelling-checkers, graphics, databases, spreadsheets, statistical and other analytic programs, and telecommunications to enrich their learning experiences and enhance their academic performance. Classroom technology is viewed by many researchers as an important catalyst for improving the education of all students (Owens & Waxman, 1995). In addition, classroom technology has the potential of revolutionizing K-12 learning and instruction in our nation's schools (Maddox, Johnson, & Willis, 1997). Such knowledge-building electronic tools can be beneficial resources for transforming the current classroom environment into one which will prepare our students for the next century (Scardamalia & Bereiter, 1992).

There are four sources of computer experience for students (Resta, 1992): (1) required computer literacy or use of computers; (2) self-selected computer courses; (3) home use of computers; and (4) public access, such as in the library, museum, school computer clubs, community centers, etc. Meta-
analyses of research studies have demonstrated that computer-based education (CBE) significantly increases student achievement scores when compared to traditional (non-computer) instruction. Following are some of the major meta-analyses and syntheses relating to the use of computers and academic achievement in the classroom.

A meta-analysis by Burns and Bozeman (1981) integrated 16 secondary education studies, 11 dealing with computer drill and practice programs, and 5 examining computer tutorial programs. Students in the drill and practice experimental groups, typically, scored significantly higher on achievement than did the control (non-technology) groups, attaining a small effect size of .24 (approximately the 60th percentile). In the computer tutorial studies, the benefit was more than twice that of the drill and practice students. A moderate effect size of .52 (approximately the 70th percentile) was noted, indicating that the computer users, in general, scored significantly higher on achievement tests when compared to the non-technology students.

Kulik, Bangert, and Williams (1983), using meta-analysis, reviewed 32 studies of high school students (grades 9-12) involving computer-based teaching and conventional instruction. An effect size range of -.75 to 1.75 was
reported for the 32 separate studies. In the meta-analysis, instructional matter consisted mainly of mathematics and science classes, with approximately 20% involving other subject areas. A moderate effect size of .34 (approximately the 63rd percentile) was found, indicating that computer-based students, typically, attained significantly higher achievement scores when compared with the non-technology students. In a similar investigation, Bangert-Drowsn, Kulik, and Kulik (1985) also examined only secondary school students (grades 10-12), using research data from 42 individual studies. The 42 separate studies had an effect size range of -.46 to 1.44. Approximately 70% of the independent studies examined mathematics and science courses. Their meta-analysis showed the classes using CBE, in general, scored significantly higher on achievement than did the non-computer control groups, with a small effect size of .29.

Niemiec and Walberg (1985) conducted a synthesis of 48 independent research studies which investigated elementary school students and the impact of computer use on their achievement scores. The researchers collapsed the various grade levels (K-8) into three categories: (a) primary (K-3), (b) intermediate (4-6), and (c) upper (7-8) in order to get a clearer understanding of the results. In each of the three
grade categories, the computer-using classes, usually, scored
significantly higher on exams than did the traditional (non-
computer) classes. Furthermore, in 1987 Niemiec and Walberg
conducted a meta-analysis which integrated approximately 250
separate studies, conducted from 1969 to 1986, dealing with
computer-assisted instruction (CAI). With regard to
achievement gains, 81.9% of the individual studies making up
the meta-analysis revealed that the CAI students attained
significantly higher scores as compared to the non-CAI
students. The meta-analysis found that classes using
technology, in general, scored significantly higher than the
traditional (non-technology) classes on achievement tests,
with the overall, moderate effect size being .42.

A research synthesis by Liao (1992) examined 31
independent studies, with a total of 207 comparisons, to
determine the effect of CAI on cognitive outcomes. The
studies analyzed were published from 1968 to 1989, and there
were no restrictions as to grade level or classroom subject.
The effect sizes of the 31 separate studies showed a range of
-.91 to 3.31. Results from the meta-analysis showed that,
generally, the CAI groups scored significantly higher on
cognitive evaluation than non-CAI groups. The technology
classes showed an overall, moderate effect size of .48;
meaning that the average student in the CAI class scored approximately 18% higher than the average non-CAI student.

Kulik (1994) used meta-analysis to aggregate the findings from more than 500 individual research studies of computer-based instruction (CBI). CBI individualizes the educational process to accommodate the needs, interests, current knowledge, and learning styles of the student. CBI software consists of tutorial, drill and practice, and more recently Integrated Learning Systems. Kulik found that: (1) on average, students who used computer-based instruction scored at the 64th percentile on tests of achievement compared to students in the control conditions without computers who scored at the 50th percentile; (2) students learn more in less time when they receive computer-based instruction; and (3) students like their classes more and develop more positive attitudes when their classes include computer-based instruction.

Using meta-analysis, Fletcher-Flinn and Gravatt (1995) examined 120 independent studies, published between 1987 and 1992, which investigated the impact of CAI on student learning. The experimental groups received the CAI treatment, while the control groups received traditional (non-technology) instruction. With regard to all grade levels and content
areas, results showed that students in the CAI classes typically scored significantly higher on cognitive examinations than did the non-CAI students; with a small effect size of .24. This degree of effect means the average computer-using student out-scored approximately 60% of the students who did not use computers. That same meta-analysis reported results for the 20 individual CAI studies which investigated only secondary students (grades 7-12), and their achievement gains in several different content areas. Again, the purpose was to learn the impact that CAI has on academic gain when compared with traditional instruction. Findings revealed that the computer-using classes (i.e., the experimental groups), in general, scored significantly higher on academic tests than did the non-computer (i.e., control) classes; indicating a small effect size of .20.

Sivin-Kachala (1998) reviewed 219 research studies from 1990 to 1997 to assess the effect of technology on learning and achievement across all learning domains and all ages of learners. From his analysis of these individual studies he reported the following consistent patterns. The positive findings of the study were: (1) students in technology rich environments experienced positive effects on achievement in all major subject areas; (2) students in technology rich
environments showed increased achievement in preschool through higher education for both regular and special needs children; and (3) students' attitudes toward learning and their own self-concept improved consistently when computers were used for instruction. The inconclusive finding of the study was that the level of effectiveness of educational technology is influenced by the specific student population, the software design, the educator's role, and the level of student access to the technology.

**School Environment**

The school environment may foster or hinder students' academic achievement. Schools exert their own unique influence on the academic achievement of their students through their climate or environment and teachers. Effective schools, usually identified in terms of above-average student achievement scores, have strong instructional leadership from the principal, closely monitor student progress, have high expectations for students, establish clear goals, and have an orderly environment (Clark, Lotto, & McCarthy, 1980; Edmonds, 1979; Felsenthal, 1983; Hallinger & Murphy, 1986; Purkey & Smith, 1983; Venezky & Winfield, 1979). Hallinger and Murphy (1986) presented findings from a study that explored the
operation of selected school effectiveness factors in schools of different socioeconomic status. The purpose of their paper was to extend the understanding of how schools that serve student populations of differing SES promote effective learning. According to the authors, the effective low-SES schools held high expectations for their students while maintaining rather weak linkages with their environments. The high-SES schools seemed to derive their effectiveness in large part through the development of particularly strong connections with their environments. Lee and Bryk (1989) also found several school factors associated with socially equitable outcomes (smaller class size, a constrained curriculum, and fairness in discipline). They found that a safe and orderly school climate is associated with more equitable academic achievement between racial/ethnic and White students. Meanwhile, Newman, Rutter, and Smith (1989) argued that similar factors (e.g., small size, student integration into school life) reduce alienation and promote engagement in high schools, factors that are in turn associated with achievement.

The quality of school life can also influence the adjustment and academic performance of African American students. The academic performance of African American
students is enhanced when they perceive their teachers and other school personnel as supportive and helpful (Patchen, 1982; Pollard, 1989). Estler (1985) also discovered SES-related differences in school organization variables in a study of school goals and student achievement. She found that the academic achievement of low-SES African American students was positively related to staff and parent goal congruity.

Summary

Overall, the purpose of this section was to present a review of the literature pertinent to this study. Factors such as parental involvement in education, school computer use, individual motivation, and school environment were investigated in regards to their effect on academic achievement. As has been mentioned, academic achievement is influenced by a multitude of factors. In the next section, the hypothesized theoretical model is discussed. The model has been defined by the parental-, individual-, and school-level factors that were outlined in the review of literature. The relationships presented in the model are supported by the literature.
The Hypothesized Theoretical Model

The hypothesized theoretical model to be tested is shown in Figure 1. The purpose of the hypothesized theoretical model is to graphically display the expected relationships between the variables outlined in the review of literature. As can be seen in Figure 1, it is expected that, when viewed cross-sectionally at the study's outset, the specified family and achievement variables at Time 1, or 8th grade, (i.e., caregiver education, household educational resources, family income, caregiver school involvement, and 8th grade achievement) will be interrelated. This expectation was formed because several writers have pointed out that families and the home environment influence the academic behavior (i.e., academic achievement) of students (Coleman, 1987; Craft, Raynor & Cohen, 1980; Fehrmann, Keith & Reimers, 1987; Henderson, 1987; Lareau, 1989; Mercy & Steelman, 1982; Rich, 1985; Scott-Jones, 1988; Teachman, 1987). It is also expected that all Time 1 variables will be significant and positive.

This study also looks at prior achievement in order to estimate subsequent achievement. Many studies have suggested that ability, as measured by prior achievement and IQ, has a significant positive influence on subsequent academic achievement (Walberg, 1984). In order to make a strong causal
Figure 1. The Theoretical Model.
argument, I am controlling for an early measure of academic achievement (i.e., 8th grade achievement). A path has been drawn from academic achievement in Time 1 (8th grade) to the outcome variable, academic achievement in Time 3 (12th grade). This path should have the strongest coefficient in the model because it is a measure of itself at an early time. This measure is further predicted to be stable across time.

The model also proposes that caregiver education at Time 1 will predict students' perception of the school environment, student motivation and extracurricular involvement in Time 2. Caregiver education is also conjectured to be associated with student's academic achievement. For caregivers with more years of formal education, the school context should be more familiar and have fewer associations with negative experiences, resulting in a greater likelihood that caregivers will participate in academic activities. On the basis of past research (Eastman, 1988; Seginer, 1983), I expect that those caregivers who achieved higher levels of education would have children who were more involved in school and who had higher occurrences of educational success.

Furthermore, the model proposes that caregiver school involvement at Time 1 will predict students' perception of the school environment, student motivation, and extracurricular
involvement in Time 2. The research to date is consistent in demonstrating that students whose caregivers are more involved in their children's schooling earn higher grades and have fewer self-control difficulties at school (Baker & Stevenson, 1986; Epstein, 1983; Reynolds, 1989; Stevenson & Baker, 1987). Caregiver school involvement is also conjectured to be associated with student's academic achievement. Based on previous research, there is a direct path from caregiver school involvement to academic achievement.

Next, the model proposes that household educational resources at Time 1 will predict 12th grade achievement at Time 3. The influence of family background on educational resources that caregivers can provide to their children is important. Household educational resources (such as books, computers, and newspapers) are particularly essential for shaping orientations to school and levels of achievement and attainment (Blake, 1981; Lareau, 1989; Mercy & Steelman, 1982; Teachman, 1987). Accordingly, I hypothesized a link between household educational resources and academic achievement.

The arrow between family income at Time 1 and 12th grade achievement indicates that this path is expected to be statistically significant and positive. A number of studies have suggested that a family's socioeconomic level (measured
by factors such as family income) influences caregiver involvement in their children's education and that greater caregiver involvement fosters more positive student attitudes toward school, improves homework habits, reduces absenteeism and dropping out, and enhances academic achievement (Astone and McLanahan, 1991; Epstein, 1987a, 1987b; Fehrmann, Keith, and Reimers, 1987; Lareau, 1987; Muller & Kerbow, 1993; Stevenson and Baker, 1987).

I hypothesize a link between family income and school computer use. Prior research suggests that many Americans have access to computers at school or work, and others purchase computers for home use (Becker, 1991; Milone & Salpeter, 1996). With this in mind, I have predicted a direct path from family income to school computer use. Moreover, family income is hypothesized to predict academic achievement indirectly through school computer use. Such a prediction is important because there is a growing body of research indicating that family income directly influences academic achievement (e.g., Brody et al., 1995; Conger et al., 1992; Patterson et al., 1990). However, these studies have typically failed to obtain information on other aspects of academic socialization, such as the amount of school computer use and school resources. I expect the direct effects of family income and academic
achievement to be non-significant when school computer use is in the model.

Moving to the right in Figure 1, one can see that, by ordering the study constructs over time, the dynamic process is expected to unfold. First, it is expected that the students' perceptions of the school environment predicts 12th grade achievement. It is also assumed that caregiver education and caregiver school involvement are indirectly related to academic achievement through students' perceptions of the school environment. Second, it is expected that school computer use predicts 12th grade achievement. Third, it is expected that student motivation predicts 12th grade achievement. It is also assumed that caregiver education and caregiver school involvement are indirectly related to academic achievement through student motivation. Lastly, it is expected that students' extracurricular involvement predicts 12th grade achievement. It is also assumed that caregiver education and caregiver school involvement are indirectly related to academic achievement through extracurricular involvement. Furthermore, the error terms are correlated between the Time 2 variables (i.e., students' perception of the environment, school computer use, student motivation, extracurricular involvement) because one cannot
determine causality or directionality due to the cross-sectional nature of the model in this specific time period. In other words, one cannot determine the mechanisms behind which variable affects the other. The error terms are the unexplained variance (or residual) in the dependent variable(s).
CHAPTER THREE. METHODS

This study involves a large national sample of African American students, and examines the influence of family, individual, and school variables on the academic achievement of African American students.

Data: NELS:88

The data used in this study were collected for the National Center for Education Statistics (NCES). The National Education Longitudinal Study of 1988 (NELS:88) is a nationally representative longitudinal study of eighth grade students in public and private schools. In the spring of 1988, the NCES instituted the first stage of the study. NELS:88 was part of an effort to obtain data relative to students' school experiences and activities, values and aspirations, and family and home characteristics (NCES, 1992). In the 1988 base year a stratified national probability sample of 24,599 eighth graders attending 1,052 high schools was selected for participation. Of these, 20,062 participated and provided usable data. The database also contains scores of students from cognitive tests in four subject areas (reading, math, science, and social studies). Moreover, data were collected
from students' parents, teachers, and school administrators. The cohort was originally surveyed in 1988. Follow-up surveys were administered in 1990, 1992, and 1994. More than 75% of the 1988 base year cohort remained active participants through the second follow-up conducted in 1992. The third follow-up was completed in 1994. In 1994, the cohort members were either dropouts, in postsecondary institutions, or part of the workforce.

NELS:88 major features include the planned integration of student, school dropout, school administrator, teacher and parent studies; the initial concentration on an eighth-grade student cohort with follow-up at two year intervals; the inclusion of supplementary components to support analyses of geographically or demographically distinct subgroups; and the design linkages to previous longitudinal studies and other current studies.

All sample members completed a student questionnaire. The sixty-minute, self-administered student questionnaire used in each wave collected information on a wide range of topics, including: student background, language use, home environment, perceptions of self, occupational or postsecondary educational plans, jobs and household chores, school experiences and activities, and work and social activities. In addition to
the student questionnaire, students completed a series of cognitive tests in each wave. The combined tests covered four subject areas (reading comprehension, mathematics, science, and history/citizenship/geography) and included 116 items to be completed in 85 minutes. In particular, the mathematics test items (40 questions, 30 minutes) included word problems, graphs, equations, quantitative comparisons, and geometric figures. Some questions could be answered by simple application of skills or knowledge, others required the student to demonstrate a more advanced level of comprehension and/or problem solving. Also, the science test (25 questions, 20 minutes) contained questions drawn from the fields of life science, earth science, and physical science/chemistry. Emphasis was placed on understanding of underlying concepts rather than retention of isolated facts.

The primary purpose of the school administrator questionnaire was to gather general descriptive information about the educational setting and environment associated with the individual students who were selected for participation in NELS:88. This school information describes the overall academic climate in terms of specific school practices and policies as well as enrollments and educational offerings. In each survey wave, the self-administered administrator
questionnaire was completed by the school principal, headmaster, or other knowledgeable school official designated by the school administrator of NELS:88 schools.

The NELS:88 teacher component was designed to provide teacher information that could be used to analyze the behaviors and outcomes of the student sample, including the effects of teaching on student outcomes. The teacher questionnaire was designed to illuminate questions of the quality, equality, and diversity of educational opportunity.

The self-administered parent questionnaire was designed to collect information from parents about factors that influence educational attainment and participation. The objective of the parent questionnaire was to provide data that could be used primarily in the analysis of student behaviors and outcomes, and only secondarily as a data set by itself. The questions focused on family background and socioeconomic characteristics, and on the character of the home educational support system. The parent respondent was self-selected (the parent who was most knowledgeable about the sample member's educational activities and related behaviors needed to complete the questionnaire).
Sample Design

NELS:88 employed a two-stage, stratified random probability sample design to obtain its sample. The sampling strata were comprised of schools by type of governance or control: public (77%), Catholic (9%) and other private (14%). Schools were stratified by the nine Census divisions, racial composition of the schools, 8th grade enrollment, and urbanicity (i.e., central city, county surrounding central city, and rural areas). Random samples were then drawn for African American and White students. [Note: Hispanics and Asians were oversampled to permit analyses within these populations (NCES, 1992).]

Base Year Sample Design. The NELS:88 base year survey employed a two-stage, stratified sample design, with schools as the first-stage unit and students within schools as the second-stage unit. Within each stratum, school were selected with probabilities proportional to their estimated eighth grade enrollment to achieve virtual self-weighting. In addition, schools were oversampled in certain special strata so that policy-relevant subgroups would be adequately represented in the sample.
First Follow-Up Sample Design. There were three basic objectives for the NELS:88 first follow-up sample design. First, the sample was to include approximately 21,500 students who were in the eighth grade in 1988 (including base year nonrespondents). This longitudinal cohort was to be distributed across 1,500 schools. Second, the sample was to constitute a valid probability sample of all students currently enrolled in the tenth grade in the spring term of the 1989-1990 school year. Third, the first follow-up was to include a sample of students who had been deemed ineligible for base year data collection (because physical, mental, or linguistic barriers prevented them from participating) so that those able to participate could be added to the first follow-up student sample, and demographic and school enrollment information could be obtained for them.

Second Follow-Up Sample Design. There were five basic objectives for the NELS:88 second follow-up design. First, the sample was to constitute a valid probability sample of all students enrolled in the twelfth grade in the 1991-1992 school year. Second, to continue the examination of the dropping out phenomenon, dropouts were to be retained with certainty. Third, it was highly desirable for policy analysis purposes to retain the maximum number of Hispanics, Asians, and American
Indians from the first follow-up sample. Fourth, to maximize nonresponse bias first follow-up nonrespondents were to be retained with certainty. Fifth, the sample was to be clustered in 1,500 schools from which contextual data—including school administrator, teacher, and transcript data—would be collected.

Sample Selection

In this study sample, I used the data available for African American students (N=1,464). Another criterion for inclusion in this study was the presence of two caregivers. Because I restricted the sample to two-caregiver families, I used only respondents who reside with two caregivers (N=647). Such an investigation is warranted when census data are critically evaluated. For example, half of the 10 million African American households in the United States in 1990 were headed by married couples (U.S. Bureau of the Census, 1992). However, most research on African American families has focused on single-mother-headed households, giving little attention to two caregiver families (Brody et al., 1995). Such a focus inadvertently contributes to stereotypic impressions about African American families without
acknowledging the diversity of African American families and youth.

In the present study, the first three waves of data from the NELS were used. During this time the students were in 8th, 10th, and 12th grades. This time frame was chosen because it provides a developmental perspective on academic achievement while the students were in school. It also allowed me to make causal and temporal assumptions because I am using longitudinal data that follow respondents across time.

The sample for the present study is comprised of the 647 African American students who resided with two caregivers, were eighth graders in 1988 and twelfth graders in 1992.

**Study Design**

The present study employs a non-experimental, multiequation design (Pedhazur and Schmelkin, 1991). This permits examining the impact of the independent variables on the final outcome variable (i.e., achievement). At the same time, the relationships between the independent variables can be estimated. Path analysis, a method for studying causal patterns among a set of variables, will be used to estimate the effects of several variables on students' academic achievement.
The present study relies on previous research and knowledge of factors commonly associated with the academic achievement of minority students for the selection and ordering of variables in the equations. Simultaneously looking at multiple variables, the path analytic technique will separate correlations among variables into direct and indirect effects. The theoretical model presented in Figure 1 will be estimated using AMOS (Analysis of Moment Structures) 4.0, a statistical program designed to perform structural equation modeling and path analysis procedures (Arbuckle & Wothke, 1999). AMOS calculates estimates for every path in the model (see Figure 2). Using maximum likelihood estimation, AMOS generates estimates of all parameters not constrained to specific values, as well as model fit indicators. Moreover, to evaluate the overall model fit, four measures will be used: Goodness of Fit Index (GFI), Adjusted Goodness of Fix Index (AGFI), Hoelter's (1983) "critical N", and Root Mean Square Error Approximation (RMSEA).

**Structural Equation Model**

A full structural equation model is comprised of two parts: (1) a structural model which specifies hypothesized, causal relations among latent, unobserved variables, and (2) a
Figure 2. The Fully Recursive Model.
measurement model which relates measured variables to their latent constructs. Because the present model uses only observed variables combined in composites, it does not include a measurement portion. Only the structural portion of the path model will be estimated.

The estimated path coefficients represent standardized regression coefficients and are interpreted as direct effects, controlling for other variables in the model. Each of the straight lines within the model indicates the hypothesized direct influence of one variable on another with the arrow indicating the direction of influence. The curved line indicates that two variables are related but no causal relationship is hypothesized between them. Direct effects represent the partial effect of independent variables regressed on one or more additional variables arranged in temporal or successive order (Pedhazur, 1982). Indirect effects represent paths through other mediating variables. The logic of path analysis is such that variables believed to cause other variables appear first in the model. Thus moving from left to right the endogenous variables, first seen as effects, subsequently become causes of variables ordered to the right of them. The causes of the exogenous variables are assumed to be outside the model and are not analyzed.
Finally, the model originally specified is modified to best explain the data. The Beta ($\beta$) weights (i.e., standardized partial regression coefficients) were used to estimate the paths between independent variables (i.e., causes) and each new dependent variable (i.e., effect). The criterion for "meaningfulness" (Pedhazur, 1982) for path coefficients was set at ".05" or greater. The direct, indirect, and total effects were computed for each variable. Duncan (1975) has suggested that path coefficients that do not meet the criteria of statistical significance and/or meaningfulness be deleted from the model. If the obtained sample size for the present study is relatively large, in keeping with the theory trimming approach (Heise, 1969), path coefficients that do not meet the criterion of meaningfulness were deleted from the models tested in this study. Paths were deleted from the analysis if nonsignificant or their probability was less than .05. It is when all nonsignificant paths have been deleted and estimates for the final path model have been obtained that the model was interpreted.

Plan of Analysis: The Path Model

In this study, path analysis was used to estimate the model. According to Pedhazur (1982, p. 580), path analysis was
developed by Sewall Wright (1921, 1934) for the purpose of "studying the direct and indirect effects of variables taken as causes on variables taken as effects." Pedhazur (1982, p. 580) goes on to describe the path analytic method as deeply rooted in theory, and states that decisions regarding tenability of a path model "rest not on data but rather on the theory that generated the model in the first place." In short, path analysis is a research method for presenting a causal model in which a series of independent variables is used to predict a series of dependent variables. At its simplest level, path analysis uses multiple regression analysis but in a structured and explicit manner (Keith, 1988a, 1988b).

Path analysis, which has its roots in economics and sociology, is prevalent in psychological and educational research. Emphasizing that the unsolved path model is a visual representation of the theory of cause and effect, Keith (1988a, 1988b) has stated that it is this explicit, visual statement of theory that is at the heart of path analysis and is the most important step in the path-analytic model. Keith has further maintained that if a researcher accepts the theory, and the data are adequate, then the researcher must accept the results of the path analysis (that is, the numbers
generated are the implications of the data and theory in combination.

Although path analysis encourages researchers to consider all important potential causes of the dependent measure within a theory-based context, like any nonexperimental research, the primary danger in path analysis is causality. According to Keith (1988a, 1988b), the main three logical requirements for inferring causality of this type are: (1) prior time precedence must be established (that is, the presumed cause must happen before the presumed effect); (2) there must be a relationship between the variables (a condition satisfied by a correlation between variables); and (3) such a relationship must be nonspurious.

**Assessment of Model Fit**

Version 4.0 of AMOS provides four indices of overall fit for the model: the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the root mean square error approximation (RMSEA), and Hoelter's (1983) "critical N." Both the GFI and the AGFI (which adjusts for the number of degrees of freedom in the model) represent the ratio of the sums of squares accounted for in the model to the total sums of squares of the estimated population matrix (Byrne, 1989).
Both are interpreted like regular correlation coefficients in
that the closer the index is to 1.0, the better the fit of the
model.

Based on their experience with RMSEA, Browne and Cudeck
(1993) suggest that a RMSEA of .05 or less indicates a "close
fit." According to Browne and Cudeck (1993, p. 154),
"Practical experience has made us feel that a value of the
RMSEA of about .05 or less would indicate a close fit of the
model in relation to the degrees of freedom. This figure is
based on a subjective judgment. It cannot be regarded as
infallible or correct, but it is more reasonable that the
requirement of exact fit with the RMSEA = 0.0. We are also of
the opinion that a value of about 0.08 or less for the RMSEA
would indicate a reasonable error of approximation and would
not want to employ a model with a RMSEA greater than 0.1."

Hoelter's (1983) "critical N" is the largest sample size
for which one would accept the hypothesis that a model is
correct. Hoelter does not specify a significance level to be
used in determining the critical N, although .05 is frequently
used in examples. AMOS reports a critical N for significance
levels of .05 and .01.
Direct, Indirect, and Total Effects

Direct, indirect, and total effects of presumed causes of academic achievement were computed in the data analysis. Direct effects represent the partial effect of independent variables regressed on one or more additional variables arranged in temporal or successive order (Pedhazur, 1982). In other words, direct effects are those that are not mediated or that remain after the effects of mediating variables have been removed (Vogt, 1999). The indirect effect, on the other hand, is the part of the effect that is mediated by another variable or other variables. The indirect effect is computed by multiplying and summing paths. For example, in a model (see Figure 3) where the path from A to B = .35; B to Y = .45, A to C = .56, and C to Y = .44, Y being the outcome variable, the indirect effect of A on Y would be computed as follows:

\[(AB \times BY) + (AC \times CY)\]

\[= (.35 \times .45) + (.56 \times .44)\]

\[= .16 + .25 = .41\]

Finally, the total effect is the sum of the direct and indirect effects. If, in the above analogy, the direct effect
of A on Y was .14, the total effect would be direct effect (.14) + indirect effect (.41) = total effect (.55).

**Measures**

In the following section, the variables that assess the model constructs are outlined. For several of these variables, the Cronbach's alpha is presented. According to Vogt (1999), the Cronbach's alpha is a measure of internal reliability or consistency of the items in an index. Cronbach's alpha ranges from 0 to 1.0. Scores toward the high end of that range (e.g., above .70) suggest that the items in an index are measuring the same thing.
Caregiver Education: Caregiver education measured the educational attainment of the child's caregivers. This construct was assessed using two variables on which the primary caregiver reported. The scale for these variables ranged from "eighth grade or less" to "Ph.D., M.D., or other advanced degree."

Caregiver School Involvement: Caregiver school involvement indicated how often the caregivers were involved in their child's schooling. This construct was assessed using ten variables on which the primary caregiver reported. A couple of examples of the items include: "How often do you or your spouse/partner help your child with his or her homework; How often do you or your spouse/partner talk with your child about his or her experiences in school." The Cronbach alpha was .8977.

Family Income: Family income measured the family's income level. This construct was assessed using a single variable, each family's 1987 total income from all sources. The items on this scale ranged from "$9,999 or less" to "$100,000 or more."
School Computer Use: School computer use indicated how often students used computers for academic purposes. This construct was assessed using eight variables. A few examples of these items include: "How often do/did you use computers to write up experiments or reports; How often do/did you use computers to do calculations; How often do/did you use computers for models and simulations." The Cronbach alpha was .8653.

Student Motivation: Student motivation assessed the student's motivation toward pursuing education. This construct was assessed using nineteen variables. The questions included the following: "How important are good grades to you; Education is important for getting a job later on (strongly disagree/strongly agree); I get a feeling of satisfaction from doing what I’m supposed to do in class (strongly disagree/strongly agree)." The Cronbach alpha was .7739.

Household Educational Resources: Consistent with Teachman's (1987) and Roscigno and Ainsworth-Darnell's (1999) research, an indicator of household educational resources was included. This measure reflected the number of items in a
student's household that are conducive to learning. These items include a computer, books, encyclopedias, etc. This construct was assessed using five variables. The Cronbach alpha was .9229.

Students' Perception of the School Environment: Students' perception of the school environment assessed the quality of school life for students. This construct was assessed using eight variables. Students answered questions that asked them about their perceptions of the overall academic atmosphere (e.g., "There is real school spirit; The teaching is good; Students get along well with teachers"). The Cronbach alpha was .6875.

Extracurricular Involvement: Extracurricular involvement assessed the respondent's involvement in extracurricular and intramural activities. This construct was assessed using thirteen variables. The students responded to questions that asked them to indicate their involvement in activities that ranged from sports (e.g., football, basketball, etc.) to academic clubs (e.g., debate, honor society). The Cronbach alpha was .9385.
Academic Achievement: Academic achievement measured student's cognitive abilities. This construct was assessed using two variables. Assessment of academic achievement included science and mathematics IRT theta scores from cognitive tests that were administered in the 8th and 12th grades. Science and mathematics scores were chosen because, generally, these courses are used to represent student achievement (Seyfried, 1998). The science and mathematics scores were combined in order to form a global assessment of academic achievement. Higher scores will indicate higher academic achievement. The Cronbach alphas were .9174 and .9708 in the 8th and 12th grades, respectively.
CHAPTER FOUR. RESULTS

Overview of the Results

Mean scores, standard deviations, and ranges for all study variables are displayed in Table 1. Of particular interest is the change in the mean levels of academic achievement across time. Eighth grade achievement (Time 1) has a mean score of 83.91 and twelfth grade achievement (Time 3) has a mean score of 97.04. This shows that there was a significant increase in academic achievement from Time 1 to Time 3 (t = 27.38; p < .01). Also of interest are the mean scores for caregiver school involvement, student motivation, and school computer use. For school involvement, caregivers reported a mean level of 19.51 (sd = 5.32). Students reported below average levels of motivation (m = 58.13; sd = 28.56). Finally, students reported below average levels of computer use in school (m = 15.64; sd = 9.09).

Table 2 presents the correlation matrix for all of the study variables. The relatively large correlation between eighth grade achievement and twelfth grade achievement (r = .68) reflects the strong stability between these variables at Times 1 and 3. Several variables show relatively strong associations with the twelfth grade achievement variable. The
Table 1. Means, Standard Deviations, and Ranges for the Study Variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
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</thead>
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<td>54-125</td>
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<tr>
<td>12th Grade Achievement</td>
<td>97.04</td>
<td>15.42</td>
<td>58-152</td>
</tr>
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<td>2.91</td>
<td>1.14</td>
<td>1-6</td>
</tr>
<tr>
<td>Household Ed. Resources</td>
<td>3.60</td>
<td>1.19</td>
<td>0-5</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>58.13</td>
<td>28.56</td>
<td>19-116</td>
</tr>
<tr>
<td>Caregiver Education b</td>
<td>7.04</td>
<td>5.40</td>
<td>1-13</td>
</tr>
<tr>
<td>Caregiver School Involvement</td>
<td>19.51</td>
<td>5.32</td>
<td>10-30</td>
</tr>
<tr>
<td>School Computer Use</td>
<td>15.64</td>
<td>9.09</td>
<td>5-35</td>
</tr>
<tr>
<td>Extracurricular Involvement</td>
<td>64.10</td>
<td>22.76</td>
<td>13-86</td>
</tr>
<tr>
<td>Student Perception of the School</td>
<td>20.09</td>
<td>3.71</td>
<td>15-32</td>
</tr>
</tbody>
</table>

a 1=$9,999 or less; 2=$10,000-$19,999; 3=$20,000-$34,999; 4=$35,000-$74,999; 5=$75,000-$99,999; 6=$100,000 or more

b 1=eighth grade or less; 2=not a high school graduate; 3=GED; 4=high school graduate; 5=vocational/trade/business school for less than 1 year; 6=vocational/trade/business school for 1-2 years; 7=vocational/trade/business school for 2 years or more; 8=less than 2 years of college; 9=2 or more years of college; 10=finished a 2 year program; 11=finished a 4-5 year program; 12=master’s degree; 13=Ph.D., M.D., or other professional degree
Table 2. Correlation Matrix for All Variables in Model.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
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<tr>
<td>1 8th Grade Achievement Time 1</td>
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<td></td>
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</tr>
<tr>
<td>2 12th Grade Achievement Time 3</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
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<td>.14**</td>
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<td></td>
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</tr>
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<td>4 Household Ed. Resources Time 1</td>
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<td>.16**</td>
<td>.30**</td>
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<td>5 Student Motivation Time 2</td>
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<td>.35**</td>
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<td>.02</td>
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</tr>
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<td>7 Caregiver School Involvement Time 1</td>
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<td>-.05</td>
<td>.17**</td>
<td>.13**</td>
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<tr>
<td>8 Sch. Computer Use Time 2</td>
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<td>.23**</td>
<td>-.06</td>
<td>-.02</td>
<td>.50**</td>
<td>.10**</td>
<td>.18**</td>
<td>--</td>
<td></td>
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</tr>
<tr>
<td>9 Extracurricular Involvement Time 2</td>
<td>.20**</td>
<td>.40**</td>
<td>-.02</td>
<td>.01</td>
<td>.40**</td>
<td>.06</td>
<td>.15**</td>
<td>.29**</td>
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<td></td>
</tr>
<tr>
<td>10 Sch. Environment Perception Time 2</td>
<td>.24*</td>
<td>.33**</td>
<td>.11**</td>
<td>.09*</td>
<td>.17**</td>
<td>.26**</td>
<td>.21**</td>
<td>.11**</td>
<td>.13**</td>
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*p < .05, **p < .01; N = 647
correlation between student motivation and twelfth grade achievement is .35. Caregiver education correlated at .29 with twelfth grade achievement. Extracurricular involvement correlated at .40 with twelfth grade achievement. And, students' perception of the school environment correlated at .33 with twelfth grade achievement. Most of the variables are statistically significant at the .05 and .01 levels in the expected direction. This suggests the variables chosen for this study are empirically as well as theoretically valid.

Path Analysis Results

According to the ecological perspective on which this study is theoretically grounded, it is hypothesized that academic achievement among children and adolescents is influenced by a number of factors, such as teaching practices, school environment, and family context. This suggests that multiple environments or contexts should be considered when addressing factors that predict academic success. To establish a model representative of the ecological approach, I estimated a model that simultaneously examined the effects of family, school, and individual characteristics on academic achievement.
The main findings from the analysis are summarized in Tables 3 and 4. To facilitate interpretation, the parameter estimates for the causal relationships in the path model are plotted in Figure 4. Among the family influence variables only household educational resources ($\beta = .06; t = 2.37$) had a significant direct relationship to 12th grade academic achievement. Although this relationship was hypothesized, it is surprising that caregiver education, family income and caregiver school involvement failed to exhibit any direct and significant effects on academic achievement. The results indicate that household educational resources tend to lead to increases in academic achievement, controlling for other family variables.

However, two of the family influence variables are particularly noteworthy. First, caregiver school involvement is indirectly related to 12th grade achievement with an indirect effect of .06. Second, caregiver education also has an indirect effect on academic achievement ($\beta = .03$). These findings suggest that caregiver school involvement and caregiver education work indirectly through school and individual level influences. Overall, the family influence variables appear to exert indirect effects over direct effects. This finding is important because it suggests
Table 3. Summary of Significant Path Relationships.

<table>
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<th>Path</th>
<th>β Weight</th>
<th>T-value*</th>
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<td>Caregiver Education -&gt; School Environment Perception</td>
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<tr>
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<td>2.37</td>
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<td>Caregiver School Involvement -&gt; Student Motivation</td>
<td>.13</td>
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<tr>
<td>Caregiver School Involvement -&gt; Extracurricular Involvement</td>
<td>.11</td>
<td>2.90</td>
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<tr>
<td>Caregiver School Involvement -&gt; School Environment Perception</td>
<td>.15</td>
<td>4.06</td>
</tr>
<tr>
<td>8th Grade Achievement -&gt; School Computer Use</td>
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<td>3.86</td>
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<td>2.95</td>
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<td>7.89</td>
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*T-values greater than 2 are significant.
Table 4. Summary of Model Effects.

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<td>.06</td>
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<td>.15</td>
<td>.00</td>
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Table 4. (Continued).

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<td>Involvement</td>
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<td>12&lt;sup&gt;th&lt;/sup&gt; Grade Achievement</td>
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<tr>
<td>School Environment</td>
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<tr>
<td>Perception</td>
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<td>Extracurricular</td>
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<tr>
<td>Involvement</td>
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<tr>
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<td>12&lt;sup&gt;th&lt;/sup&gt; Grade Achievement</td>
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<td>School Computer Use</td>
<td>.00</td>
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</table>
Figure 4. The Reduced Model.
that caregivers can increase their child's academic success by being involved in the type of programs that are being enacted in schools. In addition, caregivers are important for encouraging their child to become involved in extracurricular activities.

Next, I move to the Time 2 variables that include school and individual characteristics. Among the individual influence variables, student motivation ($\beta=.10; t=3.59$) and extracurricular involvement ($\beta=.22; t=7.89$) were significantly and directly related to academic success. Also, there was a significant and direct relationship between students' perceptions of the school environment ($\beta=.15; t=5.48$) and 12th grade academic achievement. One of the most surprising findings in the model was that school computer use was not significant, as hypothesized. Indeed, it has been argued that computer use in school affects academic achievement. The final variable significantly related to 12th grade achievement is 8th grade achievement ($\beta=.57; t=20.61$). A summary of the significant paths is displayed in Table 3.
Expanded Discussion of the Results

Family Influences on Achievement

Caregiver School Involvement: A big surprise from this analysis was the finding that caregiver school involvement did not have a direct effect on student achievement. This finding should not be interpreted to mean that caregivers have no influence on the academic achievement of their children, but it suggests that when other variables such as family income, prior (8th grade) achievement, and school influences are controlled for, caregiver school involvement does not affect academic achievement. It is also important to note that the study provides a snapshot of effects operating between the eighth and twelfth grades. It does not take into account prior levels of caregiver involvement, for example. At best, therefore, it can only be said that between the eighth and twelfth grades, a time when students typically begin establishing their independence from family, that family variables had little or no effect on students’ achievement.

Another possibility is that these caregivers may not have within their means the avenues to help bolster their children’s achievement. It is unlikely that students from families having incomes from $20,000 - $35,000 would be enrolled, for example, in a course to help prepare them to
take a standardized test such as the SAT. Therefore, the absence of a substantive path coefficient from caregiver school involvement may also reflect a different opportunity structure for minority students compared to non-minority students (Johnson, 1992; Kozol, 1991; Ogbu, 1982).

Family Income: The path from family income to 12th grade achievement dropped out of the final (reduced) model. This means that the path was not significant. This is a surprise finding. Studies often show a significant relationship between family income (or SES) and achievement (for example, Epstein, 1987a, 1987b; Lareau, 1987; Muller, 1993). In particular, it has been found that students having higher levels of socioeconomic status often enjoy greater access to learning resources that aid in their higher achievement. On the other hand, other researchers have found an insignificant relationship between SES and achievement. For example, Fehrmann, Keith, and Reimers (1987) reported, looking at an ethnically mixed sample of high school seniors, a path coefficient from family background/SES of .008. Their study suggested that family background had little if any direct effect on achievement as measured by grades. Donovan (1984), estimated a path model for low-income African American youth, found the direct effect from parents' education and family
income to be .037 and .033 respectively. Her study also suggested that SES had little if any direct effect on achievement. For Donovan's study, grades were the outcome measure as well. In a study where Keith and Benson (1992) examined effects on high school grades across five ethnic groups, the path from family background to achievement was constrained to zero because it was found to be nonsignificant. The results obtained in the present study are consonant with these studies. SES did not lead to significant increases in achievement.

Caregiver Education: Caregiver education had a significant indirect influence on student 12th grade achievement. Students' perception of the school environment mediated the effect between the two variables ($\beta = .03$). Also, caregiver education was correlated with 12th grade achievement at $r = .32$. Other studies have also shown significant relationships between caregiver education and achievement. In a national study of 1,247 students in the top 1% to 2% ability level, Benbow et al. (1991) found fathers' education ($r = .18$) and mothers' education ($r = .13$) correlated highly with achievement. In a separate study, McCartin and Meyer (1988), studying economic effects on a sample of 4,587 Washington state public school students, found that parental education
correlated with academic success for mothers at .17 and fathers at .19. Finally, Hossler and Stage (1992), while exploring data from a statewide sample of 2,497 9th grade students, found that parental education had a positive significant impact on GPA with a path coefficient of .35. The present findings should be interpreted to mean that caregivers' educational background influences the type of school that the child attends and the type of school environment that the child will be situated in.

Household Educational Resources: The variable household educational resources was found to have a significant direct effect on 12th grade achievement ($\beta=.06; t=2.37$). This suggests that students whose homes had more educational resources (e.g., books, encyclopedias, computer) tended to achieve a greater level of academic success. Several analyses (DiMaggio, 1982; DiMaggio & Ostrower, 1990; Kalmijn & Kraaykamp, 1996; Teachman, 1987) have indicated that educational resources vary significantly as a function of family background and have strong and positive effects on both GPAs and standardized achievement. Downey (1995) also offered empirical evidence of the influential nature of household educational resources in his analyses of students' achievement. Contradictory to these studies, Roscigno and
Ainsworth-Darnell (1999) suggest that African American and low-SES students receive less return for household educational resources. In their study, household educational resources were found to be more beneficial to high-SES students, but only for standardized achievement. For along with cultural advantages, high-SES parents can also give their children human and material resources that enhance academic skills and orientations (Blake, 1981; Leibowitz, 1977; Mercy & Steelman, 1982). The present findings are in line with the former studies that suggest household educational resources lead to increases in academic achievement.

**Individual Influences on Achievement**

The Effect of Prior Achievement on Achievement: The path from 8th grade achievement to 12th grade achievement ($\beta = .57; t = 20.61$) is very large. This overwhelmingly suggests that students who did well in the past will be the students who do well in the future. That the path indicates a very strong effect of prior achievement on current achievement comes as no surprise as it stands to reason that nothing better predicts achievement than previous achievement. However, by comparison, this coefficient is extremely large. Studies finding a significant path from a prior measure of achievement
to a later measure of achievement typically range from .3 to .6 (Cool & Keith, 1991; Keith & Benson, 1992; Keith & Cool, 1988, 1992; Keith, Keith, Bickley, & Singh, 1992; Singh et. al., 1995). The magnitude of the coefficient in the present study falls on the high end of this range.

Student Motivation: Student motivation has a direct effect on 12th grade achievement of .10. Also, student motivation is a mediator between caregiver school involvement and 12th grade achievement ($\beta=.13$). This effect of caregiver school involvement on student motivation suggests that higher levels of caregiver school involvement with their children is related to higher level of motivation among them. Other researchers have investigated this relationship between student motivation and achievement and have found significant effects. Reynolds (1991), investigating the relationship between student motivation and academic achievement, concluded from his study of 3,116 eighth graders that academic motivation exerted small direct and indirect effects when geographic, home, peer, and school variables were included in the model. In their study of a High School and Beyond cohort, Keith and Cool (1992) found motivation to exert direct effects on achievement as well as indirect effects through homework and coursework when measures of ethnicity, gender, family
background, ability, coursework, and homework were included in the model. The findings observed here support the direct effects of motivation on achievement.

Extracurricular Involvement: Student extracurricular involvement had a significant direct effect on 12th grade achievement ($\beta = 0.22; t=7.89$). This means that students who were involved in a number of extracurricular activities tended to enjoy higher levels of academic success. Previous research found that students who participated in extracurricular activities tend to have higher levels of achievement (Camp, 1990; Eidsmore, 1964; Haensly, Lupkowski, & Edlind, 1986; Sweet, 1986). The most elaborate theories contend that a higher level of student involvement leads to the decreased likelihood of student school failure or withdrawal (Spady, 1970, 1971; Tinto, 1975, 1987). Finn (1989) argued that students engage in school activities at different rates and thus identify with the value of school and the school culture differently. For example, involved students succeed because of a change in attitude resulting from increased involvement, a rational decision attributed to a greater number of social ties to their peers, or an overall greater sense of attachment to or investment in school. This pattern of results was observed in the present study.
School Influences on Achievement

Students' Perception of the School Environment: A significant path was found to exist between students' perception of the school environment and their achievement ($\beta=.15; t=5.48$). The school effect was measured by items that solicited students' perceptions regarding rapport with teachers, instructional quality, positive feedback for effort, and teachers showing respect for students. A significant school effect means that when students perceive teachers as caring about them, giving them praise for their effort, and the quality of instruction is good, they are likely to be higher achievers (Clark, 1991; Cool & Keith, 1991; Keith & Benson, 1992; Keith & Cool, 1992).

The significant school effect is extremely important, particularly in light of the fact that it suggests that the school environment has a unique impact on students above and beyond the impact of students' prior levels of achievement, parental school involvement, and family income. By interpretation this means that regardless of whether the student is rich or poor, male or female, academically gifted or challenged, school environments can make a difference in
students' later academic achievement. This finding is supported here.

School Computer Use: As mentioned previously, it has been argued that computer use in school affects academic achievement (Niemiec & Walberg, 1985; Sivin-Kachala, 1998). However, the results of the present study show that the path from school computer use to 12th grade achievement dropped out, indicating no significant effect. The result should not be interpreted to mean that African American students are not using computers in their coursework. However, this result could be interpreted to mean that the method by which students are using computers in coursework is seen as insignificant and ineffective. Several authors have written about the ineffective uses of computers by minority students. According the Resta (1992), poor and minority students are more likely to spend computer time on drill and practice learning, and less likely to be asked or expected to make judgments, draw inferences or engage in critical thinking or problem solving with computers. Wenglinsky (1998), after factoring out the influence of several other variables that affect achievement (e.g., SES, class size, teacher qualifications), found strong links between certain kinds of technology use, scores on the National Assessment of Educational Progress, and an improved
school climate. In particular, he found that low-income and African American students are the least likely to have teachers who use technology to its full advantage. Also found was that African American students have closed the digital divide where it matters least—the amount of time on a computer. The gap persists, however, where it matters most—how the computer is used.

Gender Differences

According to Oakes (1990), gender differences in the domains of opportunity, achievement, and choice emerge during the secondary school years, but little is known about the exact and developmental nature of this relationship. This lack of knowledge is due mainly to limitations in research that has not been longitudinal in scope, generalizable in extent, and ethnic-race specific (Clewell & Anderson, 1991; Oakes, 1990). Using the national longitudinal data available for African American students in a two-caregiver family, separate models were run in order to estimate how well the model fit the data for both boys and girls. In the current sample of African American students, there were 306 males and 338 females. Figures 5 and 6 present the reduced models for boys and girls, respectively. An examination of the models
Figure 5. The Reduced Model - Boys.
Figure 6. The Reduced Model - Girls.
for boys and girls shows that the models' fits are quite similar. There are, however, several paths that seem to be quite dissimilar. These seemingly dissimilar paths are presented in Table 5.

The first dissimilar path is from caregiver school involvement to extracurricular involvement. The β weight of this path for boys equals -.01. For girls, the β weight is .25. A test of the difference in chi-square was performed. The chi-square difference for this path was 13.01. This number is significant. This means that there is a difference in this path for boys and girls. Several researchers have sought answers to gender-based differences in academic achievement and involvement (Best & Kahn, 1986; Clewell & Anderson, 1991; DiMaggio, 1982; Epstein & Conners, 1994; Grant, 1984; Oakes, 1990). Certain types of involvement are unwelcomed by preadolescent or adolescent students. Best and Kahn (1986) found that older students did not always appreciate, or even benefit from, parental involvement in school activities. Many students felt that having their parent(s) at school inhibited their own personal and social development (Epstein & Conners, 1994). There are many types of parental involvement; finding out what type of involvement
Table 5. Comparison of Paths for Boys & Girls.

<table>
<thead>
<tr>
<th>Path</th>
<th>Boys</th>
<th>Girls</th>
<th>Chi-square difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta )</td>
<td>T-value</td>
<td>( \beta )</td>
</tr>
<tr>
<td>Caregiver School</td>
<td>-.01</td>
<td>-.19</td>
<td>.25</td>
</tr>
<tr>
<td>Involvement -&gt; Extracurricular Involvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caregiver School</td>
<td>.22</td>
<td>3.89</td>
<td>.08</td>
</tr>
<tr>
<td>Involvement -&gt; School Environment Perception</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household</td>
<td>.11</td>
<td>2.58</td>
<td>.02</td>
</tr>
<tr>
<td>Educational Resources -&gt; 12\textsuperscript{th} Grade Achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**significant at .01 level.
Change in df = 1.
Chi-square differences of 3.84 or greater are significant.
benefits older male and female students' learning is important.

The second dissimilar path is from caregiver school involvement to supportive school environment. The $\beta$ weight of this path for boys equals .22. For girls, the $\beta$ weight is .08. The test of the difference in chi-square reveals a difference of 2.67. This number is not significant. This means that there is no difference in this path for boys and girls.

The third, and final, dissimilar path is from household educational resources to 12th grade achievement. The $\beta$ weight of this path for boys equals .11. For girls, the $\beta$ weight is .02. The test of the difference in chi-square shows a difference of 2.18. This number is not significant. This means that there is no difference in this path for boys and girls.

Overall, it has been shown that the model proposed fits the data for the boys and the girls in a somewhat similar fashion. The only exception to this being the significant difference in the path from caregiver school involvement to extracurricular involvement. This indicates that I was correct to combine the boys and girls into one sample.
CHAPTER FIVE. DISCUSSION

The purpose of this study was to test an ecological model of family, individual, and school effects on the academic achievement of African American students. The findings for this study include the following. Eighth grade achievement was found to influence 12th grade achievement overwhelmingly. Family income produced no effect on achievement. Caregiver school involvement and caregiver education had indirect effects on 12th grade achievement. Household educational resources had a significant, direct effect on achievement. Students' perceptions of the school environment exerted a statistically significant effect on 12th grade achievement. School computer use produced no effect on achievement. And, student motivation and extracurricular involvement had direct effects on 12th grade achievement.

The major factor that determined the academic achievement of African American students was found to be their previous achievement. The large effect of 8th grade achievement on 12th grade achievement is not a surprising finding and has been reported in similar studies. There may be some plausible reasons for such a large effect. It seems that patterns of
achievement are formed during earlier schooling and these same patterns continue during high school years.

Caregiver variables were also found to affect the academic achievement of African American students. From a policy perspective, caregivers influence their children’s academic achievement directly by the kind of educational environment they provide in the home, and indirectly by their impact on the schools their children attend. Low-SES and African American families often lack the human and material resources needed for a positive academic environment in the house. However, as research has shown, positive learning environments do exist in some low-SES African American homes. It is generally accepted that caregiver involvement in their children’s educational experiences enhances students’ achievement.

Another predictive factor of academic achievement was the school environment. Students’ perceptions of the school environment were found to significantly impact the academic achievement of students. A significant school effect means that when students perceive teachers as caring about them and giving them praise for their effort, and when they feel that the quality of instruction is good, they are more likely to be higher achievers. This finding is important, particularly in
light of the fact that it suggests that the school environment has a unique impact on students. It indicates that regardless of whether the student is rich or poor, male or female, academically gifted or challenged, the school environment can make a difference in students' later achievement.

A distinctive feature of this study was the inclusion of school computer use to determine academic achievement. As mentioned in the previous chapter, school computer use was not significant in producing high achievers. This finding of no effect was especially surprising in light of the findings of researchers such as Burns and Bozeman (1981), Niemiec and Walberg (1985, 1987), and Kulik (1994). In meta-analyses of computer-based and computer-assisted instruction studies, these researchers found significant relationships between computer use and achievement. However, a finding by Wenglinsky (1998) might better address the current finding of no effect. In his research, Wenglinsky (1998) found that African American students are the least likely to have teachers who use technology to its full advantage. Furthermore, his findings suggest that African American students are "behind" in terms of the amount of time and methods by which they use school computers. It may, therefore,
be this "lack" of use that produces no significant effect between school computer use and 12th grade achievement.

It is crucial to identify variables influencing the academic achievement of African American students and the present study is an attempt in that direction. Examining these sources of variation, educators and policy makers will be in a better position to intervene and reverse negative educational trends among African American students and, ultimately, modify service delivery for the improved learning and development of all students.

In the following sections, recommendations, limitations of the data, and future directions for research are presented. Afterwards, the final thoughts are given.

**Recommendations**

The present study was conducted using a nationally representative sample of African American eighth grade students. The variables in the study fell into three categories (parental, individual, school) that may be influenced by different individuals and organizations that directly impact the academic lives of African American students. Thus, the recommendations from this study are directed to individuals and organizations that are responsible
for educating African American students. Based on the findings of this study, the following recommendations are made.

1. Although motivation is an individual level variable, it may be modified through external forces. It is, therefore, recommended that programmatic steps be examined to increase the level of motivation among African American students. Possible approaches teacher education institutions and school districts may want to investigate include: teacher training curricula with emphasis on practical motivational strategies. School districts and schools may study programs that are likely to enhance African American students' achievement and implement the most successful ones.

2. Based on the finding that supportive school environment had a direct effect on the academic achievement of African American students, it appears that these students have a greater need for classroom environments where teachers are accepting, understanding, supportive, and fair. It is recommended that teacher education curriculum include multicultural perspectives with sensitivity training; and that states require teachers to demonstrate knowledge of multicultural approaches and sensitivity skills for
licensure to insure appropriate interaction between teachers and all students. Further, school districts should consider providing inservice in multicultural sensitivity training, study its effects, and hold teachers responsible for their behavior toward students in their classrooms.

3. The involvement of caregivers in their children’s education appears to be an indirect predictor of academic success. It is recommended that school administrators do more to involve family members in their students’ education.

4. Being that school computer use had no effect on the academic achievement of African American students, it is important to reconceptualize the methods by which technology is used in classrooms and schools with predominantly minority audiences. Suggested approaches include collaborations between instructors and institutions to share “best practices” (i.e., effective teaching strategies). Moreover, frequent participation in computer training opportunities would help to heighten the computer competency of instructors.
Limitations of the Data

A serious drawback in the present study involved the absence of data in NELS:88 with regard to how computers were being put to use in mathematics classrooms. Simply knowing that a computer was used by a student in a mathematics class is useful information, but gives no indication as to the way in which the computer was used. Some of the many methods of computer use in a classroom environment might include: (a) remedial work, (b) enrichment, (c) seat work, (d) exploration, (e) drill and practice, or (f) discovery; with varying possible effects on achievement outcomes.

Another question that was not addressed by the NELS:88 survey data is the following: For what length of time was the computer used during the particular class session in which there was use? Data were only available as to the frequency of class periods in which computers were used, not the duration of use. Thus, a student who used a computer for a brief time during one class period per week received the same magnitude of frequency as another student who used a computer for almost one entire class session per week.

In addition, there was the drawback of not knowing the type of equipment that was employed by the students in mathematics and science classrooms. The term, computer,
probably encompassed a wide variety of different machines, some state-of-the-art for that time, while others quite dated and less useful. Software and hardware configurations were most likely not totally compatible, and may have limited the student's access to certain innovative learning materials.

Finally, the NELS data do not include detailed information on school and classroom policies and practices that may encourage parents to participate in school-related activities or dissuade them from doing so. This is a limitation of a study if it is not known if school policies on parental involvement varied; if so, the variation could be accounted for with direct measures describing school policy and practice.

Future Directions for Research

This study, like all research, raises as many questions as it answers and suggests directions for further research. Some critical areas for research and practice suggested by the study include the following. Additional empirical research is needed to investigate whether patterns of school achievement are determined at an earlier age for African American children. This research would examine the earlier influences on school learning. Secondly, since in the present study
school achievement was not directly affected by caregiver involvement, it supports the view that effects of caregiver involvement may be age specific. Earlier research has reported that the effect of caregiver involvement is stronger in younger years than in adolescent years. In that case, more empirical research on caregiver involvement and its effect on school achievement should be focused on younger African American children. Another point that should be emphasized is that factors that affect achievement, such as student motivation and caregiver school involvement, are multidimensional. When considering the complex ways in which family, individual, and school factors influence school achievement and attainment, it becomes necessary to review carefully both the ways in which achievement is measured and the total context in which attainment is reached. Issues of validity and reliability in measurement of such complex constructs are always paramount. Models with strong scientific bases, but constructed with a recognition of the reality of the African American experience, have evolved and continue to develop. Their continued development should clearly involve the skills of psychologists, sociologists, economists, and political scientists, but it should also employ the expertise of those skilled in educational and psychological measurement.
Thus, while the measures proposed in the present study had high reliabilities and face validity, new studies may conceptualize these constructs using more comprehensive, multiple measures.

Final Thoughts

In the end, American public schools must better serve all racial and ethnic student groups that are its clients. At all levels, philosophical decisions are being made about the education of minority students. These policies are transformed into reality at the state and district levels. The findings from this study may be a source of information for national decision makers and professionals as they make strategic judgments to allot fiscal resources and plan programs to improve the quality of education for minority students in the nation, states, and school districts. At the school and classroom levels where tactical decisions are made to implement strategic plans, administrators and teachers need a thorough understanding of the myriad of elements that contribute to the academic achievement of minority students. It is hoped that the findings of this present study will provide useful information and better understanding for parents, practitioners, and school-related personnel.
Moreover, it is my hope that research of this type will help provide greater balance in the portrayal of African American families by those who help to shape the images of American families.
APPENDIX A.

STUDY ITEMS
## PARENTAL SCHOOL INVOLVEMENT

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since your eighth grader's school opened last Fall, how many times have you or your spouse/partner contacted the school about each of the following? • Your eighth grader’s academic performance • Your eighth grader’s academic program for this year</td>
<td>• None • Once or twice • Three or four times • More than four times</td>
</tr>
<tr>
<td>Do you and your spouse/partner do any of the following at your eighth grader’s school? • Belong to a parent-teacher organization • Attend meetings of a parent-teacher organization • Take part in the activities of a parent-teacher organization • Act as a volunteer at the school</td>
<td>• Yes • No</td>
</tr>
<tr>
<td>Are there family rules that are enforced for your eighth grader about any of the following activities? • Maintaining a certain grade average • Doing homework</td>
<td>• Yes • No</td>
</tr>
<tr>
<td>Parents differ in how much they talk to their children about what they do in school. How often do you or your spouse/partner talk with your eighth grader about his or her experiences in school?</td>
<td>• Not at all • Rarely • Occasionally • Regularly</td>
</tr>
<tr>
<td>How often do you or your spouse/partner help your eighth grader with his or her homework?</td>
<td>• Seldom or never • Once or twice a month • Once or twice a week • Almost every day</td>
</tr>
</tbody>
</table>

## STUDENT MOTIVATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some students are recognized by their school or community. In the first half of the school year, did you win any of the following awards or were you recognized for doing well or participating in certain activities? • Elected officer of a school class • Won an academic honor • Participated in a science or math fair</td>
<td>(Mark all that apply)</td>
</tr>
</tbody>
</table>
- Received special recognition for good attendance
- Received special recognition for good grades or honor roll
- Received special recognition for writing an essay or poem
- Named most valuable player on a sports team

What is the main reason you are taking the following subjects?
- Math
- Science

<table>
<thead>
<tr>
<th>Scale</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>I'm not taking it this term</td>
<td></td>
</tr>
<tr>
<td>It was required</td>
<td></td>
</tr>
<tr>
<td>I wanted to take it</td>
<td></td>
</tr>
<tr>
<td>My parents requested it</td>
<td></td>
</tr>
<tr>
<td>My teachers recommended it</td>
<td></td>
</tr>
<tr>
<td>My friends suggested it</td>
<td></td>
</tr>
<tr>
<td>My school assigned me to it</td>
<td></td>
</tr>
</tbody>
</table>

In each of the current classes, how often do you try as hard as you can?
- Math
- Science

<table>
<thead>
<tr>
<th>Scale</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not taking this subject</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td></td>
</tr>
<tr>
<td>About once a week</td>
<td></td>
</tr>
<tr>
<td>A few times a week</td>
<td></td>
</tr>
<tr>
<td>Almost every day</td>
<td></td>
</tr>
</tbody>
</table>

How important are good grades to you?

<table>
<thead>
<tr>
<th>Scale</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not important</td>
<td></td>
</tr>
<tr>
<td>Somewhat important</td>
<td></td>
</tr>
<tr>
<td>Important</td>
<td></td>
</tr>
<tr>
<td>Very important</td>
<td></td>
</tr>
</tbody>
</table>

Do you agree with the following statements about why you go to school?
- I think the subjects I'm taking are interesting and challenging
- I get a feeling of satisfaction from doing what I'm supposed to do in class
- Education is important for getting a job later on

<table>
<thead>
<tr>
<th>Scale</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td></td>
</tr>
</tbody>
</table>

Among the friends you hang out with, how important is it to...
- Attend classes regularly?
- Study?
- Get good grades?
- Finish high school?

<table>
<thead>
<tr>
<th>Scale</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all important</td>
<td></td>
</tr>
<tr>
<td>Somewhat important</td>
<td></td>
</tr>
<tr>
<td>Very important</td>
<td></td>
</tr>
</tbody>
</table>

EXTRACURRICULAR INVOLVEMENT

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please mark all that apply for EACH interscholastic activity and/or intramural activity that you have participated in THIS SCHOOL YEAR.</td>
<td>School does not have</td>
</tr>
<tr>
<td>Baseball/softball</td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td></td>
</tr>
<tr>
<td>Football</td>
<td></td>
</tr>
<tr>
<td>Did not participate</td>
<td></td>
</tr>
<tr>
<td>Participated in intramural sports</td>
<td></td>
</tr>
<tr>
<td>Participated on a junior varsity/freshman team</td>
<td></td>
</tr>
<tr>
<td>Participated on a varsity team</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>School Response</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Soccer</td>
<td>Participated as a captain/co-captain</td>
</tr>
<tr>
<td>Swim team</td>
<td></td>
</tr>
<tr>
<td>Other team sport (hockey, volleyball, etc.)</td>
<td></td>
</tr>
<tr>
<td>Other individual sport (cross-country, gymnastics, golf, tennis, track, wrestling)</td>
<td></td>
</tr>
<tr>
<td>Cheerleading</td>
<td></td>
</tr>
<tr>
<td>Pom-pom, drill team</td>
<td></td>
</tr>
</tbody>
</table>

Please mark one for each activity that you have participated in THIS SCHOOL YEAR.
- Student government
- NHS or other academic honor society
- Service clubs (AFS, Key club)
- Academic clubs (Art, Computer, Engineering, Debate/Forensics/Foreign languages, Science, Math, Psychology, Philosophy, etc.)
- School does not offer
- Did not participate
- Participated
- Participated as an officer

**COMPUTER USE**

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
</table>
| From the beginning of ninth grade to the end of this school year, how much coursework will you have taken in each of the following subjects? Count only courses that meet at least three times (or three periods) a week for at least one half year. Also include summer school courses taken in 1988 or 1989 that counted for one half year or more. | - None  
- ½ year  
- 1 year  
- 1 ½ years  
- 2 years |
| From the beginning of ninth grade to the end of this school year, how much coursework will you have taken in each of the following subjects? Count only courses that meet at least three times (or three periods) a week for at least one half year. Also include summer school classes taken in 1988 or 1989 that counted for one half year or more. | - None  
- ½ year  
- 1 year  
- 1 ½ years  
- 2 years |
| In your most recent or current SCIENCE classes, how often do/did you... | - Very rarely  
- Once a month  
- Once a week  
- Almost every day  
- Every day |
<p>| Use computers to write up experiments or reports?                       |                                |
| Use computers for collecting and/or analyzing data?                     |                                |
| Use computers to do calculations?                                       |                                |
| Use computers for models and                                           |                                |</p>
<table>
<thead>
<tr>
<th>simulations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your most recent or current MATH</td>
</tr>
<tr>
<td>class, how often do/did you...</td>
</tr>
<tr>
<td>• Use computers?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>• Never</td>
</tr>
<tr>
<td>• Sometimes</td>
</tr>
<tr>
<td>• Often</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACADEMIC ACHIEVEMENT - 8TH GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>Math IRT Theta</td>
</tr>
<tr>
<td>Science IRT Theta</td>
</tr>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>(Not applicable)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACADEMIC ACHIEVEMENT - 12TH GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>Math IRT Theta</td>
</tr>
<tr>
<td>Science IRT Theta</td>
</tr>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>(Not applicable)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SUPPORTIVE SCHOOL ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>How much do you agree with each of the following statements about your current school and teachers?</td>
</tr>
<tr>
<td>• Students get along well with teachers</td>
</tr>
<tr>
<td>• There is real school spirit</td>
</tr>
<tr>
<td>• Discipline is fair</td>
</tr>
<tr>
<td>• Students make friends with students of other racial and ethnic groups</td>
</tr>
<tr>
<td>• The teaching is good</td>
</tr>
<tr>
<td>• Teachers are interested in students</td>
</tr>
<tr>
<td>• When I work hard on schoolwork, my teachers praise my effort</td>
</tr>
<tr>
<td>• Most of my teachers really listen to what I have to say</td>
</tr>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>Strongly disagree</td>
</tr>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOUSEHOLD EDUCATIONAL RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
</tr>
<tr>
<td>Which of the following does your family have in your home?</td>
</tr>
<tr>
<td>• A daily newspaper</td>
</tr>
<tr>
<td>• An encyclopedia</td>
</tr>
<tr>
<td>• A dictionary</td>
</tr>
<tr>
<td>• A Computer</td>
</tr>
<tr>
<td>• More than 50 books</td>
</tr>
<tr>
<td>Scale</td>
</tr>
<tr>
<td>Have</td>
</tr>
<tr>
<td>Do not have</td>
</tr>
</tbody>
</table>
### PARENTAL EDUCATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the highest level of education you have completed?</td>
<td>• Eighth grade or less</td>
</tr>
<tr>
<td></td>
<td>• Beyond eighth grade, but not high school graduation</td>
</tr>
<tr>
<td></td>
<td>• GED</td>
</tr>
<tr>
<td></td>
<td>• High school graduation</td>
</tr>
<tr>
<td></td>
<td>• Vocational, trade, or business school after High School</td>
</tr>
<tr>
<td></td>
<td>• Less than one year</td>
</tr>
<tr>
<td></td>
<td>• One to two years</td>
</tr>
<tr>
<td></td>
<td>• Two years or more</td>
</tr>
<tr>
<td>College program</td>
<td>• Less than two years of college</td>
</tr>
<tr>
<td></td>
<td>• Two or more years of college</td>
</tr>
<tr>
<td></td>
<td>• Finished a two-year program</td>
</tr>
<tr>
<td></td>
<td>• Finished a four or five-year program</td>
</tr>
<tr>
<td></td>
<td>• Master's degree or equivalent</td>
</tr>
<tr>
<td></td>
<td>• Ph.D., M.D., or other advanced degree</td>
</tr>
</tbody>
</table>

| What is the highest level of education your spouse/partner has completed? | • Eighth grade or less                                               |
|                                                                          | • Beyond eighth grade, but not high school graduation                |
|                                                                          | • GED                                                                 |
|                                                                          | • High school graduation                                             |
|                                                                          | • Vocational, trade, or business school after High School             |
|                                                                          | • Less than one year                                                 |
|                                                                          | • One to two years                                                   |
|                                                                          | • Two years or more                                                  |
| College program                                                         | • Less than two years of college                                     |
|                                                                          | • Two or more years of college                                       |
|                                                                          | • Finished a two-year program                                        |
|                                                                          | • Finished a four or five-year program                               |
|                                                                          | • Master's degree or equivalent                                      |
|                                                                          | • Ph.D., M.D., or other advanced degree                              |
### FAMILY INCOME

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
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</thead>
<tbody>
<tr>
<td>What was your total family income from all sources in 1987?</td>
<td>• None</td>
</tr>
<tr>
<td></td>
<td>• Less than $1,000</td>
</tr>
<tr>
<td></td>
<td>• $1,000 - $2,999</td>
</tr>
<tr>
<td></td>
<td>• $3,000 - $4,999</td>
</tr>
<tr>
<td></td>
<td>• $5,000 - $7,499</td>
</tr>
<tr>
<td></td>
<td>• $7,500 - $9,999</td>
</tr>
<tr>
<td></td>
<td>• $10,000 - $14,999</td>
</tr>
<tr>
<td></td>
<td>• $15,000 - $19,999</td>
</tr>
<tr>
<td></td>
<td>• $20,000 - $24,999</td>
</tr>
<tr>
<td></td>
<td>• $25,000 - $34,999</td>
</tr>
<tr>
<td></td>
<td>• $35,000 - $49,999</td>
</tr>
<tr>
<td></td>
<td>• $50,000 - $74,999</td>
</tr>
<tr>
<td></td>
<td>• $75,000 - $99,999</td>
</tr>
<tr>
<td></td>
<td>• $100,000 - $100,000</td>
</tr>
<tr>
<td></td>
<td>• $200,000 or more</td>
</tr>
</tbody>
</table>
APPENDIX B.

ADDITIONAL TABLE AND FIGURE
Table B. Summary of Significant Correlations.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>β Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caregiver Education &lt;-&gt; Household Educational</td>
<td>.19</td>
</tr>
<tr>
<td>Caregiver Education &lt;-&gt; Total Family Income-1987</td>
<td>.22</td>
</tr>
<tr>
<td>Caregiver Education &lt;-&gt; Caregiver School</td>
<td>.13</td>
</tr>
<tr>
<td>Caregiver Education &lt;-&gt; 8th Grade Achievement</td>
<td>.32</td>
</tr>
<tr>
<td>Total Family Income-1987 &lt;-&gt; Household Educational Resources</td>
<td>.30</td>
</tr>
<tr>
<td>Total Family Income-1987 &lt;-&gt; Caregiver School</td>
<td>-.15</td>
</tr>
<tr>
<td>Total Family Income-1987 &lt;-&gt; 8th Grade Achievement</td>
<td>.18</td>
</tr>
<tr>
<td>Caregiver School Involvement &lt;-&gt; Household</td>
<td>-.05</td>
</tr>
<tr>
<td>Educational Resources</td>
<td></td>
</tr>
<tr>
<td>8th Grade Achievement &lt;-&gt; Household Educational Resources</td>
<td>.14</td>
</tr>
<tr>
<td>8th Grade Achievement &lt;-&gt; Caregiver School</td>
<td>.22</td>
</tr>
<tr>
<td>e2 &lt;-&gt; e3</td>
<td>.35</td>
</tr>
<tr>
<td>e2 &lt;-&gt; e5</td>
<td>.07</td>
</tr>
<tr>
<td>e1 &lt;-&gt; e2</td>
<td>.47</td>
</tr>
<tr>
<td>e1 &lt;-&gt; e3</td>
<td>.26</td>
</tr>
</tbody>
</table>
Figure B. The Estimated Fully Recursive Model.


DeSantis, J., Ketterlinus, R., & Youniss, J. (1990). Black adolescents' concerns that they are academically able. Merrill Palmer Quarterly, 36, 287-299.


of parental involvement on high school grades. *Journal of Educational Research, 80*(6), 330-337.


annual meeting of the National Council on Measurement in Education, New York, NY.


Reynolds, A. J. (1989). A structural model of first-grade outcomes for an urban, low socioeconomic status,


