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AUTHOR Thomas, Gail E.
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ABSTRACT

A causal framework was used to explore factors that influence the enrollment of four-year college students in the hard and technical sciences (math, science, engineering) and the professions (pre-law, medicine, dentistry). The factors studied were family status, standardized test performance, high school rank, educational expectations, high school math and science preparation, college characteristics, and college grades. The National Longitudinal Survey of the High School Class of 1972 was the data base used in a path analytic approach to evaluate determinants of college major field choice. Findings showed that sex and high school major field intentions were the two most important determinants. Being female exerted a large direct negative effect on majoring in hard and technical sciences and the professions. The intention to major in these fields at the high school level was positively related to actually pursuing a college major in these fields. Findings from past studies regarding the importance of standardized test performance and high school math and science preparation were not strongly supported by the present data. (Five data tables are included.) (YLB)

Choosing a College Major in the Hard and Technical Sciences and the Professions: A Causal Explanation

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Gail E. Thomas

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Center for Social Organization of Schools
The Johns Hopkins University
3505 North Charles Street
Baltimore, MD 21218

Printed and assembled by the Centers for the Handicapped
Silver Spring, MD

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Introductory Statement

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Studies in School Desegregation program applies the basic theories of social organization of schools to study the internal conditions of desegregated schools, the feasibility of alternative desegregation policies, and the interrelations of school desegregation with other equity issues such as housing and job desegregation. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. It has produced a large-scale study of the effects of open schools, has developed Student Team Learning Instructional processes for teaching various subjects in elementary and secondary schools, and has produced a computerized system for school-wide attendance monitoring. The School Process and Career Development program is studying transitions from high school to post secondary institutions and the role of schooling in the development of career plans and the actualization of labor market outcomes. The Studies in Delinquency and School Environments program is examining the interaction of school environments, school experiences, and individual characteristics in relation to in-school and later-life delinquency.

The Center also supports a Fellowships in Education Research program that provides opportunities for talented young researchers to conduct and publish significant research, and to encourage the participation of women and minorities in research on education.

This report, prepared by the Studies in School Desegregation program, identifies some basic causes for the underrepresentation of women and minorities in the hard and technical sciences and professions.

Abstract

This paper uses a causal framework to explore factors (e.g., family status, standardized test performance, high school rank, educational expectations, high school math and science preparation, college characteristics, college grades) that influence the enrollment of four-year college students in the "hard" and technical sciences (i.e., math, science, engineering) and the professions (i.e., pre-law, medicine, dentistry).

The National Longitudinal Survey of the High School Class of 1972 was the data base employed in this analysis. The findings showed that sex and high school major field intentions were the two most important determinants of college major. Specifically, being female exerted a large direct negative effect on majoring in the "hard" and technical sciences and the professions. In addition, the intention to major in these fields at the high school level was positively related to actually pursuing a college major in these fields. Findings from past studies regarding the importance of standardized test performance and high school math and science preparation were not strongly supported by the present data. These latter variables were less influential on college major field choice than were sex and high school major field intentions. It was therefore concluded that school officials may find it useful to invest more extensively in countering traditional sex role socialization and advancing the career aspirations of students. Additional policy and research implications are discussed.

Introduction

For more than a decade, educators and other interested persons have been concerned about the underrepresentation of women and certain racial minorities (blacks, hispanics, native americans) in the "hard" and technical sciences and the professions (e.g., biology, chemistry, physics, math, engineering, law, dentistry, medicine, etc.). In 1977, blacks constituted 11.6 percent of the U.S. population but less than one percent of the nation's doctoral scientists and engineers, and less than two percent each of the nation's dentists and physicians (Melnick and Hamilton, 1977). Also in 1977 women were about 42 percent of the nation's work force, but were only 6.7 percent of the nation's physicians, 13 percent of its mathematicians and only 2.7 percent of its physicists with doctoral degrees (Rose, Menninger, and Nyre, 1979; Vetters, 1977).

Data on income by race and sex for persons with four-year college degrees showed that in 1975 the median income for white males was $15,165, $8,100 for white females, $12,324 for black males and $9,911 for black females (United States Commission on Civil Rights, 1978). These data show considerable race and sex variations, with white male college graduates at the top of the income hierarchy and white females at the bottom. Income data for college graduates by major field suggest that differences in career choices by males and females and blacks and whites may partially account for income disparities between these groups. In 1978, the annual starting salary for a college graduate majoring in engineering was $16,668, as compared to $13,668 for graduates in the natural sciences and $10,056 for graduates in the social sciences (Sells, 1978). If blacks and women continue to choose (or get selected into) traditional and less competitive

careers, race and sex differences in income and status attainment may persist.

Several explanations have been suggested as to why women and certain racial minorities do not actively pursue careers in the hard and technical sciences and the professions. For example, the unique and profound effect of race and sex socialization has been offered as one explanation (Maccoby and Jacklin, 1974; Persell, 1977; Duberman, 1975). Women and racial minorities have been found to internalize at an early age sex and race stereotypes and traditional career roles and expectations. One such stereotype is that blacks and women are better suited for jobs in teaching, clerical and other social and service oriented careers and less suited for managerial, entrepreneurial and advanced professional occupations (Gottfredson, 1978).

Persell (1977) and others (Rosenbaum, 1976; Gordon, 1979) have described the major role of the family in defining and reinforcing traditional race and sex role distinctions. In addition, Cole (1970) and the National Advisory Committee on Black Higher Education (1979) have reported that school officials play a major role in this process by channeling females and blacks into non-academic tracks primarily based on teachers' race and sex perceptions and biases.

The small percentage of females and blacks who have obtained advanced degrees in non-traditional fields have reported role conflict and, in many instances, a lack of recognition and acceptance by their male and white colleagues (Malcolm, Hall and Brown, 1976). Also, studies show that some high achieving minorities in math and science (particularly females) are reluctant to display their full potential for fear of unpopularity and disapproval (Aiken, 1970; Maccoby and Jacklin, 1974). Finally,

minorities who do obtain advanced degrees in the sciences and professions choose careers within these areas that are less likely to create role conflict and a lack of acceptance.For example, the high concentration of female physicians in pediatrics, public health and psychiatry has been viewed as an effort to create a balance between sex and professional roles (Kcsa and Coker, 1965).

Closely related to the socialization explanation is the impact of formal and informal sponsorship and social support on the educational and occupational achievement of women and minorities. Malcolm, Hall and Brown (1976) and others (Button and Brown, 1979; Hamilton, 1975; Duberman, 1975) reported that women and minorities lack adequate access to relevant role models and mentors that are necessary to cultivate their interest and expectations in pursuing nontraditional and more competitive careers. Also Kagan and Moss (1962) and Brophy and Good (1970) have reported the lack of adequate encouragement by parents, teachers and counselors, and peer influence as factors that discourage women and minorities from pursuing careers in the hard sciences and professional fields. In describing the educational experiences of minority women who had earned the doctorate in engineering, biomedicine and other quantative areas, Malcolm, et al. (9176) stated that these women reported the need for minority role models at the collegiate level. In addition, they indicated that they encountered considerable peer and family pressure to choose a traditional career and fulfill conventional role expectations (e.g., marriage and child rearing).

Davis (1965) noted the critical role of the early educational expectations and career orientations on the career choices of students. He hypothesized that the major outlines of career choices for college students are shaped prior to college entry. Davis also reported that as a result

of living twelve years in their local residential communities and schools prior to college entry (where the major effects of socialization occur), students go to college to implement rather than to choose a specific vocation. Davis (1965) presented data which showed that approximately 50 percent of high school graduating seniors reported a shift in their career plans between their freshman and senior year of college. However, the majority of their shifts were within rather than between major fields. For example, students who initially intended to major in the social sciences usually ended up doing so, although they may have shifted from history to sociology or political science. Similarly, students who chose majors in the professions and technical fields were found to change majors within these fields as opposed to shifting to the "soft sciences."

A third explanation of the low participation of women and blacks in the hard and technical sciences and the professions is that these groups do not have the necessary academic credentials and background required to enter these fields. Students' performance on standardized achievement tests, their high school grades, and the extent of their math and science background are the most important measures of academic background. Morris (1979) and Odegaard (1977) have noted that the low performance of blacks on standardized entry examinations required for medical and law school and on subsequent tests required for professional licensing are major barriers to increasing the access of blacks in the professions. Davis (1965) and others (Astin and Panos, 1969; Werts, 1966) also found a strong correlation between the rankings of careers and student performance on standardized tests. In general, students majoring in the physical sciences, engineering, math, law and medicine had higher test scores than students in education and business (Davis, 1965; Werts, 1966).

The amount of math and science that students take in high school also has been found to play a critical role in determining college access and the type of college major that students pursue (Sells, 1976, 1978; Young and Young, 1974; Cobb, 1963; Brooks and Miyares, 1979; Durio, Kildow and Slover, 1980; Ligon, 1980). Data consistently show that women and blacks take fewer math and science courses, have a lower interest in math and science, and are less successfully academically in these areas than their male and white counterparts (Maccoby and Jacklin, 1974; Sells, 1976, 1978; Fox, 1976; Button and Brown, 1979; Erlick and LeBold, 1975).

Sells (1978) found that 57 percent of the males versus only 8 percent of the females had an average of three and one-half years of math. In addition, 92 percent of the females in Sells' study and 50 percent of the blacks who attended college were barred from the more select undergraduate majors and colleges and universities because of inadequate math preparation and performance. In summarizing the consequences of inadequate math preparation for college access and diversity of major field choice, Sells (1976) stated that:

> Students whose arithmetic skills are too far below grade level in high school are effectively barred from access to the first year of high school algebra, which is the minimal mathematics preparation required by most colleges and universities. Students who have had three and a half to four years of high school mathematics are immediately eligible for the standard freshman calculus sequence at any college or university in the country. Until very recently those students who had not pursued second year algebra and trigonometry in high school had no way of catching up before entering as freshmen, to qualify for the standard calculus sequence, which is

required for undergraduate majors in every major field except education, criminology, the social sciences, and the humanities. These fields have almost no current job related potential for persons with bachelor's degrees.

A more recent study by Stanley and Benbow (1980) has challenged both the socialization and adequate technical course preparation explanations. These researchers reported from a sample of intellectually gifted junior high school students, that boys fare better than girls on mathematical aptitude tests. They further argue that the sex differential on test performance is more likely to influence the greater enrollment of males than females in math courses than school channeling mechanisms and prior socialization.

The present study does not permit a direct assessment of the impact of socialization on the major field choice of race and sex groups. However, it does enable an indirect evaluation of socialization effects by examining the impact of ascription (race, sex, family background), academic achievement (class rank, standardized test performance), educational expectations, high school major field intentions, and high school math and science preparation on college major field choice. The latter variables are viewed as reflecting some aspect of students' early socialization by their family and members in their school environment.

The influence of the type of college that students attend (i.e., public vs. private; selective vs. nonselective) and college grade performance on major field choice also will be examined. Only a few studies have investigated the impact of college characteristics on the educational outcomes and the career orientations and achievement of students. Thomas (1981) and others (Astin, 1978; Werts, 1966) found that attending a private college was positively related to educational expectations and attainment.

Also, Helen Astin and Cross (1977) and Alexander Astin (1978) reported that students enrolled in private and more selective colleges are more likely to pursue careers in the "hard" sciences and the professions than students in public colleges. Finally, studies have shown that high college grade performance is positively related to majoring in the "hard" and technical sciences (Werts, 1966; Astin, 1978).

Methodology

Sample

The National Longitudinal Survey (NLS) of the High School Senior Class of 1972 is the data set that is used in this study. The survey, which is currently under the auspices of the U.S. Department of Education's National Center for Education Statistics (NCES), was conducted to determine what happened to students after they left high school as indicated by their educational and vocational plans and experiences. A representative sample was drawn of twelfth graders who were enrolled in some 1,200 U.S. public, private and church affiliated secondary schools.

The project employed a two-stage probability sample with schools as first stage sampling units and students as second stage units. Schools that were located in low income areas or that had a high proportion of minority students were oversampled in order to obtain an adequate representation of black students and other racial minorities (Mexican, Native Americans, Asians). Approximately 16,683 high school seniors completed a standardized achievement test and a detailed Base-Year (1972) questionnaire that dealt with their post-high school plans, family background and previous educational experiences.

Base-Year (1972), First (1973), Second (1974) and Third-Year (1976) follow-up data were used in this study. During the Base-Year survey, some of the seniors who participated in the study were making the transition

from high school to college. Between the Base-Year and First-Follow-Up surveys, approximately 30 percent of the NLS whites and 24 percent of the blacks entered a four-year college. This study focuses on the NLS four-year college subsample and the most recent academic major declared by these students.

Variables

Family Status (SES)--a family status composite based on Heise's (1972) sheaf analytic approach was employed. The measures included in the summary composite were:

Father's Occupation--This item is a base-year measure on which respondents described their father's current occupational status. This information was coded into the metrics of Duncan's SEI scores.

Mother's and Father's Education--This is a five-category item that ranged from "less than high school completion" to "obtained a graduate or professional degree."

Household Index--A factor weighted composite of cultural and economic resources (newspaper, dictionary, typewriter, automobiles) constitutes the household index measure.

Standardized Test Performance--A test was administered during the Base-Year which tapped students' verbal and nonverbal skills. It consisted of an equally weighted linear composite of four subtests: math, vocabulary, letter grouping and reading.

High School Rank--Data on class rank were obtained during the Base-Year from high school records. Class rank was coded into deciles.

Educational Expectations--This is a Base-Year measure in which students indicated the highest level of education that they expected to achieve. Responses ranged from less than high school graduation to obtaining a graduate or professional degree.

Major Field Intentions--This is a Base-Year measure in which students were asked to indicate their first choice among twenty-one major fields. These categories were recoded into a dichotomous measure of (1) hard, technical and professional fields versus (0) the soft sciences and other remaining fields.

Hours of Science and Math--Data on respondent's status regarding the amount of high school science and math taken were also obtained from high school records during the Base-Year. These items indicated the number of semester courses of math and science that respondents had taken. The response categories ranged from 0 to 15 semester courses.

College Selectivity--The college selectivity measure was derived from a supplementary NLS institutional data file that obtained descriptive information about the colleges that NLS respondents attended. College selectivity is defined as the mean SAT score of the student body for each institution divided by 100.

College Control--The influence of attending a public (0) versus a private (1) college on student college graduation is another institutional characteristic that was obtained from the NLS college file.

College Grade Point Average--The influence of sophomore year grade point average on major field choice is also examined. This measure was obtained from the Second-Year follow-up survey and is a seven-category item that ranged from mostly A to mostly D.

Four-Year College Major--Data for this item were taken from an item included in the First (1973), Second (1974) and Third-Year (1976) follow-up surveys. In each year, respondents were asked to indicate their current field of study from among sixteen categories. This study used the most recent response that students reported. The original sixteen

categories were recoded into a dichotomous measure of: (1) hard, technical and professional fields (biology and physical sciences, math, engineering, medicine, dentistry, law) versus (0) the social sciences and other remaining fields (education, business, agriculture, etc.).

Analytical Model

This study employs a path analytic framework (see Figure 1) to evaluate determinants of major field choice. Specifically, the study examines the

Figure 1 About Here

influence of ascription as indexed by respondent's race, sex and family background (SES); the impact of academic merit as measured by students' performance on the standardized achievement test and their high school rank; the effects of students' educational expectations and major field intentions; the impact of high school math and science; and the impact of college control and college selectivity. The theoretical justification for the present model has been elaborated in similar past status attainment models (see Sewell, Haller and Ohlendorf, 1970; Portes and Wilson, 1976; Thomas, Alexander and Eckland, 1979).

Findings

A preliminary test for the significance of race and sex interactions was performed (Tatsouka, 1971) to determine if the analytical model warranted separate analysis for race and sex groups. Significant interactions exist if the percent of variance in the dependent variable accounted for by the multiple model (e.g., race and sex groups treated separately) is significantly greater than the percent of variance explained by the common or single model (e.g., race and sex groups treated as a single group, with race and sex included as covariates). The results produced by the test include: (1) the percents of variance accounted for by the multiple model

for each dependent variable; (2) the percents of variance accounted for by the common model (e.g., the equations without interactions) for each dependent variable; (3) the percents of variance increase resulting from the multiple model; and (4) the F statistics associated with the interactions.

The results from the test (not presented) showed that race and sex interactions involving the major dependent variable--college major field --were not significant. Therefore, a single model for the total sample with race and sex entered directly into the research model was initially examined. In addition, the specific manner in which race and sex main effects operated was examined in more detail via separate models with sex entered directly into the analysis for blacks and whites and race entered into the analysis for males and females.

Table 1 presents the standardized path coefficients for the model for the total sample. (See Appendix, Table 1 for item means and standard deviations and Table II for the correlation matrix for the total sample). The first six columns show the direct effects of race and sex and other independent variables on college major choice under different controls. For example, column 1 shows the direct effect of race and sex on the major dependent variable when controlling for family background and standardized test performance. Column 2 shows the impact of class rank on college major, net of the background variables. This step-wise entry procedure is followed for the remaining independent variables throughout columns 3-6. Columns 7-12 present the results for other dependent variables.

Table 1 About Here

Noting first the impact of ascription, the most striking observation in Table 1 is the strong effect of sex on college major across all equations

involving the major dependent variable. Being female has a negative influence on enrollment in the hard sciences and professional fields net of family status, race and standardized test performance. Table 2 shows that more than three-fourths of the effects of sex on college major is direct.

Table 2 About Here

The ascriptive status of race (i.e., being black) also has a significant (and positive) effect on the major dependent variable. However, its influence on college major is far less substantial than the effects of sex.

Considering next the influence of academic factors on major field choice, Table 1 shows that upon initial entry, standardized test performance has a strong impact on college major. However, its effect is substantially reduced when high school major field intention is entered into the equation (Column 3). Thus (when controlling for major field intentions) standardized test performance does not appear to be as critical in this study for determining college major as has been reported in previous studies (Werts, 1966; Astin and Panos, 1969).

Columns 3-6 show that the effect of high school major field intention is equally as influential as sex. Table 2 shows that most of its effect on college major is direct. For other independent variables, Table 1 shows that family status, educational expectations, high school rank, hours of high school math and science, and college grade performance do not have a sizeable impact on college major. In addition, the college characteristics do not exert a significant effect on the major dependent variable.

To summarize, sex and high school major field intentions are the two most important determinants of majoring in the hard sciences and the professions. In addition, race (i.e., being black), has a modest

significant positive effect on majoring in these fields. These findings suggest that ascription and the early career orientations and aspirations of four-year college students are more important in determing their major field choice than academic factors and the characteristics of the colleges that students attend.

Turning next to the effects of the independent variables on the remaining dependent variables, Table 1 shows that standardized test performance is the major determinant of educational expectations, major field intent, and hours of high school math and science enrollment. The impact of sex on other dependent variables is also interesting. Its influence on high school rank and college grades is positive, however its impact on educational expectations, major field intent, and hours of high school math and science enrollment is negative. Thus, while NLS females earned better high school grades than males, they had lower educational expectations, lower hours of math and science enrollment, and were less likely to express an intent to pursue a college major in the hard sciences and professional fields. In comparison to sex, the effect of race on remaining dependent variables is minimal. The only exception is its fairly sizeable and significant positive effect on educational expectations. Thus, net of background variables (i.e., family status, standardized test performance), NLS blacks have higher educational expectations than whites. This observation has been noted in previous research (Portes and Wilson, 1976; Thomas, et al., 1979).

The remaining two tables in the analysis (Tables 3 and 4) provide more details on the influence of sex, race and major field intentions on college major.

Tables 3 and 4 About Here

The top coefficients in the tables are the unstandardized values, which are appropriate for comparisons between groups (Blalock, 1967); the bottom coefficients are the standardized values. Beginning with the effects of sex, the unstandardized values in Table 3 show that except for rank and college major the impact of sex on the dependent variables is not significant for blacks but is significant and stronger for whites. In addition, the negative effect of sex on college major is somewhat stronger for whites (-.207) than blacks (-.181). Thus, net of background variables (i.e., family status, standardized test performance) sex is a more important factor affecting college major among whites than among blacks, and a greater liability for white females than for black females. The unstandardized values in Table 3 also show that high school major field intention has a stronger effect on college major for blacks (.325) than whites (.281).

Table 4 reports the effect of race on the dependent variables for females and males. The unstandardized values show that the positive influence of race on college major is about equal for females (.082) and males (.087). However, its impact on hours of high school math and college grades is significant for females but not significant for males. Also, its positive effect on educational expectations is stronger for females (.468) than males (.244). Finally, the unstandardized values show that the influence of high school major field intentions on college major is slightly stronger for females (.305) than males (.269).

Summary and Conclusions

This study sought to investigate factors that influence the enrollment of four-year college black and white men and women in the "hard" sciences and the professions. Previous studies have emphasized

the importance of academic factors (i.e., standardized test performance, grades) and high school math and science preparation in determining student college major and career choice (Werts, 1966; Fox, 1976; Sells, 1976, 1978). In addition, an investigation by Davis (1965) indicated that the ascriptive status of sex and students' early career aspirations were the major factors affecting students' career choice.

The present results do not support the earlier findings concerning the major role of academic factors in determining students' major field choice. However, the observations in this study do support Davis' (1965) finding. Both sex and high school major field intentions were the major determinants of college major for all groups examined. Specifically, for blacks and whites, being female had a negative effect on majoring in the "hard" and technical sciences and the professional fields. The female disadvantage was greater for white than for black females. In addition, plans at the high school level to major in the "hard" and technical sciences was positively related to actually choosing a college major in these fields. The positive effect of high school major field intentions on college major was slightly stronger for blacks than whites.

The present finding that sex and high school major field intentions have a major impact on college major held net of family background, standardized test performance and the type of colleges that students attended. Thus, Davis' (1965) point that the major outlines of career choices for college students are formed prior to college entry appears applicable to these data. In addition, family socialization (rather than family status), along with community and school socialization, may be more important in explaining the influence of sex and major field intentions on college major than academic factors and the characteristics

of the colleges that students attend.

The low predictability of the present research model (R^2 = .18 for the total sample) suggests that future studies may be able to further explain college major choice by conducting indepth investigations of the nature of family, school and sex role socialization. More importantly, these inquiries may help explain why black and white females are less likely to intend to pursue majors in the hard sciences and the professions, and less often pursue majors in these fields. The past explanation that females do not have the academic credentials required to major in these fields (Astin and Panos, 1969; Werts, 1966) does not apply to the current sample because NLS black and white females academically excel their male counterparts at the high school and college level.

Other variables that might further explain the present findings are social-psychological and attitudinal measures that tap the values and perceptions of race and sex groups about various college majors and occupations. Also, the impact of school counselors, mentors, parental attitudes and values, teacher expectations and peer influences might be examined. A recent study of the sex role and career orientations of black college females in Baltimore showed that over 60 percent of those women were high achievers and had high educational and career aspirations (Hargett and Thomas, 1981). However, over 50 percent of these women rated the high school counseling that they had received about higher educational attainment and careers as poor. In addition, they expressed the desire for greater access to female professional role models. Malcolm, Hall and Brown (1976) reported similar findings from their study of minority female scientists. Also, Blackwell (1981) noted in his study of black professional school students that students' interaction with role models of the same race

and sex was the most important factor associated with the academic success of black students.

A final issue for future research entails examining the effects of high school tracking and other postsecondary stratification and channeling processes on major field and career choice. Studies have shown that the overrepresentation of black students in non-college preparatory tracks at the high school level inhibits their access to the pre-college and professional career socialization and preparation required for competitive careers (National Advisory Committee on Black Higher Education and Black Colleges, 1976; Cobb, 1979). In addition, Persell (1977) and Rosenbaum (1976) reported that students of different race, sex and social class backgrounds are stratified and socialized differently for different careers during their secondary schooling.

Apart from generating further research inquiries, the findings from this study also suggest an important policy consideration for school administrators. Specifically, the major role of sex and high school major field intentions implies that school officials may need to invest more extensively in college and career counseling and in countering traditional sex role socialization. Some of the currently existing programs designed to increase the enrollment of women and racial minorities in the hard sciences emphasize increasing the basic math and science skills and interests of these students (Malcolm, Hall and Brown, 1976; Richards, Williams and Holland, 1981). In addition, most of these programs are designed for high school students. However, the early influence of race and sex socialization on the major field choices and career orientations of students suggested in this study and in past research (Davis, 1965; Sewell and Shah, 1967; Mednick, Tangri and Hoffman, 1975) clearly illustrate

the need for early and more extensive (i.e., basic skills and career training) educational intervention. In addition, educational policy efforts will be needed to further encourage the career aspirations of minorities and help eliminate the structural barriers and conditions that currently foster the underachievement of these groups.

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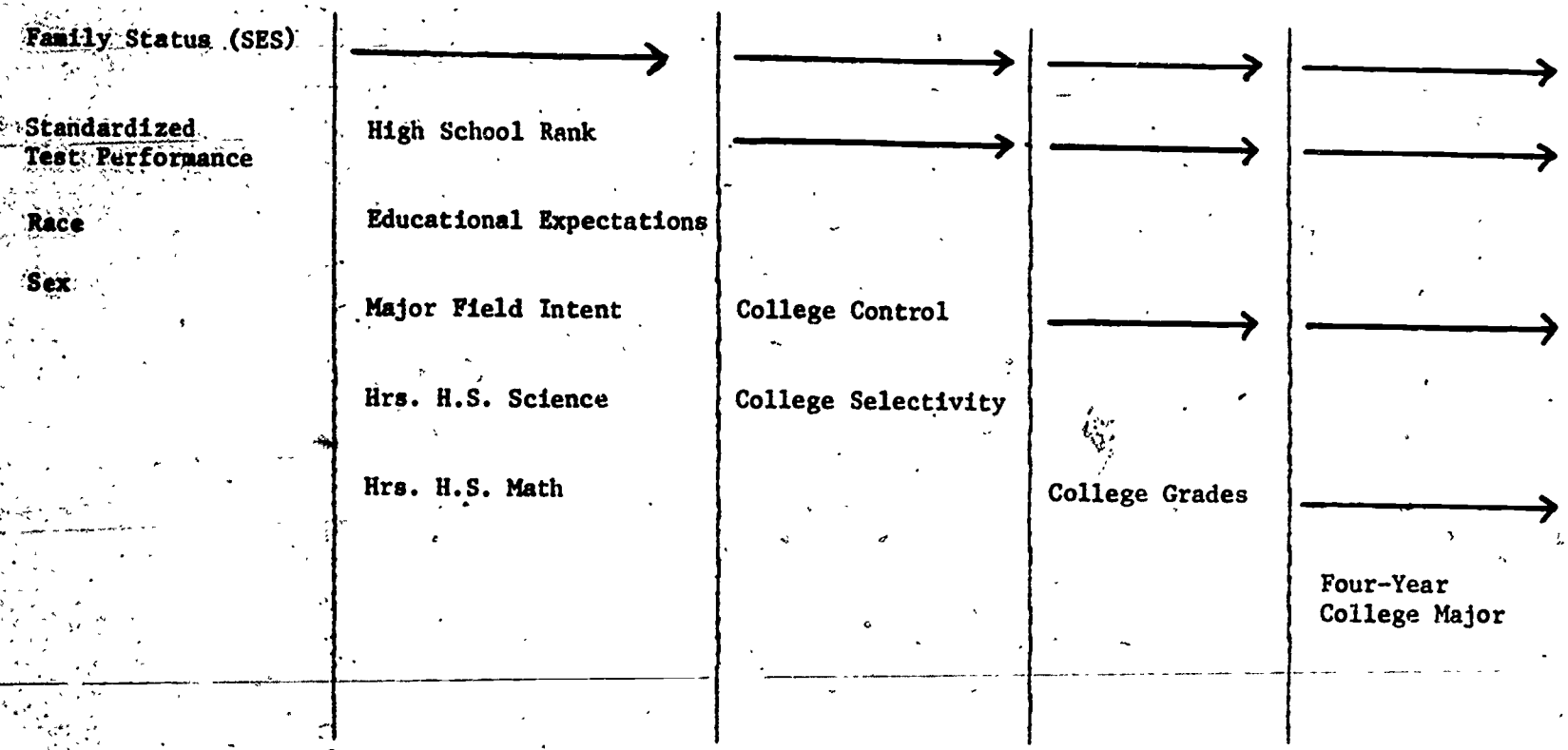
Figure 1

Determinants of Four-Year College Major[a]



[a]The causal relationship among independent variables within panels is not examined given the primary interest in the major dependent variable--college major. For simplicity of presentation, individual arrows for variables within panels are not shown. Instead, a single arrow is represented for each panel of variables to indicate their effects on variables within subsequent panels.

Table 1

Determinants of Four-Year College Major for Total Sample[a]

(Standardized Coefficients)

Independent Variables	(1) College Major	(2) College Major	(3) College Major	(4) College Major	(5) College Major	(6) College Major	(7) High School Rank	(8) Educational Expectations	(9) Major Field Intent	(10) Hrs. Science	(11) Hrs. Math	(12) College Grades
Family Status (SES)	.032	.032	.032	.032	.032	.032	.063	.145	.001	.000	.000	.055
Standardized Achievement Test	.229	.188	.128	.113	.099	.088*	.512	.254	.181	.227	.202	.220
Race	.093	.088	.068	.064	.070	.073	.076	.176	.036*	.032	.054	-.064
Sex	-.279	-.292	-.249	-.237	-.235	-.239	.183	-.114	.147	-.171	-.162	.074
High School Rank		.070	.054	.047	.048	.034*		.125	.035*	.074	.104	.270
Educational Expectations			.029*	.025*	.024*	.022*			.136	.076	.057	.031*
Major Field Intent			.245	.238	.236	.237				.179	.085	-.033
Hrs. Science				.018*	.016*	.018*						-.049
Hrs. Math				.053	.053	.053						-.005*
College Control					.029*	.024*						.090
College Selectivity					.039*	.036*						-.057
College Grades						.052						
R^2	.115	.119	.177	.180	.182	.184	.314	.136	.092	.176	.123	.205

[a] This analysis is based on SPSS subprogram regression option Pairwise Deletion. The number of cases for the total sample ranged from 3,736 to 5,822.

* Coefficients are less than twice their standard error.

Table 2

Total, Direct and Total Indirect Effects of Indendent Variables on Major Field Choice for Total Sample

Dependent Variable	Independent Variables	Total Effect[a]	Total Indirect Effect	Direct Effect
College Major	Family Status (SES)	.032	--	.032
	Standardized Test Performance	.229	.141	.088
	Race	.093	.020	.073
	Sex	-.279	-.040	-.239
	High School Rank	.070	.036	.034
	Educational Expectations	.029	.007	.022
	Major Field Intent	.245	.008	.237
	Hrs. Science	.018	--	.018
	Hrs. Math	.053	--	.053
	College Control	.029	.005	.024
	College Selectivity	.039	.003	.036
	College Grades	.052	--	.052

[a] When the independent variables are entered step-wise into the regression equations as in the present case, the total effect equals the standardized regression coefficient produced for an independent variable when it first enters the regression equation. These values are reported above. The direct or net effects shown are the standardized coefficients from column 6 of Table 2. The total indirect effects are the direct effects subtracted from the total effect. See Alwin and Hauser (1975) for a more technical method for decomposing independent variable effects.

Table 3[a]

Determinants of Four-Year College Major for Blacks and Whites

	Dependent Variables: Blacks							Whites						
Independent Variables	(1) College Major	(2) High School Rank	(3) Educational Expecta.	(4) Major field Intent	(5) Hrs. Science	(6) Hrs. Math	(7) College Grades	(1) College Major	(2) High School Rank	(3) Educational Expecta.	(4) Major field Intent	(5) Hrs. Science	(6) Hrs. Math	(7) College Grades
Family Status (SES)	.055	.105	.148	.055	.071	.095	.055	.032	.055	.145	.032	.045	.000	.045
Standardized Achievement Test	.001*[b]	.034	.008	.002	.014	.019	.007	.001	.051	.006	.002*	.016	.016	.011
	.076	.392	.233	.252	.220	.279	.168	.063	.539	.204	.146	.206	.168	.212
Sex	-.181	1.124	.164*	-.050*	-.373*	-.267*	.077*	-.207	.853	-.222	-.114	-.674	-.810	-.221
	-.224	.221	.084	-.090	-.102	-.069	.033	-.237	.181	-.142	-.153	-.177	-.176	.083
High School Rank	.016*		.035*	-.003*	.062*	.058*	.112	.004*		.045	.007	.005	.106	.153
	.098		.092	-.025	.086	.076	.246	.023		.137	.045	.068	.108	.269
Educational Expectations	-.004*			.045	.015*	.210	-.044*	.013*			.064	.210	.151	.080
	-.009			.157	.008	.105	-.039	.023			.135	.086	.051	.047
Major field Intent	.325				1.046	.760	-.104*	.281				.929	.498	-.118
	.226				.160	.110	-.025	.239				.181	.080	-.033
Hrs. Science	-.010*						.014*	.006*						-.038
	-.044						.023	.024						-.053
Hrs. Math	.020*						.013*	.009						-.004*
	.097						.021	.050						-.007
College Control	.056*						.279	.011*						.259
	.065						.114	.013						.098
College Selectivity	-.005*						-.097	.024						-.047
	-.025						-.164	.066						-.042
College Grades	-.007*							.020						
	-.020							.060						
R^2	.154	.208	.121	.103	.142	.183	.142	.189	.316	.138	.087	.174	.114	.190

[a] This analyses is based on SPSS subprogram regression option Pairwise Deletion. The number of cases for blacks ranged from 629 to 830 and for whites, 3,611 to 4,991.

[b] The top value is the unstandardized coefficient and the bottom value is the standardized coefficient.

* Coefficients are less than twice their standard error.

Table 4

Determinants of Four-Year College Major for Females and Males[a]

Independent Variables	Dependent Variables (1) College Major	(2) High School Rank	(3) Educational Expecta.	(4) Major field Intent	(5) Hrs. Science	(6) Hrs. Math	(7) College Grades	(1) College Major	(2) High School Rank	(3) Educational Expecta.	(4) Major field Intent	(5) Hrs. Science	(6) Hrs. Math	(7) College Grades
Family Status (SES)	.032	.109	.114	.001	.071	.032	.045	.089	.089	.200	.045	.000	.045	.032
Standardized Achievement Test	.001*[b]	.044	.007	.002	.013	.018	.013	.002*	.052	.007	.003	.016	.015	.008
	.118	.506	.260	.189	.225	.204	.298	.090	.526	.248	.190	.235	.221	.161
Race	.082	.468	.482	.036*	.187*	.545	-.239	.087	.528	.244	.032*	.089*	.076*	-.170*
	.101	.083	.242	.049	.041	.082	-.072	.056	.066	.094	.025	.014	.013	-.039
High School Rank	.009		.039	.001*	.029*	.077	.151	.001*		.043	.007*	.079	.111	.152
	.060		.109	.009	.036	.065	.254	.008		.131	.044	.102	.148	.282
Educational Expectations	.003*			.046	.175	.248	-.043*	.015*			.068	.171	.095	.127
	.006			.127	.077	.074	-.026	.025			.136	.072	.041	.077
Major field Intent	.305				1.204	.644	-.209*	.269				.815	.473	-.071*
	.275				.194	.071	-.046	.226				.171	.102	-.027
Hrs. Science	-.002*						-.007*	.008*						.039*
	-.001						-.010	.031						-.055
Hrs. Math	.010						-.005*	.013						.001*
	.079						-.009	.050						.001
College Control	.017*						.213	.019*						.261
	.026						.082	.020						.098
College Selectivity	.005*						-.052*	.018*						-.064
	.023						.057	.052						-.065
College Grades	-.003*							.032						
	-.013							.091						
R^2	.131	.297	.114	.057	.127	.076	.240	.122	.294	.154	.081	.165	.152	.167

[a] This analysis is based on SPSS subprogram regression option Pairwise Deletion. The number of cases for females range from 1,887 to 2,620 and for males, 2,243 to 3,282.

[b] The top value is the unstandardized coefficient and the bottom value is the standardized coefficient.

[c] Coefficients are less than twice their standard error.

Appendix

Table I

Item Means and Standard Deviations for Model Predicting Major Field Choice of Race and Sex Groups[a]

Variables		Groups				Total Sample
		Blacks	Whites	Males	Females	
Father's Occupation	$\bar{X}$	31.87	51.15	49.44	47.76	48.69
	SD	21.88	22.85	23.30	23.97	23.62
Mother's Education	$\bar{X}$	11.81	13.07	12.92	12.86	12.89
	SD	2.61	2.40	2.42	2.52	2.47
Father's Education	$\bar{X}$	11.33	13.65	13.39	13.24	13.32
	SD	2.51	2.89	2.92	3.01	2.96
Household Index	$\bar{X}$	6.87	8.49	8.37	8.15	8.27
	SD	1.85	1.44	1.58	1.62	1.60
Standardized Test Performance	$\bar{X}$	185.81	226.30	221.84	220.06	221.03
	SD	28.65	24.58	27.43	29.92	28.60
High School Rank	$\bar{X}$	6.39	7.38	6.85	7.71	7.24
	SD	2.50	2.33	2.46	2.18	2.38
Educational Expectations	$\bar{X}$	5.00	5.08	5.13	5.00	5.07
	SD	0.96	0.77	0.80	0.78	0.79
Major Field Intent	$\bar{X}$	0.08	0.16	0.20	0.09	0.15
	SD	0.28	0.37	0.40	0.28	0.36
Hrs. Science	$\bar{X}$	3.83	4.47	4.71	3.97	4.38
	SD	1.81	1.88	1.91	1.77	1.88
Hrs. Math	$\bar{X}$	4.32	4.89	5.14	4.41	4.81
	SD	1.91	2.28	1.85	2.59	2.24
College Control	$\bar{X}$	0.32	0.47	0.46	0.44	0.45
	SD	0.47	0.49	0.50	0.50	0.50
College Selectivity[b]	$\bar{X}$	8.93	10.16	10.11	9.85	9.99
	SD	1.92	1.19	1.34	1.41	1.38
College Grades	$\bar{X}$	4.15	4.87	4.64	4.96	4.79
	SD	1.14	1.32	1.33	1.30	1.32
Major Field Choice	$\bar{X}$	0.20	0.25	0.35	0.11	0.24
	SD	0.40	0.43	0.48	0.31	0.43

[a]This analysis is based on SPSS's subprogram regression option Pairwise Deletion. The number of cases for blacks ranged from 629-830; for whites 3,611-4,991; for males 2,243-3,202; for females 1,887-2,620; for the total sample 3,736 to 5,822.

[b]College selectivity has been previously defined as the average SAT score of a college's body divided by 100. Thus the mean SAT score for four-year institutions that blacks attend is 893 versus 1,016 for whites.

Table II

Inter-Item Correlations for College Major Model for Total Sample[a]

	Father's Occupation	Mother's Education	Father's Education	Household Index	Test Performance	Race	Sex	H.S. Rank	Educational Expectations	Field Intent	Hrs. Science	Hrs. Math	College Control	Selectivity	Coll Grad
Father's Occupation	---														
Mother's Education	.387	---													
Father's Education	.606	.545	---												
Household Index	.323	.317	.344	---											
Standardized Test Performance	.266	.275	.315	.240	---										
Race	-.271	-.176	-.269	-.343	-.471	---									
Sex	-.034	-.009	-.023	-.062	-.023	.116	---								
H.S. Rank	.067	.088	.095	.030	.512	-.144	.182	---							
Educational Expectations	.167	.147	.168	.110	.292	-.030	-.084	.223	---						
Major Field Intent	.054	.053	.068	.068	.229	-.076	-.153	.125	.205	---					
Hrs. Science	.065	.058	.089	.063	.308	-.115	-.192	.191	.204	.276	---				
Hrs. Math	.080	.070	.091	.065	.273	-.088	-.160	.194	.171	.176	.433	---			
College Control	.052	.024	.040	.009	.048	-.101	-.020	-.049	-.044	.002	-.003	-.029	---		
Selectivity	.245	.231	.283	.172	.487	-.300	-.087	.258	.226	.177	.222	.189	.19.	---	
College Grades	.082	.104	.121	.075	.358	-.187	.124	.383	.122	.029	.057	.072	.080	.147	---
College Major	.044	.040	.056	.016	.188	-.041	-.272	.101	.146	.318	.192	.178	.033	.159	.074

[a] This analysis is based on SPSS subprogram regression option pairwise deletion. The number of cases for the total sample ranged from 3,736 to 5,822.