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THE ROLE OF RACIAL IDENTITY AND SELF-EFFICACY IN THE MATHEMATICS-RELATED CHOICE INTENTIONS OF BLACK COLLEGE STUDENTS

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ABSTRACT

THE ROLE OF RACIAL IDENTITY AND SELF-EFFICACY
IN THE MATHEMATICS-RELATED CHOICE INTENTIONS OF BLACK COLLEGE STUDENTS

By

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In an increasingly technological society, mastery of math and science becomes essential for accessing a wide range of desirable career options. Therefore, the continued underrepresentation of Blacks in math and science courses and occupations warrants serious attention. This study sought to extend prior work on math self-efficacy by testing a social cognitive career model of math and science career aspirations in Black college students. Since mathematics-related course enrollment patterns help determine the range of one's career options, this study examined factors that may influence math- and science-related course enrollment intentions. Because racial identity has been speculated to have implications for career choice and development for African Americans, this study also sought to examine the impact of racial identity attitudes on math-related aspirations of Black students. Questionnaire data gathered on 164 first-year, Black college students consisted of demographic and background information (e.g., gender, socioeconomic status, high school math and science courses, college major, career preferences), math self-efficacy, outcome expectations, mathematics-related interests, perceived sources of efficacy information, math-related course enrollment intentions, and racial identity attitudes. Scholastic Assessment Test-I mathematics scores,

obtained from university records, were used as a measure of mathematics ability. Results of correlational, regression, and path analyses indicated general support for the utility of the social cognitive career model in explaining mathematics-related choice intentions of Black college students. Math self-efficacy and outcome expectations were jointly predictive of math-related interests. Math ability affected interests via efficacy beliefs. Efficacy and outcome expectations affected course enrollment intentions partly through interests. Direct personal experiences (i.e., personal performance, verbal persuasion, and emotional arousal) were more influential sources of efficacy beliefs than vicarious experiences. Verbal persuasion was a more important source of outcome expectations than the other three informational sources. While Black men reported significantly higher math-related efficacy beliefs than Black women, there were no significant differences in Black men's and women's course enrollment intentions. Racial identity attitudes were not related to the social cognitive variables nor did they moderate relationships among the variables. Implications for theory, research, and practice are discussed.

To T.J. and "Poppop"

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Chapter 1

INTRODUCTION

Mathematics preparation has been described as the "critical filter" through which people gain access to a wide range of desirable career options (Sells, 1976, 1982; Sherman, 1982). In an increasingly technological society, the mastery of math and science becomes essential for full participation in the labor force (Sells, 1982). Mathematics proficiency has been found to be related to (a) a wide range of educational and career opportunities (Betz, 1992a), (b) entry-level salaries (Sells, 1982), and (c) access to careers and apprenticeships in the lower- and mid-level technical fields (Sells, 1982). A solid grounding in math and science can also assist in developing the problem-solving and critical thinking skills necessary for dealing with the everyday tasks encountered in a changing and complex world (cf. Halpern, 1992). Therefore, the number of mathematics and science courses taken in high school and college plays a critical role in the range of career opportunities available (Betz, 1992a). The quality of such courses is also important to adequate vocational preparation (Sells, 1976, 1982).

Despite the ongoing emphasis on math and science education and career preparation as a means of increasing our nation's technical resources,

Blacks and other minorities remain underrepresented in math and science occupations (Bailey, 1990; Betz, 1991; National Science Foundation, 1992). For example, the National Science Foundation (1992) has reported that although Blacks constitute 12 percent of the total population and 11 percent of the total work force in the United States, they account for only about 3 percent of employed scientists and engineers. This occurs despite evidence that Black college freshman are more likely to express vocational goals in the careers of medicine, computer programming, and law than their White counterparts (National Science Foundation, 1992). Further, it has been estimated that in inner-city schools, where a significant proportion of Black students receive their education, 50% of students do not take any mathematics courses beyond basic arithmetic (Bailey, 1990). Although the situation is improving, Blacks continue to be significantly underrepresented in science and engineering (National Science Foundation, 1992).

These statistics can be particularly puzzling when one considers the significant contribution of Blacks to math and science throughout history. Despite Eurocentric claims to the contrary, the origins of mathematics and science have been traced to the early Egyptians of Africa (Malcolm, 1990; Sammons, 1990). In the United States, both slaves and free Blacks invented mechanical devices that frequently could not be patented. Even when patents could be obtained, Black inventors had to keep their race secret for fear that such information would impair the commercial success of their devices (Pearson & Bechtel,

1989). Although much has been hidden, ignored, or downplayed, African Americans[1] have a proud history of success in mathematics, science, and technology (Bailey, 1990; Malcolm, 1990; Pearson & Bechtel, 1989).

Despite this legacy, African American high school and college students enroll in fewer mathematics and science courses than do their White peers (Johnson, 1984; Newell, Gipson, Rich, & Stubbenfield, 1980; Powell, 1990; Sells, 1976). A number of personal (e.g., math attitudes, math ability) and environmental factors (e.g., racial composition of the school, adequacy of school facilities and materials) have been identified as having an effect on Black students' participation in, and learning of, mathematics (Matthews, 1984). Studies have shown that the number of Black children showing interest and ability in math during elementary school decreases by the time they reach high school (Kennedy, Jung, & Orland, 1986). For many Black children, the quality of their exposure to math and science is compromised by overcrowded classrooms, inadequate facilities, outdated materials, and little or no computer access (Matthews, 1984; Powell, 1990).

In considering the role of self-concept in academic achievement and career development, several authors have discussed how confusion about one's racial identity may exert negative effects on Black students' social development, academic success, and career development (Ford, Harris, & Schuerger, 1993; Fordham, 1988; Fordham & Ogbu, 1986). High-achieving Black students may have to assume a "raceless persona"

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[1] Throughout much of the text, the terms "African American" and "Black" are used interchangeably. Where most pertinent, "African American" is used to denote Blacks who were born and raised in the United States and share a sociopolitical history dating back to the U.S. slave trade. "Black" refers to people of African descent from Africa, the Caribbean, and the U.S.

(Fordham, 1988) or cope with the burden of "acting White" (Fordham & Ogbu, 1986) in order to succeed academically. It is also quite possible that heightened awareness and pride in one's African or African American roots might affect a Black student's ability to see beyond systematic and institutional barriers toward careers in math and science (Cheatham, 1990). Therefore, in a society where many African Americans feel cut off from the mainstream (especially in terms of education and employment), it is important to examine the personal, contextual, and experiential factors that contribute to the participation, or nonparticipation, of Black students in math- and science-related courses and occupations.

The need for theoretical models to guide research on racial, cultural, and ethnic variables in counseling (Atkinson & Thompson, 1992; Casas, 1984; Ponterotto & Casas, 1990; Smith, 1983) and career development (Fitzgerald & Betz, 1994; Hackett & Lent, 1992; Helms & Piper, 1994) has been highlighted by a number of writers. Bandura's (1977, 1986) self-efficacy theory has been very useful in understanding career-related behaviors, especially career choice (Lent & Hackett, 1987). Much research has been done on the theory's utility in explaining why some people pursue careers in math and science and why some do not (e.g., Betz & Hackett, 1981; Hackett, 1985; Hackett & Betz, 1989; Lent, Lopez, & Bieschke, 1991, 1993). Although ethnic minorities have been included in several studies examining self-efficacy-based models of career choice and development, most studies have either failed to report the racial composition of their samples (e.g., Betz & Hackett,

1981, 1983; Lent, Brown, & Larkin, 1987; Post-Kammer & Smith, 1985), employed small numbers of ethnic minority subjects within their samples (e.g., Lent et al., 1991), or implied that small numbers of minorities were included by indicating the percentage of Whites (usually around 85 - 90%) in the sample (e.g., Bieschke, 1991; Lapan, Boggs, & Morrill, 1989; Lopez & Lent, 1992).

While the debate about the relevance of traditional theories to racial/ethnic groups continues (Brooks, 1990; Hackett & Lent, 1992; June & Pringle, 1977; Smith, 1983), several studies have examined the validity of career self-efficacy theory specifically for people of color (Bores-Rangel, Church, Szendre, & Reeves, 1990; Byars & Hackett, 1995; Church, Teresa, Rosebrook, & Szendre, 1992; Hackett, Betz, Casas, & Rocha-Singh, 1992; Lauver & Jones, 1991; Post, Stewart, & Smith, 1991; Post-Kammer & Smith, 1986; Williams & Leonard, 1988). Most of these studies have found considerable support for the use of this model with minority students (Bores-Rangel et al., 1990; Byars & Hackett, 1995; Church et al., 1992; Hackett et al., 1992; Lauver & Jones, 1991), whereas a few studies provided only partial support (Post et al, 1991; Post-Kammer & Smith, 1986; Williams & Leonard, 1988).

In considering the application of career self-efficacy theory to African Americans, a number of points about the above studies should be noted. First, three (Bores-Rangel et al., 1990; Church et al., 1992; Lauver & Jones, 1991) had no Blacks in their samples and in one (Hackett et al., 1992) Blacks comprised only about 5% of the sample. Therefore,

the utility of the theory for explaining African Americans' career development could not be ascertained from these studies. Second, although a significant portion of Post-Kammer and Smith's (1986) subjects were Black (41%), no analyses were conducted by ethnicity. That is, although this study included varying proportions of different racial/ethnic groups (i.e., 41% Black, 9% Hispanic, 39% White), racial/ethnic differences in self-efficacy and the other variables were not reported. Third, the examination of within-group differences in most of these studies focused primarily on gender. Fourth, only three studies (Byars & Hackett, 1995; Evans & Herr, 1994; Williams & Leonard, 1988) have considered the relation of racial/ethnic self-identification to self-efficacy and other career-related variables.

Problem Statement

Clearly, the generalizability of self-efficacy-based models of career development to Blacks and other racial/ethnic minority groups requires further investigation. Of particular importance is the examination of within-group differences (Parham, 1993). Although gender differences have often been explored (e.g., Betz & Hackett, 1981; Bieschke, 1991; Hackett, 1985), factors such as racial identity attitudes, socioeconomic status (SES), and environmental influences have been relatively ignored.

Lent, Brown, and Hackett (1994) have developed a unified social cognitive model of academic/career interests, choice, and performance that, among other things, attempts to account for how noncognitive variables (e.g., race, gender, SES, opportunity structures) influence the career development process. This model specifically explores the

impact of person, contextual, and experiential factors on career development and occupational choice. Lent et al. hypothesized that these factors may act as precursors, moderators, or direct facilitators (or deterrents) of career-related interests and choice behaviors. This model may help extend theory and research on career self-efficacy to nontraditional populations (e.g., women and racial/ethnic minorities).

The purpose of this study was two-fold. First, it sought to extend the research on the social cognitive model to the math/science choice intentions of Black college students. Using Lent et al.'s model as the overarching conceptual framework, this study examined the relation of personal (e.g., gender), and experiential factors (e.g., role models, personal accomplishments) to the math-related academic/career interests and choice intentions of Black college students. (Contextual factors, like opportunity structures, were not examined.) Second, the study examined the role of Black racial identity attitudes in the career choice process. The following broad research questions were addressed: (1) Is the career self-efficacy model, particularly the unified social cognitive career theory, useful in explaining the math and science preparation behaviors of Black college students?, and (2) Does racial identity play a role in the math/science preparation behaviors of Black college students?

Chapter 2

REVIEW OF THE LITERATURE

Mathematics-related Academic Choice and Career Development in Black Students

A number of authors have examined factors that may influence the academic choice and career development of Black college students (Dawkins, 1989; Lee, 1984; Slaney & Brown, 1983; Thomas, 1984; Tracey & Sedlack, 1985). Educational plans, ability, and mother's aspirations have been found to be more strongly related to professional career aspirations in Black high school seniors than socioeconomic status, gender, parents' education, and father's aspirations (Dawkins, 1989). Similarly, parental influence and high self-concept was found to be predictive of mature career choice attitudes (Lee, 1984). In Black college students, positive self-concept and community service have been found to be predictive of academic achievement, while realistic self-appraisal and community service were found to be related to academic persistence throughout the participants' college careers (Tracey & Sedlacek, 1985).

Particular attention has been paid to factors associated with mathematics-related academic choices and progress (Hall & Post-Kammer, 1987; Hill, Pettus, & Hedin, 1990; Jacobowitz, 1983; Johnson, 1984;

Maple & Stage, 1991; Powell, 1990). Mother's education, choice of major during sophomore year in college, presence or absence of Black role models, and sex-role socialization are among the variables that have been found to be related to Black students' math/science career choices (Hall & Post-Kammer, 1987; Johnson, 1984; Maple & Stage, 1991).

In a literature review conducted to understand reasons why Blacks are severely underrepresented in careers areas that offer the greatest opportunity and financial awards, Hall and Post-Kammer (1987) identified three general areas. Educational factors (e.g., early interest and academic preparation in math and science), social-psychological factors (e.g., family background, sex-role socialization, role models), and career opportunities and economic incentives (e.g., job ceiling) all influence Blacks students' pursuit of math and science careers. The authors concluded that Black students' limited background in math and science may be due to the oppressive position of Blacks in our society. For example, job discrimination reduces incentives for Blacks to study math and science and to prepare for math and science careers. This results in fewer Black scientists to serve as role models (Hall & Post-Kammer, 1987). Maple and Stage (1991) also suggested that Blacks' greater interest in "people-oriented, social" careers permits them to address more directly the pressing problems in Black communities. There appears to be limited knowledge of how math and science can be effective in solving many of these social problems (e.g., discrimination, poverty).

While the quantity and quality of high school mathematics courses are important predictors of entry and success in technical and scientific careers (Johnson, 1984; Sells, 1982), Hill et al. (1990) found that, for Black students, personal contact with a scientist who is knowledgeable about career opportunities was the major contributing "critical" factor to pursuing a career in science. This points to the significance of accessible and career-related role models for Black students. In his review of the literature, Johnson (1984) also noted the contribution of Black role models in math and science to Black students' lack of interest in taking mathematics courses.

Gender

As has been found in the general population, there is also evidence of gender differences in mathematics participation and performance among Blacks (Matthews, 1984). For example, in a longitudinal study of Black and White high school students from the "High School and Beyond" database, Maple and Stage (1990) found in a subsample of 214 Black students, that (a) major choice during sophomore year in high school, (b) number of math and science courses completed by high school senior year, and (c) math attitudes had significant direct effects on math/science college major choice for both Black males and females. Standardized test scores, number of math and science courses taken through the sophomore year in high school, and number of math and science courses planned to be taken through senior year in high school had indirect effects on the field of study choice for both gender groups. Mothers' education was a significant predictor of math/science

college major choice for Black males but not for Black females. Math attitudes were a better predictor for Black females than for Black males (Maple & Stage, 1990).

Using background and achievement variables as predictors of major field choice, Thomas (1984) found that during childhood, Black women were less likely to be interested in becoming scientists, participating in science clubs, and taking advanced high school mathematics than were Black males. By contrast, Black females were more interested in pursuing careers that would enable them to help people and society than those that would provide financial achievements (Thomas, 1984).

Socioeconomic status

The data on the role of SES is less clear than that addressing gender differences. Hill et al. (1990) noted that most of the groups (i.e., Blacks, Hispanics, Native Americans) that are disportionately economically and socially disadvantaged are underrepresented among U.S. scientists and engineers. Several studies have found SES of family of origin to be related to selection of both college major and career (Hill et al., 1990; Reyes & Stanic, 1988), however, Thomas (1984) failed to find significant results. Reyes and Stanic (1988) presented a model which identified five factors that explain differences in mathematics achievement among students of different race, sex, and SES. These factors include societal influences, school mathematics curricula, teacher attitudes, student attitudes, achievement-related behavior, and classroom processes.

There are also some indications that the SES of a significant

proportion of a student's school also affects (at least indirectly) the quality of education available to the student. In a recent report on a national assessment of Chapter 1 of the Education Consolidation and Improvement Act of 1981, Kennedy et al. (1986) found that the average achievement scores of students in a school declined as the proportion of poor students in the school increased: ". . . even after student and family characteristics ha[d] been taken into account, increases in the proportion of poor children in a school were associated with decreases in average starting achievement levels and even occasionally with decreases in learning rates over time" (Kennedy et al., 1986, p. 24). Whether one is examining the SES of students or of their educational environment, it is clear that more research that considers the role of SES in mathematics-related career choice and development is needed.

Self-concept and Career Development

Most, if not all, of the major career theories address the impact of self conceptualizations on the career development process (Blustein, 1994). Career choice is viewed as one avenue in which a person can elect to express his or her self-concept (Super, 1963). In part, individuals assess the suitability of a particular occupation (or occupations) based on their self-concept (Gottfredson, 1981, 1985). Even if choice of occupation is limited or perceived as non-existent, how one maneuvers oneself within one's job can be seen as an expression of one's self-concept (cf. Gainor & Forrest, 1991). Further, confusion about one's self-concept is believed to contribute to difficulties in

developing career-related interests, establishing career goals, and pursuing available vocational options (Blustein, 1994; Osipow, 1983).

Empirical support has been found for career self-concept theory (Osipow, 1983; Savickas & Lent, 1994; Super, 1990; Super, Savickas, & Super, 1996). Findings support the notion that career choice is a reflection of self-concept (Osipow, 1983). One study in particular (Robinson & Cooper, 1984) showed self-concept to be positively related to academic success for college students majoring in engineering and technology. As mentioned earlier, positive self-concepts have also been found to predict the academic success and science career preferences of Black students (Jacobwitz, 1983; Tracey & Sedlacek, 1989).

Two constructs, self-efficacy and racial identity, each of which are viewed as integral components of self-concept (self-efficacy: Super, 1990; Super et al., 1996; racial identity: Cross, 1991; Helms, 1990), have been explored in terms of their relationship to career development. The former has been researched extensively. The latter, however, has been investigated to a lesser degree. The present study attempted to examine the role of these two self percepts (in addition to other variables) within the career choice process of Black college students.

Self-efficacy Theory

Bandura's (1977, 1986) self-efficacy theory has its origins in a social cognitive model of behavior (a direct successor of social learning theory; Lent & Hackett, 1987) which emphasizes the effects of self-referent thought on human behavior. Social cognitive theory highlights the "importance of anticipation, forethought, and active

construction of meaning in interaction with environmental events" (Lent et al., 1994, p. 87).

Bandura (1986) defined self-efficacy expectations as "people's judgments of their capacities to organize and execute courses of action required to attain designated types of performances" (p. 391). Self-efficacy is considered a domain-specific construct that is a dynamic aspect of the self-system (Bandura, 1986; Lent & Hackett, 1987).

Self-efficacy expectations vary along three dimensions: generality, level, and strength. Generality refers to the range of domains or situations in which a person considers him or herself efficacious. That is, individuals may perceive themselves as efficacious in certain specific activities or across a wide range of situations. Level concerns the degree of difficulty of the task or behaviors at hand. In other words, efficacy beliefs may be limited to simple tasks or extend to moderately difficult and even more onerous tasks within a particular domain. Strength refers to the confidence a person has in his or her performance. For example, weak efficacy expectations may be easily modified by disconfirming experiences, whereas strong self-efficacy expectations persist despite mounting obstacles (Bandura, 1986; Lent & Hackett, 1987).

According to Bandura (1986), there are four major sources of self-efficacy beliefs: (a) personal performance accomplishments, which are based on actual mastery experiences; (b) vicarious learning, or seeing similar people successfully engage in the specific behavior; (c) verbal persuasion, or encouragement; and (d) physiological states and

reactions, such as autonomic arousal, mood, and feelings of excitement, fear, pain, and fatigue. In general, personal performance accomplishments are assumed to provide the most compelling information about one's competence (Bandura, 1986).

Perceived self-efficacy expectations are distinct from response-outcome expectations. Outcome expectations are consequences that are anticipated to result from specific actions. Whereas self-efficacy beliefs address "can I do this?", outcome expectations involve "if I do this, what will happen?" (Lent & Hackett, 1987, p. 348). Lent et al. (1994) posited that outcome expectations are informed by sources similar to those that influence self-efficacy (e.g., personal performance accomplishments, vicarious learning).

Bandura (1984, 1986) argued that while "people act on their judgments of what they can do, as well as on their beliefs about the likely effects of various actions" (Bandura, 1986, p. 231), self-efficacy generally has a more influential effect on behavior than do outcome expectations. That is, "a strong sense of efficacy . . . may sustain efforts even where outcome attainment is uncertain" (Lent et al., 1994, p. 84).

According to Bandura's theory, intentions or goals play important roles in the self-regulation and persistence of behavior (Bandura, 1986; Lent et al., 1994). Defined as "the determination to perform certain activities or to bring about a certain future state of affairs" (Bandura, 1986, p. 467), goal intentions have various motivational,

self-efficacy, and interest enhancement effects on behavior (Bandura, 1986). "By setting goals, people help to organize and guide their behavior, to sustain it over long periods of time even in the absence of external reinforcement, and to increase the likelihood that desired outcomes will be attained" (Lent et al., 1994, p. 84). To be effective, goals must be specific, challenging, and temporally proximal in relation to goal-relevant behaviors (Bandura, 1986).

Despite earlier criticisms on theoretical and methodological grounds (Eastman & Marzillier, 1984; Marzillier & Eastman, 1984), Bandura's model has received much empirical attention. Self-efficacy theory has been applied to a variety of psychological domains, such as anxiety and phobias (Bandura, 1986), adaptation to chronic illness (Schiaffino, Revenson, & Gibofsky, 1991), relationship adjustment and persistence (Lopez & Lent, 1991), and client attrition from counseling (Longo, Lent, & Brown, 1992). The relation of self-efficacy to academic performance and persistence and career-related behaviors has also been studied extensively (see Lent & Hackett, 1987, and Multon, Brown, & Lent, 1991, for reviews). However, in most of these studies, Blacks make up a small portion of research samples, if they are included at all.

Career self-efficacy

Career self-efficacy is a generic term that refers to those personal efficacy judgements that relate to the wide range of behaviors involving career choice and development (Betz & Hackett, 1986; Lent & Hackett, 1987). Nancy Betz and Gail Hackett (1981; Hackett & Betz, 1981) have been credited with taking the initial step in applying self-efficacy to

career development. They postulated that differences between men's and women's career choices may be due to differences in efficacy beliefs (Hackett & Betz, 1981). Hackett and Betz (1981) also argued that men and women receive differential access to the primary sources of efficacy information.

In a study of 235 undergraduate students, Betz and Hackett (1981) investigated the possible role of self-efficacy expectations in the continued underrepresentation of women in traditional professional and managerial occupations. While men expressed equal levels of self-efficacy for both traditional (for women) and nontraditional occupations, women expressed greater self-efficacy for traditional occupations and lower self-efficacy for nontraditional occupations. Self-efficacy expectations were also found to be related to expressed interests for both men and women.

As Hackett and Betz (1981) originally speculated, career self-efficacy also appears to mediate gender differences in career choice and development (Lent & Hackett, 1987). Such differences appear to be due to differential sex-role orientation, socialization, and educational experiences transmitted via one's environment (Lent & Hackett, 1987; Lent et al., 1994).

In an early critical review of the career self-efficacy literature, Lent and Hackett (1987) concluded that self-efficacy offers promise for understanding career behaviors such as college major choices and academic performance. This promise has been proven evident through the many studies conducted on the utility of self-efficacy in the career

development process. Topic areas in which career self-efficacy theory has been applied include vocational interests (Lapan et al., 1989; Lenox & Subich, 1994; Lent, Larkin, & Brown, 1989; Rotberg, Brown, & Ware, 1987), career choice (Betz & Hackett, 1981; Lent, Brown, & Larkin, 1986; Rotberg et al., 1987), management of stressful career events (Stumpf, Brief, & Hartman, 1987), academic persistence and success (Lent, Brown, & Larkin, 1984, 1986, 1987), and occupational stress and strain (Matsui & Onglatco, 1992). Such studies have been conducted with college (e.g., Lent et al., 1984, 1986, 1987; Taylor & Betz, 1983) and noncollege student (e.g., Post-Kammer & Smith, 1985: eighth and ninth-grade college-bound students; Post-Kammer & Smith, 1986: disadvantaged students in a precollege program) samples, with largely successful results. However, most of these studies have either failed to report the racial/ethnic backgrounds of their samples (e.g., Betz & Hackett, 1981; Lent et al., 1984, 1986, 1987) or employed predominately White participants (e.g., Lapan et al., 1989; Lenox & Subich, 1994).

Some investigations have been conducted examining career self-efficacy with racial and ethnic minority group members. In studies conducted with ethnically diverse samples, career self-efficacy was found to be related to occupational consideration (Bores-Rangel et al., 1990; Byars & Hackett, 1995; Church et al., 1992; Lauver & Jones, 1991; Rothberg et al., 1987) and academic achievement (Hackett et al., 1992). Investigations with distinct ethnic groups (Japanese college students, Matsui, Ikeda, & Ohnishi, 1989; Black college students, Williams & Leonard, 1988) have yielded similar results, with some discrepancies.

For example, although Williams and Leonard (1988) found career self-efficacy to be predictive of academic progress in Black computer science and engineering students, traditional academic indicators (e.g., high school grade point average and SAT mathematics scores) had greater predictive utility.

It is important to note that Matsui et al.'s (1989) findings replicated those of Betz and Hackett (1981). Like the students in the Betz and Hackett (1981) study, Japanese men reported higher efficacy beliefs for both male- and female-dominated occupations, whereas Japanese women indicated lower efficacy expectations for male-dominated occupations. Women's perceptions of fewer female role models in male-dominated occupations, views of self as feminine, and low math confidence contributed to their lower self-efficacy for male-dominated occupations. Matsui et al.'s (1989) findings highlight the strength of sex-role socialization and stereotypes even in a non-Western culture.

Hackett and Lent (1992), updating their previous literature review (Lent & Hackett, 1987), reaffirmed their observations that "there is growing empirical support for the extension of self-efficacy theory to career-relevant behavior" (p. 362). Overall, career self-efficacy has been found to be a significant factor in the career development process. However, more empirical research is needed in extending self-efficacy theory to the study of diverse populations and environmental contexts (Lent & Hackett, 1987).

Math self-efficacy

Bandura's self-efficacy theory and Hackett and Betz's extension of that theory have also been applied to the domain of mathematics-related behaviors. Mathematics self-efficacy expectations have been found to be related to college students' mathematics-related course choice and performance (Lent et al., 1993), math-related major choice (Hackett, 1985), as well as selection of science-based majors (Betz & Hackett, 1983) and careers (Lent et al., 1991). Siegel, Galassi, and Ware (1985) found the social learning model (including self-efficacy, outcome expectations, math skills, and incentives) to be superior to a math aptitude/anxiety model in predicting mathematics performance. Math self-efficacy was also found to be more predictive of mathematics problem-solving performance than math self-concept, perception of math usefulness, prior mathematics experience, or gender (Parajes & Miller, 1994).

Research has found support for the substantial role of personal performance accomplishments as a source of math-related efficacy expectations (Lopez & Lent, 1992; Lent et al., 1991; Matsui, Matsui, & Ohnishi, 1990). However, the utility of vicarious learning, verbal persuasion, and emotional arousal appears to vary depending on the population being considered. For example, contrary to Lent et al.'s (1991) findings with college students in which verbal persuasion, vicarious learning, and emotional arousal did not explain significant additional variance in efficacy beliefs after controlling for personal performance, Lopez and Lent (1992) found emotional arousal to add

significantly beyond perceived personal performance in predicting math self-efficacy in high school students.

Noting women's continued underrepresentation in most scientific and technical fields, several studies (Betz & Hackett, 1983; Bieschke, 1991; Lent et al., 1991, 1993) have found mathematics self-efficacy to be useful in explaining gender differences in math- and science-related career choice. The findings of Lent et al. (1993) indicate that mathematics self-efficacy may explain gender differences in mathematics-related course interest and enrollment intentions.

A few published empirical investigations have extended research on math/science self-efficacy to distinct ethnic/racial groups (Matsui et al., 1990; Post et al., 1991; Post-Kammer & Smith, 1986). Consistent with research on predominantly European samples, self-efficacy beliefs help explain the math/science career-related behaviors of people of color. For example, in a study of Japanese undergraduate students (Matsui et al., 1990), men indicated higher math self-efficacy than women. When sources of efficacy information were examined, performance accomplishments, vicarious learning, and emotional arousal uniquely contributed to math self-efficacy, but verbal persuasion did not. Matsui et al. (1990) speculated that a high correlation between verbal persuasion and personal performance served to cancel the unique contribution of verbal persuasion to math self-efficacy. Their findings suggest that for Japanese students, social encouragement may be just as important as personal accomplishments in developing positive judgements about their capacities to solve math problems and engage in math-related

tasks.

To date, only two published studies have examined the role of perceived math-related efficacy expectations in Black students (Post et al., 1991; Post-Kammer & Smith, 1986). Other investigations have explored "internalized belief systems about mathematics" (Hyde, Fennema, & Lamon, 1990), but have focused on math attitudes (Maple & Stage, 1991; Matthews, 1984), math self-concept (Jacobowitz, 1983), learned helplessness (Powell, 1990), and perceived utility of mathematics in future jobs and everyday life (Matthews, 1984).

Partially supporting math self-efficacy theory, Post et al. (1991) studied 111 first-year Black college students and found math/science self-efficacy to be predictive of consideration of math/science related occupations in Black men, but not in Black women. For Black women, math-related interest was the strongest predictor of math/science occupational consideration.

In a more ethnically diverse sample, Post-Kammer and Smith (1986) found the reverse finding. Among the 131 pre-college program students (39% White, 41% Black, 19% Hispanic, Asian, and Native American), both interests and self-efficacy were significant predictors of math and nonmath-related occupational considerations for women. However, only interests were predictive of such considerations for men.

While these studies provide some encouragement for the applicability of social cognitive theory in understanding the participation patterns of Blacks in math/science academic and career pursuits, important

methodological issues need to be considered in examining the results of these studies. For example, in the studies of Post et al. (1991) and Post-Kammer and Smith (1986), self-efficacy expectations are pitted against interests in the data analysis. Because interests have been shown to mediate the effects of self-efficacy on math/science career consideration (Lent et al., 1994), interests may cover up the significance of self-efficacy in simple regression analyses. In addition, by limiting their analyses to a nominal or demographic classification of race in which psychological characteristics are then inferred (Casas, 1984; Helms, 1994a), the impact of cultural influences or environmental perceptions on career development remains unexplored.

Social Cognitive Career Theory

Lent, Brown, and Hackett (1994) have proposed a social cognitive framework that attempts to move toward an overarching theory of career development while incorporating the impact of cultural influences. Derived primarily from Bandura's (1986) model and inspired by recent attention to theoretical convergence in vocational psychology (Lent, Brown, & Hackett, 1996; Lent & Hackett, 1994), this framework focuses on the mechanisms by which people exercise personal power in their career development process. While emphasizing three social cognitive mechanisms that appear particularly relevant to career development (i.e., self-efficacy beliefs, outcome expectations, and goal mechanisms), Lent et al's model also gives considerable attention to how other person (e.g., gender), contextual (e.g., support systems), and experiential (e.g., learning experiences) factors interact to enhance or

constrain an individual's personal agency.

Personal determinants include biological predispositions, such as basic skill potentialities and affective dispositions, and overt physical attributes, such as race and sex. Acknowledging recent arguments distinguishing sex and race (both biological variables) from gender and ethnicity (sociocultural constructs), Lent et al. (1994) highlight the psychological and social significance of these biological attributes in the career development process.

> By viewing gender and ethnicity as socially constructed aspects of experience, it is possible to emphasize those sociocultural agents that help shape the career development process, e.g., by orchestrating the learning opportunities to which particular children and adolescents are exposed, as well as the nature of the outcomes they receive for performing different activities. (Lent, et al., 1994, p. 105)

Specifically, the authors believe that "the effects of gender and ethnicity on career interests, choices, and performances will be partly mediated by the differential learning experiences and consequences that give rise to self-efficacy and outcome expectations" (p. 105). Further, "gender and cultural factors are also typically linked to the opportunity structure within which academic/career goals are framed and implemented" (p. 105).

Contextual and experiential factors speak to the influences of both objective features as well as perceived aspects of the environment on the career development process. Such factors consist of distal and proximal contextual affordances (or opportunity structure variables) as well as the experiential sources of self-efficacy and outcome beliefs. Distal contextual influences (e.g., emotional and financial support for

engaging in particular activities, stereotyping and discrimination, range of potential academic/career role models, opportunities for differential task exposure and skill development) precede and help shape self-cognitions and interest. Proximal opportunity structure variables, which come into play at critical choice junctures, include, but are not limited to, one's personal career network contacts, unplanned life events, and job availability in one's preferred field (Lent et al., 1994). In their scheme, "contextual factors (a) help shape the learning experiences that fuel personal interests and choices, and (b) comprise the real and perceived opportunity structure within which career plans are devised and implemented" (Lent et al., 1994, p. 107).

Lent et al. (1994) posit that there are three predominant causal paths through which person, contextual, and experiential factors may influence career-related interests and choice behavior. Specifically, these factors may serve as: (a) precursors of social cognitive variables (i.e., self-efficacy expectations and outcome expectations); (b) moderators of certain key theoretical relationships (e.g., interests to goals); or (c) direct facilitators or deterrents (e.g., physical requirements or discriminatory practices that restrict access to particular choice options) (Lent et al., 1994).

Although admittedly tentative, their model attempts to explain "central, dynamic processes and mechanisms through which (a) career and academic interests develop, (b) career-related choices are forged and enacted, and (c) performance outcomes are achieved" (Lent et al., 1994,

p. 80). According to this social cognitive model, the career development process proceeds as outlined below (see Figure 1):

a. Self-efficacy beliefs and outcome expectations, both obtained through direct and vicarious learning experiences, together determine academic and career interests.

b. Academic/career interests give rise to academic or vocational goals (e.g., career aspirations and choice intentions).

c. Goals promote choice-related actions (e.g., efforts to implement one's aspirations or choice intentions) which, in turn, produce various performance outcomes.

d. These performance outcomes then feed back to self-efficacy and outcome expectations via learning experiences, thus reinforcing or modifying interests and goals.

e. Person inputs (e.g., gender, race, biological predispositions) and contextual factors (e.g., opportunity structure, support system) have moderating and/or mediating effects on the major pathways of career development (Lent et al., 1994).

Unlike most other career development theories, the social cognitive model places equal importance on the objective as well as subjective aspects of the interaction between the individual and the environment.

Comprehensive qualitative and meta-analytical research reviews (Betz & Hackett, 1986; Hackett, 1995; Hackett & Lent, 1992; Lent et al., 1994; Lent & Hackett, 1987; Multon et al., 1991; also see Coon-Carty, 1995, and Sadri & Robertson, 1993, cited in Lent et al., 1996) indicate strong support for Lent et al.'s (1994) career/academic-specific elaboration of

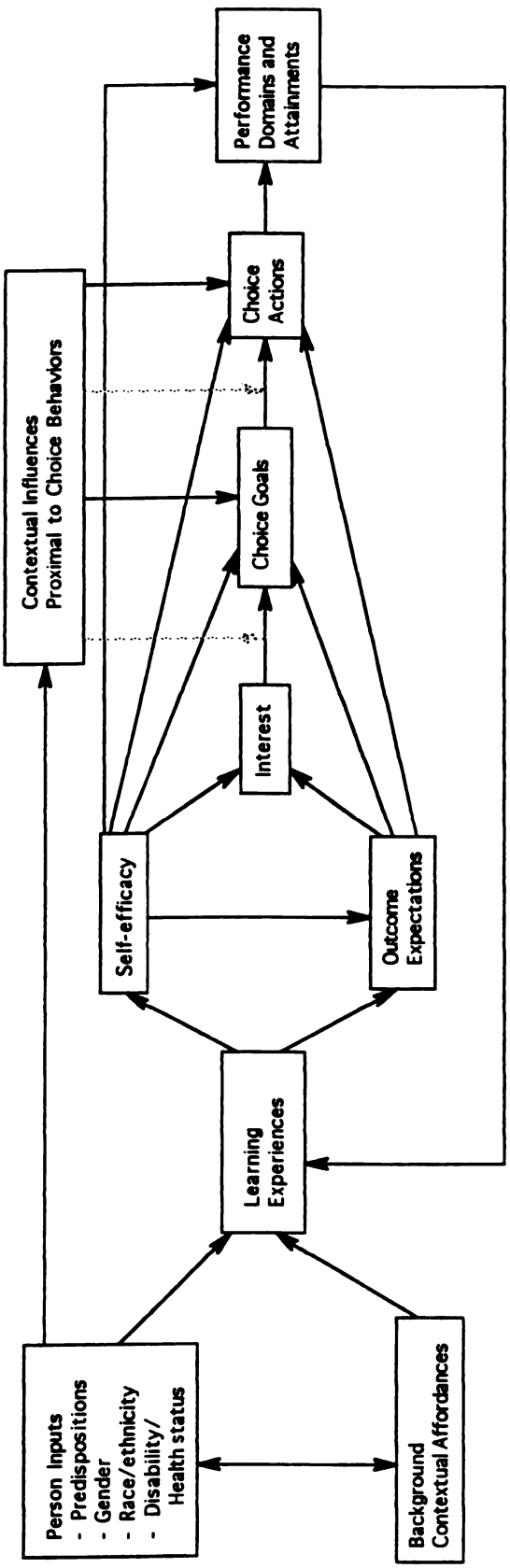

Figure 1. Unified social cognitive model of career interests, choice, and performance. Copyright 1993 by R. W. Lent, S. D. Brown, and G. Hackett. Reprinted by permission. Dotted arrows indicate moderator effects.

Bandura's (1986) social cognitive theory. In addition, several recent studies (Fouad & Smith, 1996; Lapan, Shaughnessy, & Boggs, 1996; Lent, Brown, Gover, & Nijjer, 1996; Lent, Lopez, Brown, & Gore, 1996; Lopez, Lent, Brown, & Gore, 1997) provide support for many, if not all, of the theoretical assumptions of the social cognitive career model. The authors of most of these studies have heeded Lent et al.'s (1994) suggestion of using research methods that would allow for testing causal relationships. In particular, latent variable models (including path, structural, and factor analyses; Loehin, 1992), have proven informative in understanding the likely causal relations among the social cognitive variables (e.g., self-efficacy, outcome expectations, interests).

Using average weighted correlations and partial correlations (*pr*) as the basis for their meta-analysis of relevant published research with adolescent and adult samples, Lent et al. (1994) found support for their models of interest development, choice, and performance. Self-efficacy and outcome expectations were found to be related to vocational interests (r = .53, p < .001; r = .52, p < .001, respectively) with self-efficacy and outcome expectations each accounting for about 27% of the variance in career interests (Lent et al., 1994). A self-efficacy/ outcome expectations relationship was also found (r = .49, p < .01; Lent et al., 1994.) A small, but significant relationship was found between abilities and interests (r = .20, p < .01), however, this relation was eliminated when the effect of self-efficacy was controlled (*pr* = .00). That is, self-efficacy fully mediates the relationship between academic

abilities and vocational interests.

In a longitudinal study, Lapan et al. (1996) used a linear path model and found empirical support for a strong relationship between self-efficacy and interests as well as the mediating role of efficacy beliefs on the relationship between objective ability and interests. In Lopez et al.'s (1997) path analysis of data gathered from high school students enrolled in geometry and advanced algebra courses, self-efficacy also emerged as having a mediating role on the ability-interests relationship. Further, although objective ability did not have a direct effect on interests, the fully mediated model tested by the authors (in which ability was hypothesized to influence self-efficacy which in turn affects interests) did not provide a significantly better fit than an hypothesized partially mediated model (whereby interests were expected to be affected by ability directly as well as indirectly through self-efficacy).

In terms of choice goals, Lent et al.'s (1994) analysis revealed a substantial correlation between goals and interests (r = .60, p < .001). Both self-efficacy and outcome expectations yielded some direct effects on goals (r = .40, p < .01; r = .42, p < .01, respectively; Lent et al., 1994). Self-efficacy and outcome beliefs also affected goals largely through interests. That is, when the effect of interests was controlled, the relations of self-efficacy and outcome expectations to goals were substantially reduced (pr = .12, p < .01; pr = .16, p < .05, respectively; Lent et al., 1994). Lapan et al. (1996) also found empirical support for the influence of both efficacy expectations and

math-related interests on the crystallization of college major choice goals. Math self-efficacy also mediated gender differences in math/science major choice.

In one of the first published investigations testing the social cognitive career model with an ethnically diverse sample, Fouad and Smith (1996) found the model to be quite adequate in explaining the math/science-related career behavior for middle school students (in general) as well as for the three distinct ethnic groups (Hispanics, Whites, and African Americans) making up their sample. Consistent with prior research, self-efficacy predicted outcome expectations, interests, and intentions. Interests and intentions was also determined by outcome expectations. Interests had a direct effect on intentions to pursue math/science activities or goals.

Investigations of experiential sources of career-related efficacy beliefs support propositions that self-efficacy is related to personal performance accomplishments, vicarious learning, verbal persuasion, and emotional arousal (Lent et al., 1994). Also consistent with the model, personal performance accomplishments emerged as the strongest source of efficacy information. Employing a cognitive assessment technique traditionally utilized in social and cognitive psychology, Lent, Brown, Gover, and Nijjer (1996) found that personal performance accomplishments were the most common, as well as the most influential, source of efficacy beliefs among the 101 college students they studied. Math-related interest was reported as the second most common and influential basis for self-efficacy.

A number of interesting, and even perplexing, findings emerged from these recent studies. First, Lent, Lopez, Brown, and Gore (1996) found that despite high correlations among three of the four efficacy sources (i.e., personal performance, verbal persuasion, emotional arousal), suggesting support for a two-factor model, the four-factor model (with each of the four sources of efficacy beliefs serving as distinct factors) offered a better fit than the two-factor model in both their high school and college samples. The five-factor model, identical to the four-factor model with the exception of vicarious learning being subdivided into separate peer and adult modeling components, provided an even better fit with the high school sample. The authors also found support for a hierarchical factor structure to explain these results with personal performance, social persuasion, and emotional arousal each loading on a higher order latent dimension reflecting direct, personal experiences with mathematics. This higher order dimension was distinct from indirect, vicarious experiences with mathematics.

Another interesting finding addresses gender differences found in the advanced algebra sample of the Lopez et al. (1997) study. (No significant gender differences emerged from the geometry sample.) Compared to the male students, female students reported experiencing higher levels of math-related social persuasion and vicarious influence. (They also received higher course grades.) While Lopez et al. (1997) caution against premature generalization of this finding as evidence of growing efforts to encourage young women to pursue and succeed in math,

it does mark an important deviation from previous findings of studies on women and math.

In a departure from the theoretical propositions of social cognitive career theory, Fouad and Smith's (1996) revised model revealed a direct effect of gender and age on math/science interests. That is, male students had lower math/science interests than female students and older students had lower math/science interests than younger students. Gender did not have a direct effect on self-efficacy and age did not have a direct effect on outcome expectations. The effects of such person inputs, such as gender and age, on self-efficacy and outcome expectations are partly mediated by learning experiences (Lent et al., 1994). However, omission of the experiential sources from Fouad and Smith's (1996) path analysis prevented examination of this phenomenon.

While fruitful in providing evidence in support of the theoretical assumptions of Bandura (1986) and Lent et al. (1994), the results of these studies must be viewed with some caution. First, the relatively large number of parameter estimates for the sample size (N = 101) in the Lapan et al. (1996) study may have resulted in a highly "overparameterized" model. Such models can produce a Type II error in which the model is assumed to adequately explain the data when in fact it does not (Hu & Bentler, 1995).

In addition, as with earlier self-efficacy studies, generalizability of the findings to African American and other ethnic minority populations can not be made given the limited number of students of color included in these samples. One exception is the Fouad and Smith

(1996) study; however, generalizability of this study is limited by the age and lack of SES variability of its sample. Further, as indicated earlier, the authors did not examine the impact of learning experiences for their sample. Given the theoretical importance of these variables as mediators of the relationship between person inputs (e.g., race/ethnicity, gender, SES) and the social cognitive variables (Lent et al., 1994), it is critical that sources of self-efficacy and outcome expectations be examined (Fouad & Smith, 1996). More studies replicating or extending these investigations need to be done with racially diverse populations.

Black Racial Identity Theory

Another notion considered to be a part of global self-concept is racial identity (Cross, 1991; Helms, 1990). Racial identity is thought to explain at least some of the diversity of attitudes, cognitions, and behaviors occurring within a racial/ethnic group.

Although Lent et al. (1994) addressed the characteristic reactions that race and gender may evoke from the sociocultural environment as well as a person's perceptions of the environment's response, they did not account for the individual's own perceptions, attitudes, or world views toward his or her racial group (i.e., racial identity attitudes). That is, the social cognitive model emphasizes, as have other vocational/career theories, an individual's racial classification or designation; it also acknowledges the diversity within particular racial groups. However, it does not account for the specific manner in which individuals in that group understand and react to differential access to

the world of work based upon their membership in that group (Helms & Piper, 1994; Parham & Austin, 1994).

In the past three decades, racial/ethnic identity has proven useful in understanding the psychological development and diversity within the Black population (Parham & Williams, 1993). Models of Black identity or nigrescence (a French word meaning the process of becoming Black; Cross, 1991) are a fairly recent phenomenon, stemming from the ideological emphasis of the Black power or Black consciousness movement which began in the late 1960's (Cross, Parham, & Helms, 1991). Prior to this social movement, racial identity research focused on elements of Black self-hatred. In the 1970's, a number of nigrescence models appeared in the literature (e.g, Cross, 1971; Jackson, 1975; Toldson & Pasteur, 1975). Of the numerous models, it is the Cross (1971, 1991) Nigrescence model that has yielded the most empirical research and theoretical advances.

The term "racial identity" refers to "a sense of group or collective identity based on one's perception that he or she shares a common racial heritage with a particular racial group" (Helms, 1990, p. 3). Traditionally discussed primarily in terms of stages, Helms (1986, 1990) has asserted that Cross' use of stages are synonymous with Sue's (1978) notion of world views. Sue defined world views as

> the way in which people perceive their relationship to nature, institutions, other people, and things. World view constitutes our psychological orientation in life and can determine how we think, behave, make decisions, and define events. Our cultural upbringing and life experiences frequently determine or influence our world views (Sue, 1978, p. 458).

Therefore, racial identity refers to "the portion of a person's world

view that is shaped by society's manner of attributing value to a person's socially ascribed racial/ethnic group" (Helms, 1986, p. 62). Although Cross described each of the racial identity stages in terms of a complex interaction of attitudes, behaviors, cognitions, and feelings, current measures (e.g., the Racial Identity Attitude Scale; Parham & Helms, 1981; Helms & Parham, 1990b) focus on one aspect of the stages -- attitudes associated with the racial identity stages.

Cross outlined his model as having five stages (Pre-encounter, Encounter, Immersion/Emersion, Internalization, and Internalization/ Commitment). However, Helms and her associates have focused their theory and research efforts on the first four stages, explaining that there appear to be few differences between the fourth and fifth stages (Cross, 1995a; Helms, 1990). Racial identity stages are considered to be types of attitudes or world views which develop at different rates and can be held at different times in the course of a person's development (Helms, 1990; Parham, 1989). The four types of Black racial identity attitudes differ in the degree to which a person emphasizes his or her Blackness as he or she perceives it.

Pre-encounter

The general theme of this first stage is "idealization of the dominant traditional White world view and, consequently, denigration of a Black world view" (Helms, 1990, p. 20). Although self-hatred has been viewed as a central characteristic of the Pre-encounter stage, Cross (1991, 1995a) has argued that this notion has been greatly exaggerated. (Cross, 1991, has suggested that certain clinical experiences of

psychologists and counselors may lead to different conclusions.) In actuality, this stage covers a wide range of attitudes. Black individuals with pre-encounter attitudes may (a) give little significance to their Blackness; (b) view race as a problem or an imposition; (c) possess anti-Black attitudes; (d) hold "distorted images of the historical, cultural, economic, and political potential of Black people" (Cross, 1991, p. 193); (e) prefer a Eurocentric cultural perspective; (f) be overly sensitive about racial issues, leading to a continual vigilance about negative stereotypes of Blacks or even anxiety over things being "too Black"; (g) interpret Black problems from a "blame-the-victim" perspective and believe in an assimilation-integration approach to race-conflict resolution; and/or (h) possess value orientations having low race salience and/or little nationalistic significance (Cross, 1991). More recently, Cross (1994) has termed this stage of racial identity as "the pre-change identity" (p. 122), emphasizing that

> . . . the person has an identity grounded in something other than race, such as religious orientation. That is, the person may have an intact and functional identity, but one which, in the overall scheme of things, makes being Black somewhat insignificant (Cross, 1994, p. 122)

Cross (1991) has noted that "pre-encounter Black [sic] are part of the diversity of the Black experience and must be understood as such" (p. 198).

Pre-encounter attitudes are produced by instances of success as well as oppression. Blacks in this stage typically credit their successes

and achievements to their own merit. Consequently, if they fail at an important task, it is because (in their perception) they are deficient in effort, ability, or some other personal attributes. Exceptionality or deficiency is defined according to how well or how poorly one fits into White culture and demonstrates those traits that the person believes are typical of White culture (Helms, 1990).

Encounter

This stage of racial identity consists of two phases. The first phase is characterized by a significant event or series of events in the person's life that challenges his or her view of Blackness (Helms, 1990). These events are idiosyncratic to the individual and typically catch the person "off guard" (Cross, 1991). The encounter itself need not be negative, but often has a negative flavor (Cross, 1995a). In the second phase, the individual struggles with feelings of confusion, hopelessness, anxiety, depression, and eventually anger and euphoria (Helms, 1990), which spark a "frantic, determined, obsessive, extremely motivated search for Black identity" (Cross, 1991, p. 201). The decision to begin a new journey toward a new Black identity is made (Cross et al., 1991).

Immersion/Emersion

Cross (1971, 1978, 1991) described this middle or transition stage (Cross, 1994) in two phases: Immersion and Emersion. During this stage, the Black person learns and experiences meaning and value in his or her race and culture by psychologically and, if possible, physically withdrawing into Blackness and Black culture -- first as Blackness is

defined by others (Immersion) and then as it becomes defined by the individual (Emersion). The individual is "swept along by a sea of Blackness" (Cross, 1995a, p. 63).

Immersion is characterized by a "strong, powerful, dominating sensation that is constantly energized by rage (at White [sic] people and culture), guilt (at having once been tricked into thinking Negro ideas), and a developing sense of pride (in one's Black self, in Black people, and in Black culture)" (Cross, 1991, p. 203). A primary mode of communication with others (regardless of race) frequently includes confrontation, bluntness, and directness (Cross, 1995a). Dichotomous or "either/or thinking" is characteristic of the cognitive development of persons in the Immersion phase (Cross, 1978). Black students with Immersion racial identity attitudes may avoid certain academic endeavors in which they obviously have abilities because such endeavors, according to certain stereotypes of Black people, are not accepted as "Black" behavior (Helms, 1990).

In the Emersion phase, the Black person engages in cathartic experiences within a supportive Black community. With such participation, the person can begin to sort out the strengths and weaknesses of Black culture and being Black. The intensity found in the Immersion phase begins to level off as a result of exposure to "advanced" role models (Cross, 1995a). This allows the development of a positive, nonstereotypic African American perspective. As the person begins feeling greater self control, he or she moves into the next stage of Black racial identity (Helms, 1990).

Internalization

During this stage, there is a shift away from how others define Blackness and a move toward confidence in one's personal standards of Blackness (Cross, 1991). There is a sense of pride and security in one's race and identity. The internalized Black person is able to re-establish relationships with Whites and to analyze Whiteness and White culture for both its strengths and weaknesses (Helms, 1990). This stage is also characterized by social activism designed specifically to eliminate oppression, regardless of the race of the perpetrators and victims (Helms, 1990). The internalized Black identity tends to serve three dynamic functions:

> (1) to defend and protect a person from psychological insults, and, where possible, to warn of impending psychological attacks that stem from having to live in a racist society; (2) to provide social anchorage and meaning to one's existence by establishing black [sic] people as a primary reference group; (3) to serve as a conduit or point of departure for gaining awareness about, and completing transactions with, the broader world of which blackness [sic] is but a part (Cross et al., 1991, p. 328).

In summary, Nigresence models begin with some understanding of people who place low salience on being Black. However, after encountering an experience that challenges their previous perspectives, they find a way to change their identity to make it reflect high salience for race by immersing themselves in a transition stage. Individuals then may progress to a point where the new identity takes hold and is internalized (Cross, 1994).

Most of the studies on Black racial identity use the Racial Identity

Attitudes Scale (RIAS) developed by Janet Helms and Thomas Parham (Helms & Parham, 1990; Parham & Helms, 1981). These studies have shown racial identity attitudes as relating to self-actualization and affective states (Parham & Helms, 1985b), self-esteem (Parham & Helms, 1985a), value orientations (Carter & Helms, 1987), psychological functioning (Carter, 1991), and cognitive style (Helms & Parham, 1990a). In the counseling domain, racial identity has been found to be predictive of attitudes toward counseling (Ponterotto, Anderson, & Grieger, 1986) and counseling centers (Austin, Carter, & Vaux, 1990), preferences for counselor race (Helms & Carter, 1991; Parham & Helms, 1981), perceptions of White counselors' cultural sensitivity (Bradby & Helms, 1990; Pomales, Claiborn, & LaFromboise, 1986), and preferences for counselor characteristics (Ponterotto, Alexander, & Hinkston, 1988). Racial identity attitudes have also been found to contribute to the prediction of Black college students' participation in cultural and noncultural campus organizations (Mitchell & Dell, 1992).

Recently, Parham and Williams (1993) found racial identity attitudes to be related to the geographical region of one's birth and upbringing, as well as educational level and income. Racial identity attitudes have been found to be unrelated to self-reported SES (Carter & Helms, 1988; Parham & Helms, 1985b; Parham & Williams, 1993). Carter and Helms (1988) have explained this finding by commenting that racial identity development is an internal process that "is more a result of an individual's interpretation of his or her socialization experiences and personal development than it is a reflection of actual external

conditions imposed by social class" (p. 29), even in the case of one's perception of social status.

Racial Identity and Career Development

In a special issue of the Journal of Vocational Behavior (Tinsley, 1994), the relation of racial identity to vocational behavior and career development was given special attention. Theoretical examinations argued for the potential of racial identity to explain at least some aspects of vocational development for African Americans (Helms & Piper, 1994; Parham & Austin, 1994). Helms and Piper (1994) speculated about the ways in which racial identity may interact with career interests, values, decision-making and choice as well as work satisfaction and satisfactoriness. Although they concluded that "there appears to be no obvious a priori reason (that we can think of) why it [racial identity] should be predictive of the content (e.g., interests) of the developmental process as it traditionally has been defined and operationalized," Helms and Piper (1994) believed that it "provides an alternative perspective which could permit analysis of vocational development at an intrapsychic as well as interpersonal level" (p. 136).

Parham and Austin (1994) highlighted areas where psychological nigrescence may be applicable to understanding the vocational behavior of African Americans. They noted that Black racial identity theory may be useful in understanding values, perceptions of opportunities, occupational stereotyping, career decision making, as well as diversity in the work force. The authors also acknowledged the implication of self-efficacy theory with its postulation that "outcome expectations

influence the person's willingness to expend energy towards the pursuit of a career goal" (Parham & Austin, p. 148). Like Helms and Piper (1994), Parham and Austin (1994) concluded that racial identity may be helpful in understanding the career development issues of African Americans.

Many of the studies exploring racial identity and career development have been in the form of unpublished doctoral dissertations and masters theses emanating from universities where the principle scholars in racial identity research reside (e.g., Woods, 1987, and Manese, 1984, from the University of Maryland; Grace, 1984, from Teachers College, Columbia University). Of these studies, the most frequently cited is that of Grace (1984).

Grace (1984) examined the relationship between racial identity attitudes and Black students' choice of typical (high Black representation) and atypical (low Black representation) occupations. Using a sample of 199 Black college students attending a historically Black university, she found that racial identity did not significantly relate to career preference. Gender was shown to be the single best predictor of typicality of career choice, with men choosing more atypical careers than women. Grace noted that problems with the conceptualization of the racial identity construct and with the time, setting, and sample of her study may have influenced her results.

In a partial replication of Grace's (1984) study, Woods (1991) studied the relationship of racial identity attitudes and vocational

orientation to the traditionality of academic major and occupational choice. In her study of 202 Black undergraduates, vocational orientation (as defined by Holland's vocational scale scores) was found to be the best predictor of the level of traditionality in academic major and occupational choice. While racial identity was not predictive of traditionality, three of four racial identity attitudes were significantly correlated with several career choice variables (i.e., Immersion/Emersion attitudes and occupational satisfaction, Pre-encounter and Investigative interests).

In another dissertation study, Evans (1989) found that for the subsample of Black college women, Immersion/Emersion and Internalization racial identity attitudes were the best predictors of traditional female career aspirations, while Immersion/Emersion attitudes were the best predictors of traditional Black occupations. For Black men, self-efficacy beliefs were the best predictors of traditional female occupations. This finding is consistent with the career self-efficacy literature (e.g., Betz & Hackett, 1981). As in previous studies exploring gender differences in self-efficacy, Black women reported lower levels of self-efficacy beliefs in non-traditional careers than in traditional occupations.

To date, only two published empirical articles have examined the relationship of Black racial identity to career development. In a study of 196 Black undergraduates majoring in engineering and computer science, Williams and Leonard (1988) found that racial identity was not a significant predictor of academic progress.

The same held true for the study conducted by Evans and Herr (1994). The investigators explored the impact of racial identity and the perceptions of discrimination on the career aspirations of African American college students. They found that racial identity failed to predict career aspirations for the 111 participants in their study, thereby supporting Grace's (1984) findings.

In both dissertation and published studies, a greater representation of Internalization racial identity attitudes existed among the research participants. A lack of range in racial identity attitudes may have led to premature conclusions about racial identity. For instance, it may be that Internalization racial identity attitudes are not significant predictors of career-related variables, but other racial identity world views do play an important role in the career choice and aspirations of Black college students. Clearly, more empirical investigations are needed before definitive conclusions can be made regarding the utility of racial identity (and self-efficacy) models in explaining the career development process of Black college students.

Specific Research Questions and Hypotheses

The present study sought to extend prior work on math/science self-efficacy, and to examine the role of racial identity, within a unifying social cognitive model of math and science academic aspirations in Black college students. Since mathematics-related course enrollment patterns help determine the range of one's career options (Betz, 1992a), this study examined social cognitive factors (e.g., self-efficacy and outcome expectations) that may influence intentions to enroll in math- and

science-related college courses. Essentially, this study involved two major components: (a) a theory-testing element, based on the career-specific hypotheses derived from Lent et al. (1994), and (b) a more exploratory portion, which focused on the role of racial identity attitudes in African American students' consideration of math and science college courses.

Test of social cognitive theory

Lent et al. (1994) have offered a number of specific hypotheses derived from twelve propositions which provide the basic foundation for their theory. Listed below are 17 hypotheses that are applicable to the present study. They have been revised to reflect the specific variables in this study. Consistent with Lent et al.'s model, these hypotheses are organized into three conceptual sets: (a) interests, (b) choice goals (or intentions), and (c) sources of self-efficacy and outcome expectations. The number and letters in parentheses correspond to the relevant hypothesis outlined in Lent et al. (1994). Figure 2 depicts several of the direct and indirect relationships proposed by the hypotheses.

Interests Model.

1. There will be a positive relation between math self-efficacy and math- and science-related interests (1A).

2. There will be a positive relation between positive mathematics outcome expectations and math/science-related interests (1B).

3. An additive combination of math self-efficacy beliefs and

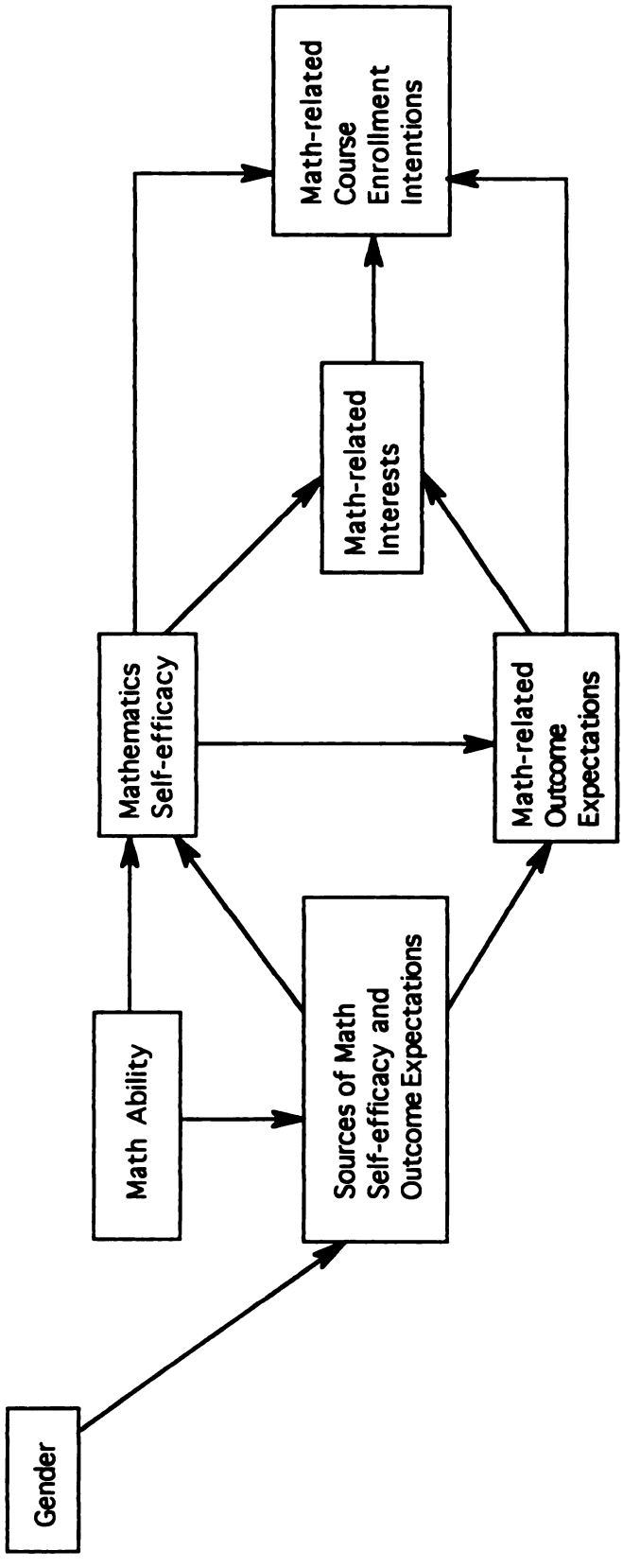

Figure 2. Illustrative model depicting research hypotheses concerning social cognitive math-related variables.

outcome expectations will account for more variance in math/science interests than will either self-efficacy or outcome beliefs alone (1C).

4. There will be a positive relation between mathematics ability and math/science interests (2A).

5. The correlation between math ability and interests will be eliminated when the influence of mathematics self-efficacy is controlled (2B).

Choice Goals (or Intentions) Model.

6. There will be a positive relation between math self-efficacy and math and science course enrollment intentions (3A).

7. The correlation between mathematics self-efficacy beliefs and math/science enrollment intentions will be reduced but not eliminated when the influence of math-related interests is controlled (3C).

8. There will be a positive relation between math outcome expectations and math-related course enrollment intentions (4A).

9. The correlation between mathematics-related outcome expectations and course enrollment intentions will be reduced but not eliminated when the influence of math/science interests is controlled (4C).

10. There will be a positive relation between mathematics-related course interests and enrollment intentions (5A).

Sources of Self-efficacy and Outcome Expectations Model.

11. There will be a positive relationship between mathematics self-efficacy beliefs and the perceived amount of sources of self-efficacy

information (i.e., personal performance accomplishments, vicarious learning, verbal persuasion, and emotional/physiological arousal) in corresponding math/science activities (10A).

12. Direct, personal performance experiences will account for more variance in mathematics self-efficacy beliefs than will vicarious learning, verbal persuasion, or emotional arousal experiences (10B).

13. Positive outcome expectations will be positively related to directly experienced (i.e., personal performance accomplishments, verbal persuasion, and emotional arousal) and vicariously experienced consequences (11A).

14. Mathematics-related outcome expectations will be more strongly related to direct, personally experienced performance consequences (i.e., performance accomplishments, verbal persuasion, and emotional arousal) than to vicariously experienced consequences (11B).

15. There will be a positive relation between mathematics-specific positive outcome expectations and math self-efficacy beliefs (12A).

16. Gender differences in math self-efficacy beliefs will be mediated largely by differential access to sources of efficacy information. Thus, the relation of gender to math self-efficacy will be reduced when differences in efficacy source experiences are controlled (10F).

17. Gender differences in mathematics-related outcome expectations are mediated largely by differential access to direct and vicarious reinforcement experiences. Thus, the relation of gender to outcome expectations will be reduced when differences in direct and vicarious

experiences are controlled (11C) (see Lent et al., 1994).

Full social cognitive path model. In addition to the above hypotheses, an overall model was assessed. Figure 2 also illustrates the portion of Lent et al's model tested by this study. Given concerns about the number of parameter estimates in relation to sample size, a simplified version of the model (e.g., excluding gender) was tested (see Figure 3).

Exploration of racial identity

The complexity of racial identity attitudes and the paucity of research on the influence of racial identity on career development made the development of specific research hypotheses difficult. Others have speculated about the role of racial identity within career choice and development (Brooks, 1990). Helms (1990) has indicated that Immersion/ Emersion racial identity may be related to career choice behaviors whereby Blacks with such attitudes pursue academic and career endeavors which are perceived as acceptable "Black" behaviors. Parham and Austin (1994) have questioned whether Pre-encounter attitudes contribute to seeking occupations which value self-preservation, competition, and material rewards. Williams and Leonard's (1988) results could be interpreted to mean that Internalization racial identity attitudes are not related to career choice.

Nevertheless, it is still too early to frame specific hypotheses about how individual racial identity stages affect (proximally or distally) math/science choice intentions in Black college students. More empirical data or refined theoretical frameworks are needed to

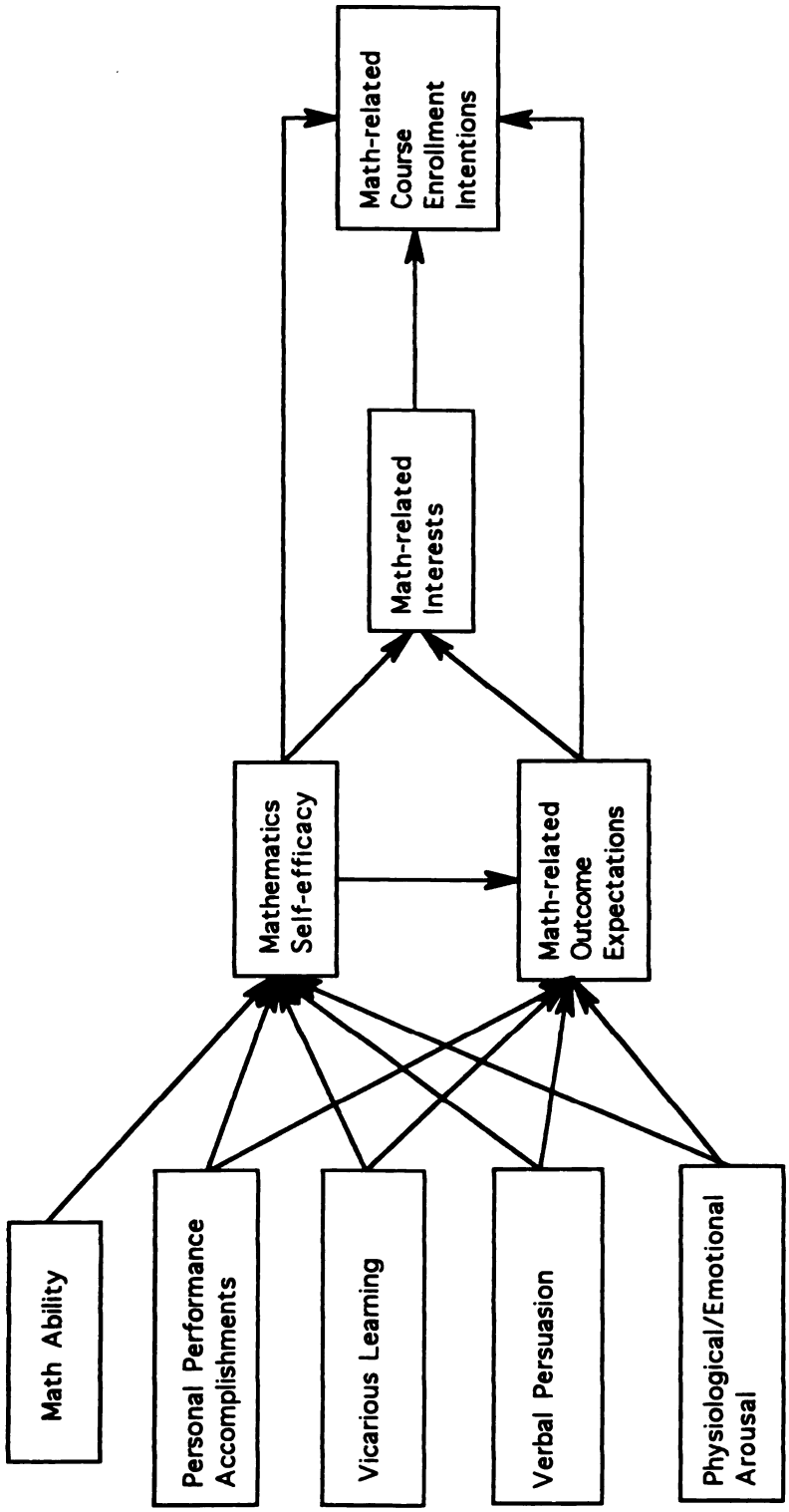

Figure 3. Proposed model of the relationships among social cognitive math-related variables.

inform such hypotheses. Therefore, the second aspect of this study was considered exploratory. Notwithstanding, a few specific research questions seem reasonable:

1. Are certain racial identity attitudes related to math-related self-efficacy beliefs, outcome expectations, sources of efficacy information, interests, or choice intentions regarding math/science courses?
2. Do certain racial identity attitudes influence the relationships of math-related self-efficacy beliefs and outcome expectations to math/science interests?
3. Do certain racial identity attitudes moderate the relationships of mathematics-related interests to intentions?

Chapter 3

METHODOLOGY

Preparation for Study Proper

A small pilot study was conducted in the semester prior to the study proper. The pilot study was intended to (a) assess the appropriateness of the instruments in terms of readability, ease of instructions, scale format, and time required to complete the instruments (Dawis, 1987); (b) determine the scale to be used for assessing mathematics-related interests; (c) test a possible approach to measuring vocational racial identity; and (d) identify the number of participants needed for the actual study. Appendix A provides a detailed description of the pilot study, including a clarification of points (b) through (d).

Research Participants

Data were collected from 164 first-year, Black college students attending a large northeastern, predominantly White state university. The sample consisted of 114 women and 50 men ranging in age from 17 - 22 years (M = 18.23, $S.D.$ = .74).

Since the study was designed to explain course enrollment intentions, first-year students were targeted in order to control for differences attributable to year in college and to better assess choice goals (vs. choice actions) to take math-related courses throughout one's college

career. Focusing the study on first-year students also allowed for the possibility of conducting a later follow-up investigation of actual choice behaviors and performance attainments.

Participants were from various schools and colleges within the university (i.e., liberal arts, engineering, pharmacy). The university itself consists of four liberal arts colleges and five professional schools. While the liberal arts colleges are distinguished by their mission (e.g., women, diversity and shared learning, traditional, and part-time adults), they share the same faculty and academic standards. The five professional schools consist of engineering, pharmacy, business, the arts, and a land-grant college emphasizing agricultural, environmental, life, and marine sciences. With the exception of the business school, prospective students apply to the professional schools as they would to one of the liberal arts colleges. (Students may apply to the business school during their sophomore year at the university.) Data were collected from students enrolled in all but the business school and the part-time, liberal arts college.

Table 1 presents frequencies and percentages of various demographic and background characteristics (i.e., age, whether or not one was born and raised in the United States, ethnicity, type of college attending at the university, and whether or not a college major has been chosen) of the sample. Most of the participants (about 76%) were enrolled in one of the liberal arts colleges surveyed. The majority of students (about 85%) indicated having been born and raised in the United States. Black

Table 1. Frequency Distribution of Demographic Characteristics

	Men[a]		Women[b]		Total	
	freq.	(percent)	freq.	(percent)	freq.	(percent)
Age						
17	3	(6.0)	14	(12.3)	17	(10.4)
18	31	(62.0)	70	(61.4)	101	(61.6)
19	14	(28.0)	28	(24.6)	42	(25.6)
20+	2	(4.0)	2	(1.8)	4	(2.4)
Born and raised in U.S.?						
yes	43	(86.0)	96	(84.2)	139	(84.8)
no	7	(14.0)	18	(15.8)	25	(15.2)
Ethnicity						
African American / Black	20	(40.0)	55	(48.3)	75	(45.7)
Jamaican	1	(2.0)	16	(14.0)	17	(10.4)
Other West Indies	2	(4.0)	10	(8.8)	12	(7.3)
African	3	(6.0)	6	(5.3)	9	(5.5)
other	4	(8.0)	3	(2.6)	7	4.3)
mixed ethnicity	7	(14.0)	7	(6.1)	14	(8.5)
not indicated	11	(22.0)	17	(14.9)	28	(17.1)
unknown	2	(4.0)	0	(0.0)	2	(1.2)

Table 1. (cont'd)

	Men[a] freq.	(percent)	Women[b] freq.	(percent)	Total freq.	(percent)
College attending at University						
traditional liberal arts	25	(50.0)	42	(36.8)	67	(40.9)
women's liberal arts	1	(2.0)	38	(33.3)	39	(23.8)
shared-learning liberal arts	5	(10.0)	13	(11.4)	18	(11.0)
engineering	12	(24.0)	7	(6.1)	19	(11.6)
pharmacy	1	(2.0)	1	(0.9)	2	(1.2)
the arts	0	(0.0)	1	(0.9)	1	(0.6)
agricultural/land-grant	5	(10.0)	11	(9.6)	16	(9.8)
not listed	1	(2.0)	1	(0.9)	2	(1.2)
Major chosen?						
yes	33	(66.0)	82	(71.9)	115	(70.1)
no	17	(34.0)	32	(28.1)	49	(29.9)

[a] $n = 50$. [b] $n = 114$.

students born and raised in the United States did not differ significantly on the major research variables from those not born and raised in this country. Although the majority of participants were born and raised in the United States, approximately 46% of the participants identified their ethnicity as African American or Black. Twenty-four percent identified as other than African American (e.g., Jamaican, Haitian, Guyanese, Nigerian). Seventeen percent did not indicate any ethnicity which may reflect these participants' knowledge of their ethnicity or levels of comfort with identifying an ethnicity.

Most of the participants perceived their past and current socioeconomic statuses as working to middle class (76% and 79%, respectively; see Table 2). Approximately 60% of the mothers had completed high school and/or some college, while about 40% of the fathers had attained similar educational levels. Twenty-three percent of mothers had college degrees, whereas 17% of the fathers had completed college. However, more fathers than mothers had graduate degrees (n = 25 and 12, respectively; see Table 3) Most of the research participants attended high schools where the majority of students were of working or middle class (78%) backgrounds and the minority of students were of the participants' same ethnicity (60%; see Table 4).

Seventy percent (n = 115; see Table 5) of the participants had chosen a college major. Consistent with previous research on the academic major and career choice of African American college students, most of those in the present sample expressing a major choice had indicated

Table 2. Frequency Distribution of Perceived Socioeconomic Status

Socioeconomic level	Men[a] Current freq. (percent)	Men[a] When Younger freq. (percent)	Women[b] Current freq. (percent)	Women[b] When Younger freq. (percent)	Total Current freq. (percent)	Total When Younger freq. (percent)
lower class	7 (14.0)	7 (14.0)	9 (7.9)	12 (10.5)	16 (9.8)	19 (11.6)
working class	16 (32.0)	21 (42.0)	32 (28.1)	40 (35.1)	48 (29.3)	61 (37.2)
middle class	23 (46.0)	19 (38.0)	53 (46.5)	50 (43.9)	76 (46.3)	69 (42.1)
upper middle class	4 (8.0)	3 (6.0)	20 (17.5)	12 (10.5)	24 (14.6)	15 (9.1)
upper class	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

[a] $n = 50$. [b] $n = 114$.

Table 3. Frequency Distribution of Parents' Educational Levels

Educational Level	Men[a] Mother freq. (percent)	Men[a] Father freq. (percent)	Women[b] Mother freq. (percent)	Women[b] Father freq. (percent)	Total Mother freq. (percent)	Total Father freq. (percent)
some high school	1 (2.0)	4 (8.0)	10 (8.8)	10 (8.8)	11 (6.7)	14 (8.5)
high school diploma	16 (32.0)	20 (40.0)	28 (24.6)	25 (21.9)	44 (26.8)	45 (27.4)
some college	11 (22.0)	5 (10.0)	44 (38.6)	23 (20.2)	55 (33.5)	28 (17.1)
college degree	14 (28.0)	7 (14.0)	23 (20.2)	20 (17.5)	37 (22.6)	27 (16.5)
some graduate school	0 (0.0)	0 (0.0)	2 (1.8)	2 (1.8)	2 (1.2)	2 (1.2)
graduate degree	5 (10.0)	9 (18.0)	7 (6.1)	16 (14.0)	12 (7.3)	25 (15.2)
missing data	3 (6.0)	5 (10.0)	0 (0.0)	18 (15.8)	3 (1.8)	23 (14.0)

[a] $n = 50$. [b] $n = 114$.

Table 4. Frequency Distribution of Perceived Characteristics of High School

	Men[a]		Women[b]		Total	
	freq.	(percent)	freq.	(percent)	freq.	(percent)
Same ethnicity						
0 - 20%	19	(38.0)	49	(43.0)	68	(41.5)
21 - 40%	10	(20.0)	21	(18.4)	31	(18.9)
41 - 60%	5	(10.0)	17	(14.9)	22	(13.4)
61 - 80%	2	(4.0)	5	(4.4)	7	(4.3)
81 - 100%	13	(26.0)	22	(19.3)	35	(21.3)
missing data	1	(2.0)	0	(0.0)	1	(0.6)
SES of majority of students						
lower class	4	(8.0)	5	(4.4)	9	(5.5)
working class	18	(36.0)	42	(36.8)	60	(36.6)
middle class	21	(42.0)	47	(41.2)	68	(41.5)
upper middle class	6	(12.0)	17	(14.9)	23	(14.0)
upper class	1	(2.0)	2	(1.8)	3	(1.8)
missing data	0	(0.0)	1	(0.9)	1	(0.6)

[a] $n = 50$. [b] $n = 114$.

Table 5. Frequency Distribution of Major and Career Choice

Discipline Category	Men[a] Major Choice freq. (percent)	Men[a] Career Choice freq. (percent)	Women[b] Major Choice freq. (percent)	Women[b] Career Choice freq. (percent)	Total Major Choice freq. (percent)	Total Career Choice freq. (percent)
none	1 (2.0)	6 (12.0)	1 (.9)	9 (7.9)	2 (1.2)	15 (9.1)
fine arts	1 (2.0)	1 (2.0)	1 (.9)	2 (1.8)	2 (1.2)	3 (1.8)
humanities	1 (2.0)	0 (0.0)	7 (6.1)	2 (1.8)	8 (4.9)	2 (1.2)
social science	17 (34.0)	17 (34.0)	50 (43.9)	52 (45.6)	67 (40.9)	69 (42.1)
biological science	10 (20.0)	9 (18.0)	35 (30.7)	35 (30.7)	45 (27.4)	44 (26.8)
physical science	20 (40.0)	17 (34.0)	20 (17.5)	14 (12.3)	40 (24.4)	31 (18.9)

[a] $n = 50$. [b] $n = 114$.

majors in the social sciences (41%, see Table 5). However, over 25% of the students had selected a biological science major (e.g., biology, biochemistry), while 24% indicated a physical science major (e.g., engineering, mathematics).

Procedures

Two methods were used to recruit participants for the study: (a) direct solicitation (e.g., via posters, Educational Opportunity Fund (EOF) programs, special interest student groups) with group administrations and (b) a mailing to students who did not respond or were not reached through the first recruitment method.

Direct recruitment

For the direct solicitation phase of the data collection, students were recruited from Black and minority student organizations, residence halls, and other student services (e.g., study skills programs, minority support programs, Black and Latino student orientation). Key administrators and faculty advisors associated with the above programs, as well as the presidents of Black student undergraduate organizations, were contacted for their assistance in recruiting participants. (See Appendix B for the letter sent to the presidents of the Black student organizations.) In addition, a brief article concerning the study (see Appendix C), accompanied by an advertisement calling for participants (see Appendix D), was published in the campus Black and Latino student paper.

A variety of settings were chosen in order to increase the diversity

represented in the sample and to control for extraneous variables. The same Black female undergraduate research assistant who recruited students for the pilot study also assisted in obtaining participants for the study proper. Instruments were completed using group administrations, and a general statement about the study and the nature of informed consent was read to the students (see Appendix E). Students who did not wish to participate were allowed to leave the room prior to distribution of the packets. Before completing the questionnaires, informed consent forms (see Appendix F) were read and completed by all participants. Seventy-one participants were obtained using this method; one packet was eliminated because the participant was a transfer student.

Mailing

Because the direct recruitment procedure did not achieve the necessary sample size, a direct mailing to first-year self-identified Black or African American students was conducted. A modified version of the Total Design Method (TDM) outlined by Dillman (1978) was used to guide the procedures for conducting the mail survey. This method consisted of an initial mailing followed by a reminder postcard sent one week after the first mailing, and a follow-up replacement packet sent three weeks after the first mailing. Dillman has recommended a third follow-up, however, due to time constraints (i.e., the approaching end of the semester), a third mailing was not conducted.

A list of admitted first-year, self-identified African American students was obtained from the University's admissions office. The

student directory was consulted to identify and obtain addresses of those students who had enrolled in the university as of the fall semester. Students who had already participated in the study were eliminated. Packets were sent to the remaining 314 students via campus mail. Each packet contained a personalized letter inviting the student to participate in the study (see Appendix G), a white envelope with a return address, two copies of the informed consent form (one for the student to keep), and the research measures.

The first follow-up mailing consisted of a postcard (see Appendix H) reminding students of the initial mailing. If the first packet had not been received, the postcard invited the student to call in order to receive one. A second follow-up mailing was sent to students who had not returned packets (complete or incomplete) by the end of the fourth week. Another personalized letter was included (see Appendix I), along with a replacement research packet using the same code number as the first packet sent to the student.

Ninety-five completed packets were received. Uncompleted packets were returned because the student was no longer at the University (n = 8), declined to participate (n = 6), or had not claimed one or all of the mailings (n = 5); one student called to explain that he had not returned the questionnaire because he was not African American.

Toward the end of the time period available for collecting data from the same class of first-year students, follow-up phone calls were attempted in an effort to encourage their participation. However, only twelve nonresponders had published phone numbers in the student

directory. Several (n = 5) indicated that they had not had time to fill out the questionnaire, but would do so. Messages were left for six students. One phone number was disconnected. Packets were received from the five students who were directly contacted. Overall, 195 packets were never returned. Total usable response rate for the mailing was 32.3%. Fifty-seven percent of the total number of research participants were recruited through the mailing.

All potential subjects, whether recruited by direct solicitation or mail, were provided with a general statement of the purpose of the study. Except for the background questionnaire and the racial identity scale (described more fully below), measures were presented in counterbalanced order in order to control for sequencing effects. The background questionnaire was always presented first and the racial identity scale was always last.

Lottery

Participation in this study was voluntary. A monetary incentive in the form of a lottery was offered to students at the time of data collection. Four chances to win fifty dollars following completion of the study were offered. Students were asked to submit a self-addressed envelope (provided in the packet) which was used for the lottery drawing. These envelopes were placed in a large ballot-type box. The drawing was conducted once the data collection was completed. Four envelopes were randomly selected by an impartial university administrator and witnessed by another administrator, neither of whom

were affiliated with the study. Winners received their lottery prizes by mail.

Instruments

Subjects completed measures of demographic and background characteristics, mathematics self-efficacy, outcome expectations, mathematics-related course interests, perceived sources of mathematics self-efficacy, mathematics-related course enrollment intentions, and racial identity attitudes.

Scholastic Assessment Test-I: Reasoning Test (SAT-I) mathematics scores, used as a measure of mathematics ability, were obtained from university records. Formerly, the Scholastic Aptitude Test (SAT), the SAT-I was first administered in March 1994 (Young, 1994) and reflects recent changes in middle and high school curriculum emphasizing higher order cognitive skills (College Board, 1993a, 1993b; Young, 1994). Hence, the SAT-I: Mathematics subsection has been designed to provide a more valid assessment of a student's abilities in problem solving and mathematical reasoning (College Board, 1993a). In particular, the use of calculators are permitted and recommended, thus reflecting the greater emphasis on mathematics understanding than on computation (Young, 1994). In addition, the Mathematics subsection includes 10 grid-in answers in which students produce their own responses to the questions (College Board, 1993a, 1993b; Young, 1994). Like the previous SAT, scores on the SAT-I: Mathematics subsection range from 200 to 800 (College Board, 1993a, 1993b).

Background Questionnaire

Subjects were asked to complete a demographic questionnaire (see Appendix J) providing the following information: age, gender, year in college, and math and science courses taken in high school. Gender was dummy coded: 1 for male and 2 for females. Further, as requested by Dr. Janet Helms (in exchange for permission to use the RIAS for this study), information was gathered regarding ethnicity of the subjects and their perception of the ethnicity of students in their high school.

Participants were also asked to indicate their current or anticipated college major and career preferences. The science-relatedness of major and career choices were assessed according to Goldman and Hewitt's (1976) 5-point science-nonscience continuum. Lower scores indicate relative absence of math/science content (e.g., art), whereas higher scores indicate an increasingly greater scientific emphasis (e.g., engineering) (Lent et al., 1991, 1993). (Information regarding college major, career preferences, and high school math and science courses was used to describe the sample and may also be used in subsequent research.)

Lastly, subjects were asked to indicate their subjective perception of their socioeconomic status by selecting one of five categories: lower class, working class, middle class, upper middle class, upper class (Carter & Helms, 1988). These categories were coded 1-5, consecutively. Carter and Helms (1988) found that Black respondents were more willing or able to provide subjective estimates of social class than they were to provide traditional estimators of social class (e.g., parents'

occupation or income). Noting that self-reported social class correlated positively with traditional estimates, they suggested the use of self-reported social class when minimizing the length of one's measure is of concern (Helms & Parham, 1990a). Since socioeconomic status (SES) is a dynamic and developmental concept that can vary throughout a person's life (Featherman, Spenner, and Tsunematsu, 1988), participants were asked to give their perception of their SES, both currently and when they were younger.

For the purpose of comparison, an objective index of SES was also used to measure this variable. Participants were asked to indicate the occupation for both mother and father. Occupation of each parent was scored using Stevens and Featherman's (1981) revised scale of socioeconomic status. This revision offers a more contemporary version of Duncan's (1961) Socioeconomic Index. The Duncan index is based on education and income data from the 1950 census classification of occupations. However, its construction was limited to the characteristics of the male labor force. Stevens and Featherman's (1981) revision is based on the 1970 census and considers the attributes of both male and female workers.

Codable occupations ranged from 11.13 (loom fixer) to 88.65 (law teacher). For solely descriptive purposes (i.e., to allow for frequency calculations), unemployed persons, vets, disabled, and retirees were arbitrarily coded 99.99. Self-employed parents of unknown occupations were coded 99.00. Housekeepers of own home were coded 11.11. These

codings were excluded from the correlation and inferential analyses. If both parents worked, the student's SES was determined using the higher score (not including 99.00). Participants were also asked to indicate each parent's level of education, which was used to further describe the sample (i.e., with frequencies and percentages) and not in calculating SES. Finally, participants were asked to provide a subjective analysis of the SES of their high school using the same categories (i.e, lower, working, middle, upper middle, and upper classes) and coding (i.e., 1 to 5, consecutively) employed in participants' perceptions of their own SES.

Mathematics self-efficacy scale (MSE)

A slightly modified version of Betz and Hackett's (1983) Mathematics Self-Efficacy College Courses Scale (see Appendix K) was used to measure confidence in one's ability to complete each of fifteen different mathematics-related college courses with a grade of B or better. (Revisions were made to reflect local course offerings and titles.) Betz and Hackett's (1983) original MSE scale consisted of three subscales: Math Tasks, Math Problems, and College Courses. The authors reported interscale correlations of .90, .93, and .92. Given the high interscale correlations and the nature of the outcome variable (i.e., mathematics-related course enrollment intentions), it was decided to employ only the Mathematics Courses subscale for the present study. Item-total score correlations for the Math Courses subscale have ranged from .33 to .73. Analyses of a revised MSE scale indicated adequate internal consistency reliability (α = .92, Lent et al, 1991; α = .94,

Lent et al., 1993), comparable to that reported by Betz and Hackett (1983; α = .93). Test-retest correlations were also stable over a 2-week period (r = .94, Lent et al., 1991).

Responses were obtained on a scale ranging from no confidence at all (0) to complete confidence (9). Strength of self-efficacy scores were calculated by dividing the summed item responses by 15. Higher scores reflect stronger self-efficacy (Lent et al., 1991).

Perceived sources of mathematics self-efficacy (SMSE)

A forty-item instrument designed for the Lent et al. (1991) study was used in the present study (see Appendix L). This measure consists of four 10-item scales corresponding to the four primary sources of efficacy described by Bandura (1986): perceived personal performance accomplishments (e.g., "I received good grades in my high school math classes"); vicarious learning (e.g., "My favorite teachers were usually math teachers"); verbal persuasion (e.g., "My friends have discouraged me from taking math courses"); and emotional arousal (e.g., "I get really uptight while taking math tests") (Lent et al., 1991). Participants responded by indicating their level of agreement with each statement on a 5-point scale, with higher scores reflecting greater agreement. Half of the items were positively worded and half were negatively worded. The latter items were reverse-scored so that higher SMSE scores indicate more favorable mathematics experiences (Lent et al., 1991).

Cronbach alpha internal consistency reliabilities of the SMSE have been reported as: personal performance accomplishments, .86; vicarious

learning, .56; social persuasion, .74; and emotional arousal, .90. In general, the subscales of the SMSE possessed adequate reliabilities, although the estimate for vicarious learning was marginal. Test-retest correlations (two-week interval) have indicated fairly good stability (personal performance accomplishments, r = .96; vicarious learning, r = .85; social persuasion, r = .91; emotional arousal, r = .91; Lent et al., 1991).

Outcome expectations (OE)

Also developed for the Lent et al. (1991) study, this measure (see Appendix M) consists of ten items that reflect a variety of positive outcomes that might accrue from taking math courses (e.g., "My friends would respect me if I enrolled in math courses"). Participants indicated their level of agreement with each statement on a 10-point scale ranging from strongly disagree (0) to strongly agree (9). As with the MSE, item scores were summed and divided by the total number of items, yielding total scores that could range from 0 to 9. Higher scores indicate stronger positive outcome expectations with regard to mathematics courses (Lent et al., 1991).

Cronbach alpha estimates of the OE have been reported as .90 (Lent et al., 1991) and .89 (Lent et al., 1993), indicating adequate internal reliability. Test-retest correlations have indicated good stability of outcome expectations (r = .91) over a two-week period (Lent et al., 1991).

Interests (INTC/INTA)

Two instruments were considered to assess mathematics-related interests. The first measure, Math-related Course Interests (INTC; see Appendix N), developed for Lent et al. (1991), used a 15-item scale asking participants to indicate their degree of interest in each of the mathematics courses listed on the MSE measure. Responses were obtained on a 10-point scale ranging from strongly disinterested (0) to strongly interested (9). As with the MSE and the OE scales, item scores for these scales were summed and divided by the total number of items. Higher scores on the INTC scale indicate stronger interests in mathematics-related courses (Lent et al., 1991). Reliability analyses have indicated that the INTC scale is an internally consistent (α = .86) and stable (over two-weeks: r = .72) measure of expressed interests in mathematics-related college courses (Lent et al., 1991; Lent et al., 1993).

The INTC consists of the same items as the MSE and the Mathematics Course Intentions scale (see below). While several authors (Langenfield & Parajes, 1993; Lent & Hackett, 1987; Parajes & Miller, 1995) have argued for the need for assessment specificity when examining the relationship of self-efficacy to a particular outcome, use of the INTC as the interest measure in this study also brings with it the problem of multicollinearity. Multicollinearity could result in artificially higher correlations (Cohen & Cohen, 1983) among interests, self-efficacy, and choice intentions.

The Math-related Activities Interests Scale (INTA), developed for

Bieschke's (1991) study, used items from the Investigative activities section of Holland's (1985) Self-Directed Search (SDS) and six additional items (see Appendix O). This instrument asked respondents to indicate their degree of interest in each of 20 different math- and science-related activities. Responses on the INTA are obtained on a 3-point Likert-type scale (1 = like, 2 = indifferent, 3 = dislike). Item scores are totaled and divided by the total number of items. Higher scores indicate weaker interests in math- and science-related activities.

Internal consistency of the SDS (using Kuder-Richardson formula 20) for college freshmen have ranged from .67 to .94. Test-retest correlations (over 7 - 10 months) ranged from .60 to .84 (Zucker, 1986). Bieschke (1991) found the revised INTA measure to have good internal consistency with coefficient alphas ranging from .89 to .91. Test-retest correlations were not reported for this instrument.

As indicated earlier, the pilot study was conducted in part to determine if the second measure (INTA) could be used as a way of avoiding the problem of multicollinearity present with the first measure (INTC). Based on the pilot study data, the INTA was chosen as the main interest variable (see Appendix A). However, for the sake of comparison, the INTC remained as part of the research protocol.

Mathematics course enrollment intentions (MCEI)

Subjects were also asked to indicate the likelihood that during their college career they would take each of the courses listed on the MSE and INT scales (see Appendix P). Intentions were obtained on a 10-point

scale ranging from extremely unlikely (0) to extremely likely (9), with scores being formed by dividing the sum of the item ratings by 15. Higher scores indicate greater intentions to enroll in future mathematics-related courses (Lent et al., 1993). A coefficient alpha value of .77 was obtained on this scale (Lent et al., 1993). Test-retest correlations have not been reported for this instrument.

Racial identity attitudes scale -- Form B (RIAS-B)

A 50-item version of the RIAS-B (Helms & Parham, 1990b) was used to assess the racial identity stages outlined by Black racial identity theory (see Appendix Q). The original RIAS, a rationally constructed scale, was designed to measure the general themes of four of the five stages of racial identity proposed by the Cross (1971, 1978) model of psychological nigrescence. Participants are asked to indicate their level of agreement with each item (e.g., "The most important thing about me is that I am Black") using a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree).

Helms (1989, 1990) has noted the scoring of the RIAS-B depends on how one operationalizes the construct of "stage." "On the one hand, if one considers stage to be a discrete category into which a person should be placed and further assumes that attitudes and stages are synonymous, then it makes sense to devise a scoring plan whereby a person's highest mean score can be used to so place him or her" (Helms, 1990, p. 45). Parham and Helms (1981) used this scoring method with the first version of the RIAS. "On the other hand, if one considers stages to contribute to types of attitudes, all of which are held by a person to some extent,

then it makes sense to use scoring procedures that allow the scale administrator to make use of the scale-taker's scores on all four subscales" (Helms, 1990, p. 45). This philosophy is consistent with discussions concerning the complexity of the racial identity attitudes (Helms, 1989, 1990; Parham, 1989) and reflects recent usage of the scale (e.g., Helms & Parham, 1990b; Bradby & Helms, 1990; Evans & Herr, 1994; Mitchell & Dell, 1992; Parham & Helms, 1985b).

The present study held that racial identity attitudes are continuous and that individuals may hold different attitudinal levels simultaneously. Scores for each of the subscales were obtained by summing the responses to the appropriately keyed items and dividing by the number of items for that subscale. Higher scores for each subscale indicate higher levels of a given attitude. Use of all four scores provides information about the levels of each attitude within the individual (K. Evans, personal communication, August 1994).

Estimations of the RIAS-B's internal consistency reliability (using Cronbach's alpha) have ranged as follows: Pre-encounter = .67 to .76; Encounter = .51 to .72; Immersion/Emersion = .66 to .69; Internalization = .71 to .80 (Helms, 1990; Parham & Helms, 1985a, 1985b). Helms (1989, 1990) has noted that the wide range in the reliability of the Encounter stage may be due to the dynamic, inconsistent nature of Encounter attitudes. That is, "it is difficult to measure a phenomenon consistently if the phenomenon itself is not consistent" (Helm, 1990, p. 44).

Recent analysis of test stability also appears to reflect variability among the four racial identity stages (Lemon & Waehler, 1996). Test-retest reliability coefficients (Pre-encounter, $\underline{r}$ = .61; Encounter, $\underline{r}$ = .60; Immersion/Emersion, $\underline{r}$ = .66; Internalization, $\underline{r}$ = .52) were only moderate, reflecting the dynamic and possibly, cyclical nature of racial identity proposed by Parham (1989).

In terms of construct validity, it has been found that the RIAS-B covaried with characteristics that should be related to racial identity (e.g., self-esteem), but did not correlate with those with which it should be unrelated (e.g, social class; Helms, 1990). Although Ponterroto and Wise (1987) indicated little empirical support for the construct validity of the Encounter stage as measured by earlier versions of the RIAS, Helms (1989) noted that this problem has been resolved by adding items to the Encounter subscale that reflect conscious awareness of Encounter-type events (Phase 1) rather than having items that focus exclusively on the feelings, beliefs, and behaviors that occur in response to such awareness (Phase 2).

Yanico, Swanson, and Tokar (1994) examined the psychometric properties of the 30-item version of the RIAS-B. The results of item, subscale, and factor analyses indicated (a) problems with the internal structure of the instrument, (b) unequal support for the four subscales, and (c) markedly skewed score distributions for the Pre-encounter and Internalization subscales (Yanico et al., 1994). It is unclear whether the 50-item version of the RIAS-B has similar problems.

The RIAS-B has been found to correlate with other measures of racial

identity development (Helms, 1990). Further, current versions of the scale have been developed using samples of Black college and university students diverse in age, gender, geographic region, type of educational institution (private, state, and community colleges), and racial composition of the respondents' college environments (Helms, 1990). To avoid respondent reactivity, Helms and Parham (1990b) have suggested using the title "Social Attitudes Scale" when administering the RIAS-B.

Data Analysis

This phase of the study consisted of three components: (a) preliminary and descriptive statistics, (b) analyses of the theory-testing component of the study, and (c) examination of the exploratory research questions concerning the role of racial identity in the social cognitive career model.

Preliminary and Descriptive Statistics

1. Internal consistency reliabilities (using Cronbach's coefficient alphas) were computed for each instrument (except for the background questionnaire and SAT-I math scores) used in the study.
2. Scatterplots were constructed in order to visually examine the data for outliers, linearity, and skewness.
3. Descriptive statistics (mean, standard deviation, variance, range, kurtosis, and skew) were computed for each of the variables (not including gender and perceived SES) used in this study.
4. A correlation matrix was calculated in order to examine the bivariate relationships between each of the variables.

Testing of Theory-based Hypotheses

5. Hypotheses 1, 2, 4, 6, 8, 10, 11, 13, and 15 were tested using pairwise correlations and scatterplots. Hypotheses 11 and 13 were also tested using multiple regressions to predict math self-efficacy and outcome expectations, respectively.

6. Hypothesis 3 was tested using hierarchical regression to predict interests with self-efficacy entered first, followed by outcome expectations. To compare the unique contribution of each variable, a second regression was conducted with outcome expectations entered first, followed by math self-efficacy.

7. Hypotheses 5, 7, and 9 were tested using partial correlations and scatterplots.

8. Hypotheses 12 and 14 were tested by comparing the magnitudes of the correlation coefficients using Fisher's r to z transformations. Significance levels for r to z transformations were set at .05. That is, correlation coefficients differed significantly at the .05 level when $z \geq |1.96|$ for two-tailed tests and $\geq |1.65|$ for one-tailed tests.

9. Before hypotheses 16 and 17 could be tested, several analyses were conducted with each gender group to examine and test for any gender differences. Once relevant gender differences and variable correlations were confirmed, these hypotheses were then tested.

10. Hypothesis 16 was tested using a hierarchical regression to predict self-efficacy. The sources of efficacy information were

entered into the equation first, followed by gender. Reduction in the gender/self-efficacy relation after the efficacy sources are controlled would suggest that gender differences in self-efficacy arise through differential access to efficacy-building experiences.

11. Hypothesis 17 was tested using a hierarchical regression to predict outcome expectations. Direct and vicarious reinforcement experiences were entered into the equation first, followed by gender. The mediator hypothesis was tested in the same manner as analysis #10, above.

12. In order to test the adequacy of the proposed model (see Figure 3) in describing the data from this sample, a path analysis was conducted using the EQS (Version 5) statistical package (Bentler & Wu, 1995). EQS performs over and beyond correlations and regressions by providing "goodness-of-fit" indices. It also uses estimation methods that assume multivariate normality of the data, but also make use of a test statistic that corrects for nonnormality (Byrne, 1995). A principle advantage of this statistical analysis (i.e., over multiple regression and analysis of variance) is its ability to flexibly and comprehensively control for extraneous variables, confounding variables, and measurement error (Hoyle, 1995).

First, a covariance matrix was conducted, regressing each of the variables of the hypothesized model on the variables that were presumed to influence them. The maximum likelihood estimation method was used to construct as closely as possible an implied covariance matrix from the observed covariance matrix while minimizing the

residual matrix (Hoyle, 1995; Loehlin, 1992). Maximum likelihood estimation has been shown to perform well even when small sample size and normality among variables are less than optimal (Hoyle & Panter, 1995). Standardized partial regression coefficients (i.e., beta weights) serve as path coefficients indicating the size of the effect of a particular variable on another variable while controlling for the effects of all the other variables in the equation (for example, the effect of math aptitude on math self-efficacy while controlling for the perceived sources of efficacy; see Figure 3).

Hu and Bentler (1995) recommended the use of multiple indices of overall fit. Three indices were selected to indicate the fit of the hypothesized model to the observed data: (a) the chi-square goodness-of-fit test (Jöreskog & Sörbom, 1984), (b) the normed fit index (NFI; Bentler & Bonnet, 1980), and (c) the comparative fit index (CFI; Bentler, 1990). The chi-square goodness-of-fit test is the most common fit index used in structural model analyses (Hu & Bentler, 1995). Perfect fit is indicated by a chi-square value of 0, with increasing values revealing greater discrepancies between the implied covariance matrix and the hypothesized covariance matrix (Hoyle & Panter, 1995). In this sense, the chi-square is actually a "badness-of-fit" index; larger values indicate a poor fit, while smaller values represent a better fit (Hoyle, 1995). The chi-square test statistic is also sensitive to sample size and violations of the multivariate normality assumption (Byrne, 1995; Hoyle, 1995; Loehlin, 1992). Further, its low statistical power can lead to failure to

reject an inadequate model (Hoyle & Panter, 1995). Therefore, alternative fit indices have been developed (Bentler & Bonnett, 1980) and are frequently reported in conjunction with the chi-square test statistic.

Adjunct fit indices, however, are not statistics. They are simply global indices of model adequacy (Hoyle, 1995). Hoyle and Panter (1995) have encouraged the use of at least two alternative fit indices when reporting the results of structural model analyses. The NFI and the CFI are two generally used adjunct indices (Hu & Bentler, 1995). The NFI compares the proposed model to a null model that assumes no correlations among the observed variables (Hu & Bentler, 1995). Values for the NFI can range from 0.00 to 1.00 with a value of 0 indicating a poor fit and a value of 1 reflecting a perfect fit. Fit index values of .90 or greater are generally considered to indicate that a given hypothesized model adequately represents the observed data (Bentler, 1990; Hoyle, 1995). Although there is some evidence that this cutoff may not always be reasonable, at the present time there are no justifiable alternatives (Hoyle & Panter, 1995).

A disadvantage of the NFI is its sensitivity to sample size. With small samples (i.e., less than 250; Byrne, 1995), NFI values may not reach 1.0 even when the model explains the data well (Bentler, 1990). The CFI, a revised version of the NFI, addresses these limitations. Although the NFI and the CFI can be used

interchangeably with larger samples, the CFI offers a less biased fit index in small samples. The CFI also performs well when maximum likelihood estimation is used (Bentler, 1990). Like the NFI, CFI values range from 0.00 to 1.00, with values greater than .90 indicating good fit. Therefore, the CFI was considered the primary fit index for the current study.

Role of Racial Identity Attitudes

13. Question 1 was explored using pairwise correlations and scatterplots.

14. Question 2 was examined using hierarchical regression to predict interests. Two equations were examined, one using math self-efficacy, the other, outcome expectations. Math self-efficacy beliefs (or outcome expectations) were entered first, followed by the four racial identity attitudes, and then the interactions between math self-efficacy (or outcome expectations) and each of the racial identity attitudes.

15. Question 3 was also explored using hierarchical regression to predict math course enrollment intentions. Interests were entered first, followed by the four racial identity attitudes, and then the interactions of interests with each of the racial identity attitudes.

Chapter 4

RESULTS

Prior to beginning any analyses, the data were examined for accuracy of data entry, missing values, and outliers. Group mean substitution was used for missing continuous values. In the case of ordinal variables, like PSESY and PSESC, the group median was used.

Descriptive Results

Internal consistency reliability (using Cronbach's coefficient alpha) was computed for each measure (except the background questionnaire and SAT scores) used in the study. Table 6 shows the number of items and reliability coefficients for each measure. Coefficient alphas ranged from a low of .41 for the Encounter subscale of the RIAS-B to as high as .93 for the Math Self-efficacy Scale. The reliability coefficients for Math Self-efficacy Scale, the Math-related Course Interests Scale, and the Mathematics Course Enrollment Intentions Scale were calculated after the removal of two courses (elementary and intermediate algebra) when it was discovered that these were non-credit courses. While all but one of the coefficient alphas (Internalization) were comparable with prior research, several coefficients were still less than optimal (i.e., the Vicarious Learning subscale of the SMSE, α = .55; and the Encounter and Internalization subscales of the RIAS, α = .41 and .50, respectively).

Table 6.

Internal Consistency of Scales

Scale	No. of Items	Coefficient Alpha
PERF	10	.8419
VICA	10	.5484
VERB	10	.7335
AROU	10	.9066
MSE	13	.9273
OE	10	.8932
INTC	13	.8392
INTA	20	.8950
MCEI	13	.7643
PRE	16	.7188
ENC	6	.4095
IMM	12	.7368
INT	14	.5042

Note. PERF = personal performance accomplishments, VICA = vicarious learning , VERB = verbal persuasion, AROU = emotional/physiological arousal, MSE = math-related self-efficacy, OE = outcome expectations, INTC = math-related course interests, INTA = math-related activities interests, MCEI = math-related course enrollment intentions, PRE = pre-encounter racial identity attitudes, ENC = encounter racial identity attitudes, IMM = immersion/emersion racial identity attitudes, INT = internalization racial identity attitudes.

The marginal reliability coefficient for the Vicarious Learning subscale in this study was consistent with that found by Lent et al. (1991). Prior research using the RIAS-B has also shown less than optimal consistency coefficients on the Encounter subscale (Evans & Herr, 1994; Lemon & Waehler, 1996; Ponterotto & Wise, 1987). In the present study, it seemed counterproductive to increase the coefficient alphas of these scales (Vicarious Learning and Encounter) by deleting items given the limited number of items for those scales (i.e, 10 and 6 items, respectively). Irrespective of number-of-items considerations, deleting items from the Internalization subscale would have provided no substantial increase in internal consistency.

Descriptive statistics (mean, standard deviation, variance, range, kurtosis, and skew) were computed for each of the variables (not including gender and perceived SES) used in this study (see Table 7). Table 8 shows means for each gender group and mean differences between the two groups on each of the variables. A multivariate t test was conducted using Hotelling's T^2 to control inflated Type I error risk associate with multiple t tests. Results indicated that the two gender groups differed significantly on the combined set of dependent variables ($T^2 = .160$, $p = .003$[2]).

Scatterplots were constructed in order to visually examine the data for outliers, linearity, and skewness. Although initial examination of the scatterplots indicated some outliers, analyses were conducted first

[2]Huck and Cormier (1996) recommend providing the precise p-level associated with the sample findings for better clarity of the results.

Table 7. Descriptive Statistics for Continuous Variables

Variable Name	Abbreviation	M	SD	SK	Range
Personal performance accomplishments	PERF	34.43	7.97	-.37	12.00 - 49.00
Vicarious learning	VICA	31.72	5.46	-.09	12.00 - 45.00
Verbal persuasion	VERB	36.05	6.29	-.48	15.00 - 48.00
Emotional/physiological arousal	AROU	32.85	9.40	-.25	11.00 - 50.00
Math-related self-efficacy	MSE	5.19	1.83	-.49	.15 - 9.00
Outcome expectations	OE	5.34	1.91	-.43	.20 - 8.70
Math-related course interests	INTC	4.33	1.77	-.24	.29 - 8.14
Math-related activities interests	INTA	1.84	.44	.48	1.05 - 3.00
Math-related course enrollment intentions	MCEI	4.17	1.60	-.39	.14 - 7.21
Pre-encounter	PRE	1.88	.44	.60	1.06 - 3.24
Encounter	ENC	2.70	.58	-.06	1.33 - 3.83
Immersion/Emersion	IMM	2.59	.54	.26	1.08 - 4.00
Internalization	INT	4.09	.37	-.33	3.07 - 4.86
No. of math courses taken in high school	MACRS	3.95	.89	1.09	2.00 - 9.00
No. of science courses taken in high school	SCCRS	3.51	.90	-3.03	2.00 - 6.00
No. of math and science courses taken in high school	HSCRS	7.46	1.35	-.22	4.00 - 13.00
Math ability	MABIL	487.55	84.89	.10	310.00 - 700.00
Objective measure of current socioeconomic status	OSES	48.11	24.24	-.44	0.00 - 87.14

Table 8. Mean Differences for Gender Groups

Variable	M_{men}[a]	SD_{men}[a]	M_{women}[b]	SD_{women}[b]	Mean Difference	t[c]	p
PSESY	2.36	.80	2.54	.82	-.18	-1.33	.19
PSESC	2.48	.84	2.74	.84	-.26	-1.80	.07
OSES	43.77	26.08	50.30	22.69	-6.53	-1.62	.11
MABIL	512.79	82.89	476.47	83.73	36.32	2.57	.01**
PERF	35.18	7.67	34.10	8.11	1.08	.80	.43
VERB	32.74	4.97	31.27	5.63	1.48	1.60	.11
VICA	35.99	5.93	36.07	6.47	-.08	-.08	.94
AROU	35.55	8.36	31.67	9.61	3.89	2.47	.01**
MSE	5.85	1.69	4.90	1.82	.95	3.14	.00**
OE	5.55	1.88	5.25	1.93	.31	.94	.35
INTC	4.53	1.68	4.25	1.81	.28	.94	.35
INTA	1.74	.38	1.89	.46	-.15	-1.96	.05*
MCEI	4.28	1.40	4.12	1.68	.16	.58	.56
PRE	1.93	.46	1.86	.42	.07	.95	.35
ENC	2.63	.58	2.72	.58	-.09	-.91	.36
IMM	2.58	.59	2.59	.52	-.01	-.15	.88
INT	4.02	.37	4.13	.36	-.11	-1.75	.08

Note. PSESY = perceived socioeconomic status when younger, PSESC = perceived current socioeconomic status, OSES = objective measure of current socioeconomic status, MABIL = math ability, PERF = personal performance accomplishments, VICA = vicarious learning , VERB = verbal persuasion, AROU = emotional/physiological arousal, MSE = math-related self-efficacy, OE = outcome expectations, INTC = math-related course interests, INTA = math-related activities interests, MCEI = math-related course enrollment intentions, PRE = pre-encounter racial identity attitudes, ENC = encounter racial identity attitudes, IMM = immersion/emersion racial identity attitudes, INT = internalization racial identity attitudes.

[a] $n = 50$. [b] $n = 114$. [c] $df = 162$. Hotelling's $T^2 = .160$, $p = .003$**.

* $p \leq .05$, ** $p \leq .01$.

with the outliers included and then with them excluded in order to fully understand their possible effects on the study's results. A correlation matrix was calculated in order to examine the bivariate relationships between each of the variables (see Table 9).

Theory-testing Results

Interests Model

Hypothesis 1: There will be a positive relation between math self-efficacy and math- and-science-related interests. This hypothesis was tested using a bivariate correlation coefficient. There was a significant, moderate positive correlation between math self-efficacy beliefs and math- and science-related interests (r = -.48, p = .000[3]). That is, higher beliefs in one's math and science abilities were associated with higher levels of interests in math- and science-related activities. (The activities measure of mathematics-related interests was scored with lower scores indicating higher interests. Therefore, a negative correlation indicates a positive relationship between interests and the corresponding variable.) An examination of the scatter diagram revealed a linear relationship between math self-efficacy and math-related interests and no outliers.

Hypothesis 2: There will be a positive relation between positive mathematics outcome expectations and math/science-related interests. A bivariate correlation coefficient was used to test this hypothesis. A significant, positive relationship of moderate strength was found between math outcome expectations and math- and science-related

[3]Precise p-values less than .0005 are noted as .000.

Table 9. Intercorrelations Among Major Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. GEN	1.00																	
2. PSESC	.14*	1.00																
3. PSESY	.10	.55***	1.00															
4. OSES	.13*	.38***	.31***	1.00														
5. MABIL	-.20**	.24***	.13	.27***	1.00													
6. PERF	-.06	.05	-.03	-.14*	.39***	1.00												
7. VICA	-.12	.09	.10	-.01	.14*	.45***	1.00											
8. VERB	.01	.15*	.11	-.01	.34***	.70***	.48***	1.00										
9. AROU	-.19**	-.02	-.09	-.14*	.37***	.72***	.44***	.61***	1.00									
10. MSE	-.24***	.01	-.10	-.06	.52***	.58***	.28***	.58***	.57***	1.00								
11. OE	-.07	.09	.05	-.04	.27***	.49***	.37***	.55***	.47***	.54***	1.00							
12. INTC	-.07	.01	-.10	-.17*	.15**	.41***	.26***	.43***	.42***	.53***	.61***	1.00						
13. INTA	.15*	.07	.19**	.10	-.27***	-.44***	-.26***	-.38***	-.43***	-.48***	-.44***	-.51***	1.00					
14. MCEI	-.05	-.06	-.02	-.19**	-.02	.28***	.11	.29***	.25***	.38***	.45***	.66***	-.31***	1.00				
15. PRE	-.07	-.10	-.19**	-.11	-.02	-.06	-.06	-.16*	-.08	-.02	-.04	.05	-.14*	-.02	1.00			
16. ENC	.07	-.04	-.15*	-.18*	-.22**	-.03	-.08	-.01	.01	-.07	.10	.14*	-.08	.11	.21**	1.00		
17. IMM	.01	-.09	-.15*	-.11	-.29***	-.08	-.05	-.08	-.03	-.04	.10	.09	-.02	.01	.19**	.53***	1.00	
18. INT	.14*	.12	-.05	.08	-.06	.05	.03	.13*	-.01	.04	.02	.08	-.09	.11	-.23***	.05	.10	1.00

Note. GEN = gender, PSESC = perceived current socioeconomic status, PSESY = perceived socioeconomic status when younger, OSES = objective measure of current socioeconomic status, MABIL = math ability, PERF = personal performance accomplishments, VICA = vicarious learning, VERB = verbal persuasion, AROU = emotional/physiological arousal, MSE = math-related self-efficacy, OE = outcome expectations, INTC = math-related course interests, INTA = math-related activities interests, MCEI = math-related course enrollment intentions, PRE = pre-encounter racial identity attitudes, ENC = encounter racial identity attitudes, IMM = immersion/emersion racial identity attitudes, INT = internalization racial identity attitudes.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$ (one-tailed)

interests (r = -.44, p = .000). The scatterplot indicated a linear relationship between the two variables and no outliers. Hence, as expectations of positive outcomes from pursuing math courses increased, so did interests in math-related activities.

Hypothesis 3: An additive combination of math self-efficacy beliefs and outcome expectations will account for more variance in math/science interests than will either self-efficacy or outcome beliefs alone. This hypothesis was tested using simple regressions with interests as the criterion and self-efficacy and outcome expectations as the predictor variables. Math self-efficacy was entered into the equation first, followed by outcome expectations. Outcome expectations added significant variance in interests (see Table 10). The same pattern held when self-efficacy was entered after outcome expectations (also see Table 10), suggesting that both predictors contribute uniquely to the equation. Therefore, math-related efficacy beliefs and outcome expectations together contribute to higher math-related interests than either self-efficacy or outcome beliefs alone.

Hypothesis 4: There will be a positive relation between mathematics ability and math/science interests. A bivariate correlation coefficient was used to test this hypothesis. A significant positive relationship was found between math ability and math-related interests (r = -.27, p = .000). Higher math ability scores were associated with higher math-related interests. An examination of the scatter diagram revealed a small linear relationship and no outliers.

Table 10. Summary of Regression Analysis for Testing the Additive Combination of Math Self-efficacy and Outcome Expectations in Predicting Interests

Predictors	R	R^2	F change	p_{Fchg}	Beta	p_{Beta}
Math self-efficacy	.483	.233	49.32	.000***	-.483	.000***
Math self-efficacy and Outcome expectations	.530	.280	10.53	.001***	---	---
Outcome expectations	.443	.196	39.50	.000***	-.443	.000***
Outcome expectations and Math self-efficacy	.530	.280	18.88	.000***	---	---

*** $p \leq .001$.

Hypothesis 5: The correlation between mathematics ability and interests will be eliminated when the influence of mathematics self-efficacy is controlled. A partial correlation coefficient (pr) was used to test the mediator effect of math self-efficacy on the relationship between math ability and math-related interests. After controlling for math self-efficacy, the correlation between math ability and math interests was virtually eliminated (pr = -.03, p = .368). Although not significant, this finding suggests that the ability-interest relation was fully mediated by self-efficacy.

Choices (or Intentions) Model

Hypothesis 6: There will be a positive relation between math self-efficacy and math and science course enrollment intentions. A bivariate correlation coefficient was used to test this hypothesis. A significant, moderate positive relationship between math self-efficacy and math course enrollment intentions was found (r = .38, p = .000). Higher levels of math self-efficacy were associated with greater intentions to take math-related courses in college.

An examination of the scatter diagram revealed a linear relationship between math self-efficacy and math-related course enrollment intentions. In addition, three outliers were found. One indicated high math course enrollment intentions but low math self-efficacy beliefs. The other two outliers consisted of high self-efficacy beliefs, but low course enrollment intentions.

After removing the outliers, the bivariate correlation increased to

.45 (p = .000). However, a Fisher's r to z transformation indicated that the second correlation was not significantly different from the initial correlation (z = .76).

Hypothesis 7: The correlation between mathematics self-efficacy beliefs and math/science enrollment intentions will be reduced but not eliminated when the influence of math-related interests is controlled. A partial correlation coefficient was used to test the mediator effect of interests on the relationship between self-efficacy and course enrollment intentions. The positive relation between math self-efficacy and math course enrollment intentions was reduced, but not eliminated (pr = .28, p = .000) when the influence of math-related interests was controlled. This suggests that the efficacy-intentions relation was partially mediated by interests.

Hypothesis 8: There will be a positive relation between math outcome expectations and math-related course enrollment intentions. This hypothesis was tested using a bivariate correlation coefficient. A significant, positive correlation of moderate strength (r = .45, p = .000) was found between math outcome expectations and math course enrollment intentions. Strong positive outcome expectations regarding math courses corresponded with greater intentions to take such courses in college. An examination of the scatter diagram revealed a linear relationship and no outliers.

Hypothesis 9: The correlation between math-related outcome expectations and course enrollment intentions will be reduced but not eliminated when the influence of math/science interests is controlled.

A partial correlation coefficient was used to test the mediator effect of math-related interests on the relationship between outcome expectations and course enrollment intentions. After controlling for the influence of math/science interests, the relationship between outcome expectations and course enrollment intentions was reduced but not eliminated (pr = .37, p = .000). Therefore, it can be said that the relationship between outcome expectations and enrollment intentions is partially mediated by interests.

Hypothesis 10: There will be a positive relation between mathematics-related interests and course enrollment intentions. A bivariate correlation was used to test this hypothesis. A significant, moderate positive correlation was found between math/science interests and course enrollment intentions (r = -.31, p = .000). Strong interests in math-related activities were associated with greater intentions to take math and science college courses. An examination of the scatter diagram revealed a moderate linear relationship and no outliers.

Sources of Math Self-efficacy and Outcome Expectations Model

Hypothesis 11: There will be a positive relationship between mathematics self-efficacy beliefs and the perceived amount of sources of self-efficacy (i.e., personal performance accomplishments, vicarious learning, verbal persuasion, and emotional/physiological arousal) in corresponding math/science activities. This hypothesis was analyzed using bivariate correlation coefficients. There was a significant, moderately strong positive correlation of math self-efficacy beliefs with personal performance accomplishments (r = .58, p = .000), verbal

persuasion (r = .58, p = .000), and emotional/physiological arousal (r = .57, p = .000). A significant positive, but lower correlation was found between math self-efficacy beliefs and vicarious learning (r = .28, p = .000). Math self-efficacy was moderately related to favorable experiences with personal performance, verbal persuasion, and emotional slightly related to vicarious learning experiences. The set of source variables accounted for about 43% of the variance in math self-efficacy percepts, and three of the four variables produced significant beta weights in a multiple regression predicting math self-efficacy (see Table 11).

An examination of the scatter diagrams revealed linear relationships for each of the four pairs of variables. Outliers were found in the scatterplots which depicted the relationships between math self-efficacy and three of the efficacy sources (i.e., vicarious learning, verbal persuasion, and emotional arousal). When the outliers were removed, there were no significant changes in the correlation coefficients (math self-efficacy/verbal persuasion, r_2 = .59, p = .000, z = .14; math self-efficacy/vicarious learning, r_2 = .25, p = .001, z = .30; math self-efficacy/emotional arousal, r_2 = .59, p = .000, z = .27).

Hypothesis 12: Direct, personal performance experiences will account for more variance in mathematics self-efficacy beliefs than will vicarious learning, verbal persuasion, or emotional arousal experiences. Personal performance accomplishments correlated with math self-efficacy to the same degree as verbal persuasion and emotional arousal. However,

Table 11. Summary of Regression Analysis for Predicting Math Self-efficacy

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Personal performance accomplishments	.580	.336	82.007	.000***	.210	.033*
Vicarious learning	.580	.001	.112	.739	-.081	.251
Verbal persuasion	.631	.062	16.503	.000***	.351	.000***
Physiological/Emotional arousal	.655	.030	8.415	.004**	.259	.004**

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

performance accomplishments correlated significantly more strongly with math self-efficacy than did vicarious learning (z = 3.41, p < .05, one-tailed). Thus, only one of the three comparisons supported Hypothesis 12.

Hypothesis 13: Positive outcome expectations will be positively related to directly experienced (i.e., personal performance accomplishments, verbal persuasion, and emotional arousal) and vicariously experienced consequences. Bivariate correlation coefficients were used to analyze this hypothesis. There was a significant moderate positive correlations of positive outcome expectations with personal performance accomplishments (r = .49, p = .000), verbal persuasion (r = .55, p = .000), emotional arousal (r = .47, p = .000), and vicarious learning (r = .37, p = .000). Positive math-related outcome expectations were moderately associated with favorable direct and vicarious learning experiences. The set of source variables explained 34% of the variance in outcome expectations, though in a multiple regression analysis predicting outcome expectations, only one of the four variables, verbal persuasion, produced a significant beta weight (see Table 12).

An examination of the scatter diagrams revealed linear relationships between the pairs of variables. Two outliers was observed in the outcome expectations/vicarious learning scatterplot. No significant difference was found in the correlation after removing the outliers (r_2 = .34, p = .000, z = .30)

Table 12. Summary of Regression Analysis for Predicting Outcome Expectations

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Personal performance accomplishments	.486	.237	50.212	.000***	.099	.348
Vicarious learning	.517	.030	6.686	.011**	.101	.181
Verbal persuasion	.577	.066	15.792	.000***	.346	.000***
Physiological/Emotional arousal	.585	.009	2.175	.142	.141	.142

** $p \leq .01$, *** $p \leq .001$.

Hypothesis 14: Mathematics-related outcome expectations will be more strongly related to direct, personally experienced performance consequences (i.e., performance accomplishments, verbal persuasion, and emotional arousal) than to vicariously experienced consequences. The magnitudes of the bivariate correlation coefficients were compared using Fisher's r to z transformations. The outcome expectations/verbal persuasion relationship was found to be significantly greater than the relationship between outcome expectations and vicarious learning ($z = 2.10$, $p < .05$, one-tailed). Comparisons of the differences between the outcome expectations/personal performance accomplishments and the outcome expectations/emotional arousal relationships were not found to be significant ($z = 1.35$). Although the correlation between outcome expectations and personal performance accomplishments was greater than that between outcome expectations and vicarious learning, this difference was not found to be significant ($z = 1.11$).

Hypothesis 15: There will be a positive relation between mathematics-specific positive outcome expectations and math self-efficacy beliefs. This hypothesis was tested using a bivariate correlation coefficient. A significant, positive correlation of moderate strength was found between outcome expectations and math self-efficacy ($r = .54$, $p = .000$). Higher beliefs in one's math and science capabilities were associated with stronger positive outcome expectations regarding math courses. An examination of the scatter diagram revealed a linear relationship and two outliers (moderate to high self-efficacy

beliefs, but low outcome expectations). When the outliers were removed, the second correlation was not significantly different (r_2 = .58, p = .000, z = .52) from the initial correlation coefficient.

Hypothesis 16: Gender differences in math self-efficacy beliefs will be mediated largely by differential access to sources of efficacy information. Thus, the relation of gender to math self-efficacy will be reduced when differences in efficacy source experiences are controlled. This hypothesis assumes that math self-efficacy beliefs differ for each gender group. The differences between the group means was tested using a Hotelling's T^2. A significant result on this test (T^2 = .160, p = .003) provided justification for examining a univariate t test of group difference on the math self-efficacy variable. Males showed significantly higher levels of math self-efficacy than females (t[162] = 3.14, p = .011; see Table 8).

To test hypothesis 16, a hierarchical regression was then conducted, predicting self-efficacy from gender while controlling for the sources of efficacy information. The set of source variables were entered into the equation first, followed by gender. Gender continued to be a significant predictor of math self-efficacy (see Table 13). This suggests that the effects of gender on self-efficacy are not fully mediated by differential efficacy-building experiences for the two genders in this sample. A slight reduction in the R^2 change statistic when gender is entered at the last step (vs. the first step) suggests a partial mediator effect of efficacy information on the gender/self-efficacy relationship (see Table 13). Therefore, gender differences in

Table 13. Summary of Regression Analysis for Predicting Math Self-efficacy from Gender While Controlling for Sources of Efficacy Information

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Sources of efficacy information (AROU, VICA, VERB, PERF) [a]	.655	.429	29.842	.000***		
Gender	.683	.039	11.437	.001***	-.204	.001***

[a]Sources of efficacy information are listed in order in which the entered the equation.
*** $p \leq .001$.

self-efficacy, in part, arise through differential access to efficacy-building experiences.

Hypothesis 17: Gender differences in mathematics-related outcome expectations are mediated largely by differential access to direct and vicarious reinforcement experiences. This hypothesis assumes that outcome expectations are different for each gender group. Differences in the group means on this variable were tested using a *t* test for independent groups. Men and women did not differ significantly in outcome expectations ($t[162] = .94$, $p = .348$; see Table 8). Therefore, the hypothesis that gender differences in outcome expectations would be mediated by differential access to direct and vicarious experiences was not tested.

Social Cognitive Model Goodness of Fit

A path analysis using EQS was computed to assess the overall model's "goodness of fit" to the data. Figure 4 displays the standardized path coefficients (or beta weights) for the hypothesized model. Standardized path coefficients can be interpreted as representing the effect of each predictor variable on a criterion variable while controlling for the effects of the other predictors in the path model (Loehlin, 1992).

In the present study, when the sources of efficacy information were controlled, math ability continued to produce a significant path to self-efficacy. This suggests that in this sample, math ability has a direct effect on math self-efficacy. Personal performance accomplishments, verbal persuasion, and emotional arousal produced a

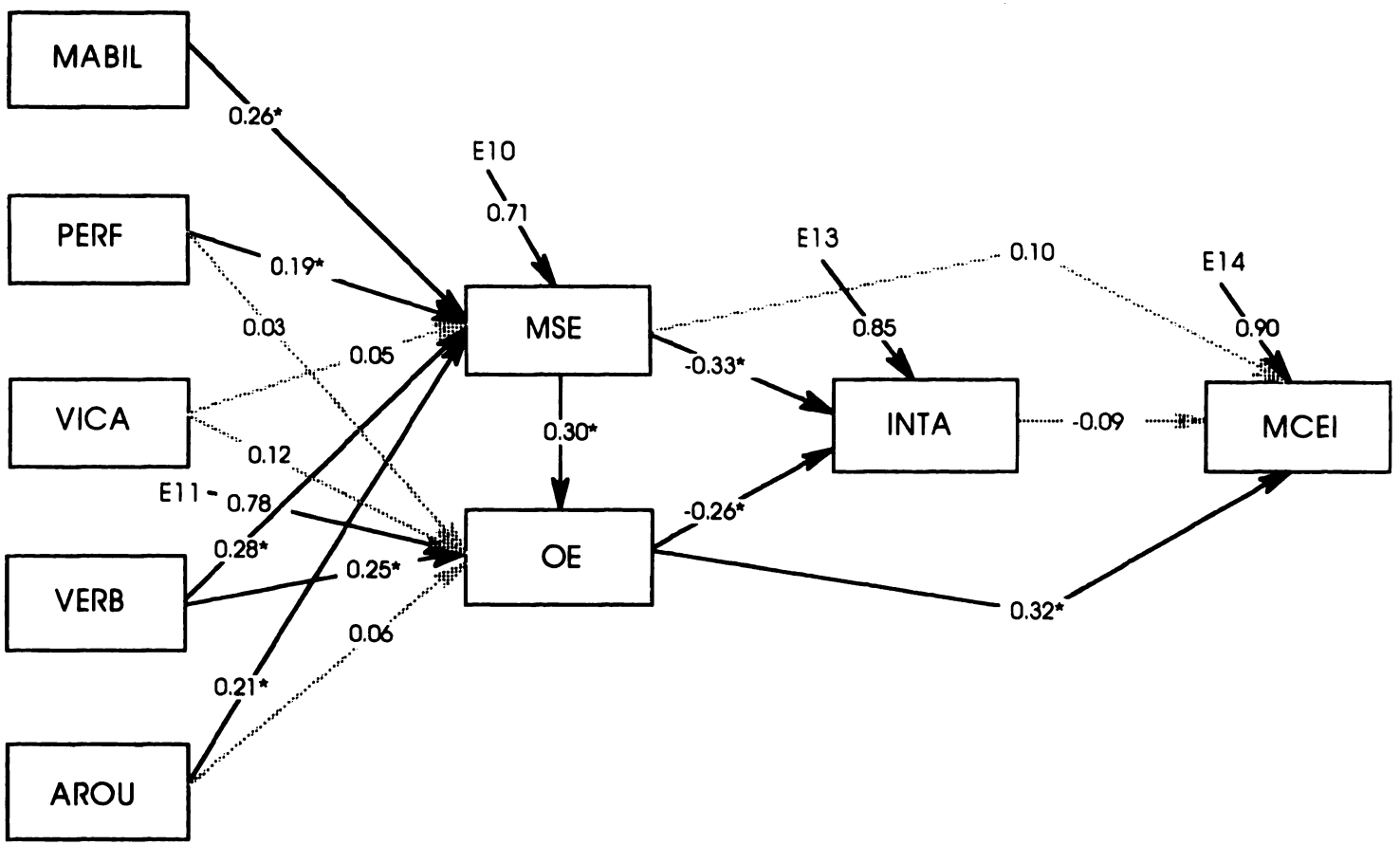

Figure 4. Final model of path analysis with standardized path coefficients. Path coefficients indicate causal effect of one variable on another in the direction of the arrow. Dashed arrows indicate nonsignificant paths. Scores on math ability and the source variables were freed to covary. MABIL = math ability, PERF = personal performance accomplishments, VICA = vicarious learning, VERB = verbal persuasion, AROU = emotional/physiological arousal, MSE = math-related self-efficacy, OE = outcome expectations, INTA = math-related activities interests, MCEI = math-related course enrollment intentions, E = residual or error term (associated with measurement error and/or unexplained portion of predictions).
* $p \leq .05$.

greater effect on self-efficacy than vicarious learning. Verbal persuasion had a greater effect on outcome expectations than personal accomplishments, vicarious learning, or emotional arousal. Collectively, the efficacy sources explained 27% of the self-efficacy variation and 23% of the outcome expectations variation. Math ability and efficacy sources together explained 54% of the variance in math self-efficacy.

Math ability was found to affect interests via self-efficacy, consistent with Lent et al.'s (1994) hypotheses. Support was also found for direct effects of outcome expectations and self-efficacy on interests, as well as an indirect effect of self-efficacy on interests mediated by outcome expectations. The total effect coefficient for self-efficacy on interests was .41. (This was calculated by combining the direct and indirect effects of self-efficacy on interests; .33 + [.30 x .26].) Math self-efficacy and outcome expectations accounted for 27% of the variance in interests.

In predicting math-related course enrollment intentions, the direct effect of outcome expectations was significant, though the direct effect of math self-efficacy was not. Support was found for an indirect effect of self-efficacy on course enrollment intentions that was mediated by outcome expectations. The path of interests to intentions was nonsignificant. This pattern did not support an indirect effect of math self-efficacy on course enrollment intentions through interests nor did it indicate an indirect effect of outcome expectations on intentions via

interests. The total effect coefficient for self-efficacy on course enrollment intentions was .23 (.10 + [.33 x .09] + [.30 x .32] + [.30 x .26 x .09]). This model (i.e., self-efficacy, outcome expectations and interests) accounted for 18% of the variance in math-related course enrollment intentions.

The fully mediated model produced a CFI value of .97 (NFI = .95; χ^2 [11, $\underline{N}$ = 164] = 31.18, $\underline{p}$ = .001), indicating that the hypothesized model adequately fits or explains the observed data. However, high residual terms (see Figure 4) suggests that a substantial portion of the model remains unexplained by the proposed predictions.

In order to decide whether separate models needed to be fitted for each gender group, a Box's M test was conducted. (Box's M tests for homogeneity of the variance-covariance matrix; Tabachnick & Fidell, 1996). Results indicated that the variance-covariance matrices were not significantly different for men and women (see Table 14). Therefore, separate models did not need to be fitted for each gender group.

Racial Identity Attitudes

Question 1: Are certain racial identity attitudes related to math-related self-efficacy beliefs, outcome expectations, sources of efficacy information, interests, or course enrollment intentions?

This question was examined using bivariate correlation coefficients. Correlations among the four racial identity attitudes and the social cognitive variables ranged from -.16 to .14 (see Table 9). With a few exceptions, the correlations among the two sets of variables were nonsignificant. Significant, but miniscule correlations were found

Table 14. Homogeneity of Variance-Covariance (Box's M test) for Gender Groups

Box's M	F	df	p	χ^2	df	p
40.621	1.054	36,32723	.380	37.999	36	.378

between Pre-encounter racial identity attitudes and verbal persuasion (r = -.16, p = .021), Pre-encounter attitudes and math-related interests (r = -.14, p = .034), and Internalization attitudes and verbal persuasion (r = .13, p = .047). That is, to a minimal degree, higher levels of Pre-encounter racial identity attitudes were negatively associated with encouragement to pursue math courses, but positively related to interests in math and science activities. High levels of Internalization attitudes were slightly associated with encouragement to pursue math-related courses.

An examination of the scatter diagrams for these correlations revealed slight linear relationships among the variables. Three outliers were found in both the Pre-encounter/verbal persuasion and the Internalization/verbal persuasion scatterplots. Removal of the outliers resulted in no significant change in the Pre-encounter/verbal persuasion relationship (r_2 = -.17, p = .015, z = .10). Although no change occurred in the Internalization/verbal persuasion relationship after the outliers were removed, the correlation was no longer significant (r_2 = .13, p = .053).

Question 2: Do certain racial identity attitudes influence the relationships of math-related self-efficacy beliefs and outcome expectations to math/science interests?

That is, do the strengths of relationships between math self-efficacy and interests and outcome expectations and interests depend on the level of racial identity attitudes? This question was explored using a

multiple regression predicting interests. In the first equation, math self-efficacy beliefs were entered first, followed by the four racial identity attitudes, and then the interactions between math self-efficacy and each of the racial identity attitudes. Table 15 presents the summary of these results. The interaction terms of math self-efficacy with each of the racial identity attitudes did not account for additional significant variance in math-related interests. This suggests that racial identity attitudes did not significantly affect the relationship between math self-efficacy beliefs and math/science interests.

In the second equation, outcome expectations were entered first, followed by the four racial identity attitudes, and the interactions between outcome expectations and each of the racial identity attitudes. Racial identity attitudes and the set of interaction terms did approach, but did not reach, significance (see Table 16). Thus, racial identity attitudes did not appear to moderate the relationships of self-efficacy and outcome expectations to interests.

Question 3: Do certain racial identity attitudes moderate the relation of mathematics course interests to intentions?

In other words, does the strength of the relationship between interests and course enrollment intentions depend on the level of racial identity attitudes. This question was also examined using multiple regression, this time predicting math course enrollment intentions. Interests were entered first, followed by the four racial identity attitudes, and then the interaction terms for course enrollment

Table 15. Summary of Regression Analysis for Predicting Math-related Interests using Math Self-efficacy and Racial Identity Attitudes as Predictors

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Math self-efficacy	.483	.233	49.315	.000***	-.483	.000***
Racial identity attitudes	.524	.042	2.263	.065		
Math self-efficacy x Racial identity attitudes	.542	.019	1.051	.383		

*** $p \leq .001$.

Table 16. Summary of Regression Analysis for Predicting Math-related Interests using Outcome Expectations and Racial Identity Attitudes as Predictors

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Outcome expectations	.443	.196	39.501	.000***	-.443	.000***
Racial identity attitudes	.491	.045	2.349	.057		
Outcome expectations x Racial identity attitudes	.534	.044	2.373	.055		

*** $p \leq .001$.

intentions and each of the racial identity attitudes. Racial identity attitudes did not moderate the relation between math-related interests and course enrollment intentions (see Table 17).

Additional Observations and Post-hoc Analyses

Several subsequent observations and analyses were conducted with the present data. They point to interesting findings revealed in previous career development research with Black college students.

Social Cognitive Variables

Black women indicated significantly higher interests in math-related activities than Black men, $t(162) = -1.96$, $p = .05$ (see Table 8), though there were no significant differences between Black men and women in their intentions to take math and science courses in college, $t(162) = .58$, $p = .56$ (see Table 8). Despite differences in math-related interests and math-related efficacy expectations, Black women and men appear to express equal levels of intentions to take math-related courses in college.

Although SES was not included in the research hypotheses or in the test of the model, some findings are noteworthy given the attention paid to it in the literature. First, math ability was significantly associated with both perceived and objective measures of current SES ($r = .24$, $p = .001$; $r = .27$, $p = .000$, respectively). Whether measured objectively or perceived by the participant, Black students coming from higher socioeconomic backgrounds tended to score higher on the SAT-I math subtest.

Table 17. Summary of Regression Analysis for Predicting Math Course Enrollment Intentions using Math-related Interests and Racial Identity Attitudes as Predictors

Predictors	R	R^2 change	F change	p_{Fchg}	Beta	p_{Beta}
Interests	.306	.094	16.768	.000***	-.306	.000***
Racial identity attitudes	.336	.019	.857	.491		
Interests x Racial identity attitudes	.379	.031	1.369	.247		

*** $p \leq .001$.

Perceived current SES was also positively, but weakly, related to verbal persuasion (r = .15, p = .027). Black students who perceived their SES to be higher reported receiving more positive social encouragement to pursue math/science courses. Perceived SES when younger was negatively associated with interests (r = .19, p = .008). (Note: The reader will recall that with the INTA measure, positive correlations imply negative relationships.) That is, to a small degree the higher the SES of the student while he or she was growing up, the more likely for him or her to express lower math-related interests. Current SES (as measured by the Stevens & Featherman's (1981) coding scheme) was negatively correlated with personal performance accomplishments (r = -.13, p = .047), emotional arousal (r = -.14, p = .011), and math course enrollment intentions (r = -.19, p = .006). Although the relationships are weak, Black students who come from homes with higher SES indicated less successful personal accomplishments in math and science, were more anxious about math and science activities, and expressed lesser intentions to enroll in math and science courses during their college careers.

Racial Identity Attitudes

A slight relationship between gender and Internalization racial identity attitudes was found (r = -.14, p = .041). This indicated higher levels of Internalization for Black women than for Black men. Pre-encounter, Encounter, and Immersion/Emersion racial identity attitudes were found to have weak, significant negative relationships

with perceived SES when younger (r = -.19, p = .006; r = -.15, p = .028; r = -.15, p = .030, respectively; see Table 9). Black college students who perceived their family's SES as lower during their childhood reported somewhat higher Pre-encounter, Encounter, and Immersion/ Emersion racial identity attitudes. Encounter racial identity attitudes had a weak, significant negative relationship with the objective measure of current SES (r = -.18, p = .011; see Table 9). That is, Black students with high Encounter racial identity attitudes tend to come from lower SES as measured by parental occupation. None of the racial identity attitudes were correlated with perceived current SES.

Math ability had small, negative correlations with Encounter (r = -.22, p = .002) and Immersion/Emersion racial identity attitudes (r = -.29, p = .000). Perhaps Black college students who are experiencing the challenges and confusion of these stages have some difficulty scoring well on a standardized test of math ability.

Chapter 5

DISCUSSION

In an increasingly technological society, the continued underrepresentation of Blacks in math- and science-related courses and occupations warrants serious attention. The purpose of this study was to conduct a theoretically-based investigation of the mathematics-related academic and career behaviors of Black college students. Lent et al.'s (1994) social cognitive career theory offers one potentially useful framework for studying the math and science career aspirations of Black college students. Since mathematics-related course enrollment patterns help determine the range of one's career options, this study examined factors (i.e., math self-efficacy, outcome expectations, learning experiences, and math-related interests) that may influence Black students' intentions to enroll in math and science-related courses during college.

In addition to examining the influence of several social cognitive variables, the relation of racial identity attitudes (using the Cross Nigrescence model; Cross, 1971, 1991, 1995a, 1995b) to math- and science-related aspirations was also explored. Racial identity has been speculated to have important implications for career choice and development in African Americans (Helms, 1994b; Helms & Piper, 1994;

Parham & Austin, 1994).

Social Cognitive Career Theory and Black College Students

Results of the regression and path analyses indicated support for applicability of the Lent et al. (1994) social cognitive career theory with Black college students. The data fully supported 14 of the 17 hypotheses. The proposed model depicting relationships among math ability, learning experiences, self-efficacy, outcome expectations, interests, and intentions provided an adequate explanation of the data. In many ways, the path analysis results for this study were consistent with those of recently published investigations using structural equation and path analyses.

Consistent with prior research on primarily European American students (e.g., Lent et al., 1989; Lent et al., 1991, 1993), math self-efficacy and math-related outcome expectations were each related to math-related interests. In addition, self-efficacy and outcome expectations were jointly predictive of students' math interests as also found in Lent et al. (1991, 1993). The effect of self-efficacy on interests was partially mediated by outcome expectations. That is, self-efficacy affected interests directly and indirectly through outcome expectations. Therefore, based on the results in the current study, Black college students' (a) beliefs about their capacities to do well in math and science courses, and (b) expectations that doing so will result in positive outcomes each appear to have direct positive effects on their interests in math-related activities. Further, efficacy beliefs

appear to best predict interests when Black students, like others, believe that their efforts will be rewarded (Fouad & Smith, 1996; Lent et al., 1993).

In addition, math self-efficacy was correlated with outcome expectations. This supports prior research (e.g., Lent et al., 1993), demonstrating that students who feel efficacious about their abilities to do well in math and science college courses also tend to believe that pursuing such courses will result in successful experiences.

In the path analysis, math ability had a direct effect on math self-efficacy, even when the effects of perceived sources of efficacy information were controlled. As hypothesized by the path model (Lent et al., 1994) and supported by previous research (Lapan et al., 1996; Lopez et al., 1997), math ability did not have a direct effect on math-related interests. Math self-efficacy served to fully mediate the relationship between math ability and math-related interests. Therefore, scores on a standardized mathematics test (i.e., the SAT-I) seem to affect Black students' interests in math to the extent that they feel efficacious about their mathematics abilities.

Also replicative of previous findings (Fouad & Smith, 1996; Lent et al. (1993), math self-efficacy was positively associated with course enrollment intentions. This relationship was also partially mediated by math/science interests. These results are somewhat unlike those of Post et al. (1991) and Post-Kammer and Smith (1986), where self-efficacy and interest were differentially useful in predicting the math-related occupational considerations of Black and ethnically diverse men and

women. However, in those studies, self-efficacy and interests were pitted against each other, thereby possibly obscuring their joint role relative to occupational considerations. The present study supports the mediating role of interests on the relationship between self-efficacy and choice goals.

In addition, in the current study, outcome expectations were associated with math-related course enrollment intentions. This suggests that for Black college students, positive outcome expectations about pursuing math and science college courses are directly related to intentions to enroll in such courses. Interests also had a partially mediating role in this relationship. That is, the influence of outcome expectations on intentions to enroll in math/science courses appear to operate partly through Black students' interests. Therefore, the present findings suggest that both high efficacy expectations about one's math and science capabilities and positive outcome expectations about math and science are directly related to intentions to enroll in math and science courses in college. Further, interests partly mediates the effects of both efficacy beliefs and outcome expectations on Black students' course enrollment intentions. Fouad and Smith (1996) found similar results in their study of ethnically diverse middle school students.

Based on the correlational analysis, math-related interests were related to math-related course enrollment intentions. That is, Black students' interests in math and science activities were associated with their intentions to pursue math and science courses in college. This

finding mirrored those of Fouad and Smith (1996) and Lent et al. (1993).

However, the results of the path analysis indicated that while the direct effect of outcome expectations on math-related course enrollment intentions was significant, the direct effects of efficacy beliefs and interests on enrollment intentions were not. That is, although the correlational and regression analyses indicated an association between Black students' interests in math and science activities and their intentions to enroll in math and science college courses, results of the path analysis suggested that this relationship washed out when confidence in one's math abilities and expectations about outcomes were controlled. It appears that the direct effect of outcome expectations on enrollment intentions was so strong, that it negated the direct effect of interests on intentions and perhaps the direct effect of self-efficacy on intentions. For the present sample, math self-efficacy beliefs facilitated the development of mathematics-related interests and course enrollment intentions primarily through outcome expectations. This finding may point to the more influential role of the consequences Black students anticipate from their actions (vs. the beliefs they hold about their capabilities to do well) on their math- and science-related choice goals.

As expected, sources of efficacy information (i.e., past performance accomplishments, social encouragement, vicarious learning, emotional arousal) were positively related to math self-efficacy. Substantial correlations of math self-efficacy to performance accomplishments,

verbal persuasion, and emotional arousal (and a lower correlation between self-efficacy and vicarious learning) were consistent with the findings Lopez et al. (1997). Together these learning experiences contributed to the development of Black students' confidence in their capacities to do well in math and science courses. However, conflicting with prior findings (e.g., Lent et al., 1993), the correlational and regression analyses showed verbal persuasion to rival personal performance accomplishments as the strongest source of math self-efficacy. This suggests the importance of social support and encouragement to Black students' math-related efficacy beliefs. Emotional arousal also rivaled direct, personal performance in predicting efficacy expectations. For Black students, high levels of anxiety about math-related tasks and activities were associated with lower levels of math self-efficacy. Results of the path analysis indicated that all three direct, personally experienced performance consequences (i.e., personal performance, verbal persuasion, and emotional arousal) had a greater effect on self-efficacy expectations than did vicarious learning. That is, having their own personal experiences with regard to math and science contributed more to the development of math-related efficacy expectations in Black college students than observing the experiences of others.

Contrary to Lent et al.'s (1994) hypothesis, the path analysis found that verbal persuasion was a more important source of outcome expectations than were perceived performance accomplishments, vicarious learning, and social persuasion. That is, only verbal persuasion

produced a significant path to outcome expectations. Thus, Black students may rely more importantly on encouragement from others in order to believe that their efforts to pursue math/science-related courses will result in positive outcomes.

The path analysis also revealed no direct effects of vicarious learning on math self-efficacy or outcome expectations. It is possible that Black students recognize the lack of accessible racially-similar role models successfully engaging in math/science-related pursuits. In the absence of such models, other learning experiences (i.e., past accomplishments, emotional reactions, and social encouragement) may prove to be more informative in determining Black students' efficacy expectations.

In this sample, gender differences in math self-efficacy were also consistent with prior research (e.g., Betz & Hackett, 1983; Bieschke, 1991; Lapan et al., 1989; Lapan et al., 1996; Lent et al., 1991, 1993). Black men reported significantly higher levels of math self-efficacy than did Black women. In addition, sources of efficacy information partially mediated the relationship between gender and self-efficacy. That is, the differences in self-efficacy between Black men and women can be partly attributed to differential experiences in the areas of personal accomplishments, social encouragement, observational learning, and emotional arousal states.

Unlike previous studies (e.g., Fouad & Smith, 1996; Lent et al., 1993), however, Black men and women did not differ in their levels of math-related outcome expectations. On average, both gender groups were

moderate in their beliefs that positive outcomes would result from taking math and science college courses (see Table 8). Further, the range of scores for the entire sample was wide (.20 - 8.70; see Table 7). Black men and women, coming from similar sociocultural experiences, may expect similar outcomes regarding math courses. These results may be idiosyncratic to the present sample; therefore additional research is needed before any definite interpretations can be made.

In addition, the present results seem to contradict prior findings of gender differences in the outcome variable, in this case, math-related course enrollment intentions (e.g., Hackett, 1995; Lent et al., 1993), In this sample of Black college students, no significant differences were found in men and women's intentions to take math courses in college. Again, there was a wide range in scores in the overall sample (.14 - 7.21; see Table 7). Black women did report higher math/science-related interests than Black men, despite lower levels of self-efficacy with regard to math and science courses. While Black women enjoyed math-related activities more than Black men, this does not seem to translate into greater confidence in their abilities to do well in math and science college courses.

The fact that separate path models did not need to be tested for men and women indicates that overall, social cognitive variables have similar impacts on the math-related course enrollment intentions of Black male and female college students. This is a rather perplexing notion given the differential experiences of racism and sexism on the

lives of Black men and women (Greene, 1994). Further research is needed before more definitive conclusions can be made about the differential impact of social cognitive variables on the career choice and development of Black men and women.

Overall, the social cognitive career theory as presented by Lent et al. (1994) seems to be quite applicable to this sample of Black college students. The findings of the present study were fairly consistent with previous results with both predominantly White and more ethnically diverse samples.

Role of Black Racial Identity Attitudes

In general, Black racial identity attitudes had little or no relation to the social cognitive variables involved in math-related career development of Black college students. Two of the racial identity attitudes had weak relationships with two of the social cognitive variables. Pre-encounter attitudes had a slight, negative relationship with verbal persuasion, whereas Internalization attitudes also had a weak, positive relationship with verbal persuasion. Black students with low salience or even negative attitudes toward Blackness may perceive less social support to pursue math and science, while Blacks with a greater sense of pride and security in their racial identity may perceive more encouragement to pursue nontraditional career-related activities, like math and science.

Pre-encounter racial identity attitudes also had a small, positive association with math-related interests. This finding is consistent with that of Woods (1991) who found a weak, positive relation between

Pre-encounter attitudes and Investigative interests. Woods (1991) speculated that Investigative career fields rarely incorporate Afrocentric culture, issues, or options and that this lack of exposure to Black culture is consistent with a Pre-encounter world view in which ethnic identity is denied in favor of assimilation into the Eurocentric culture. This finding may also point to a belief by Blacks with Pre-encounter attitudes that math and science activities are "White" or "European" activities and therefore worthy of their interests. However, the present study suggests that they may not necessarily receive encouragement to pursue their interests.

Both Encounter and Immersion/Emersion attitudes had higher negative relationships with math ability than did Pre-encounter or Internalization racial identity attitudes. Encounter and Immersion/ Emersion racial identity attitudes represent periods of intense conflict and change. Doing well on standardized test of mathematics ability may be more difficult when one's sense of identity is in active flux.

These small to non-existent correlations involving the racial identity variables generally suggest these variables do not account for a large proportion of the variance in social cognitive variables. For example, it appears that there are other variables (i.e., math self-efficacy and outcome expectations) that are more influential in developing interests in math and science activities than Pre-encounter attitudes.

Previous studies have produced conflicting findings regarding the role of racial identity in vocational development. While some

investigations (Evans & Herr, 1984; Grace, 1984; Williams & Leonard, 1991) show no significant relationships between Black racial identity attitudes and career development variables (e.g., academic persistence, academic major, career choice), others (Evans, 1989; Woods, 1991) have found some relationships between certain racial identity attitudes and career aspirations, career interests, or occupational satisfaction.

As noted in Chapter 2, mean Internalization racial identity attitudes were greater among the research participants of these previous studies. This was also true in the current study (see Table 7). Therefore, as with previous investigations of the role of racial identity in vocational development, Internalization attitudes may not be predictive of math-related choice behaviors in Black college students. However, high Pre-encounter, Encounter, or Immersion/Emersion racial identity attitudes may be significant contributors to Black students' math-related choices.

Prior research has also shown racial identity attitudes to have no association with SES (Carter & Helms, 1988, Parham & Helms, 1985b; Parham & Williams, 1993). In the current study, some of the racial identity attitudes were found to have significant, but weak relationships with SES. Pre-encounter, Encounter, and Immersion/Emersion attitudes were found to have weak negative relationships to perceived SES when younger, while Encounter attitudes were negatively (and slightly) associated with an objective measure of SES. For the Black college student, higher social status during childhood may foster lower race salience during late adolescence, while

lower social status may provide the kinds of encounters that challenge and shape one's later views of Blackness. Lower current SES (as measured by parental occupation) may also foster race-related experiences that would give rise to high Encounter racial identity attitudes. Although the present study found no relationships between Internalization attitudes and SES, Woods (1991) found Internalization attitudes to be related to social class. She suggested that Blacks from higher socioeconomic statuses may be more accepting of both Afrocentric and Eurocentric worldviews. While racial identity and SES are internal and external forces, respectively (Carter & Helms, 1988), SES may represent a component of the external environment that does have some influence on racial identity development.

In sum, in the present study racial identity attitudes did not appear to directly relate to math self-efficacy, outcome expectations, learning experiences, math-related interests, or math-related course enrollment intentions. Nor did they appear to moderate the relationships between self-efficacy and interests, outcome expectations and interests, or interests and intentions. While there appears to be some relationship between math ability and Encounter and Immersion/Emersion racial identity attitudes, it is unclear how this affects other aspects of the math-related career development process of Black college students.

Implications for Social Cognitive Career Theory

The present investigation advances the study of social cognitive career development in at least two ways. First, it provides a test of a

portion of a comprehensive career development model that incorporates the impact of person, contextual, and experiential factors. Second, the study applies this theory to a traditionally under-studied population -- Black college students.

On balance, social cognitive career theory does appear to be applicable to math/science career choice and development of Black college students. Math self-efficacy and outcome expectations inform interests in math and science activities, which subsequently inform Black students' intentions to take math and science courses in college. Learning experiences like past personal performance accomplishments in math and science, encouragement to pursue math and science courses, exposure to successful role models in math and science, and emotional and physiological reactions to math and science courses and activities affect the development of Black students' math-related efficacy beliefs and expectations for positive outcomes.

Math self-efficacy assists in translating performance on standardized math tests into high or low interests in math and science activities. In much of the literature, little to nothing has been said about the impact of realistic perceptions of high academic ability despite traditionally accepted "evidence" (e.g., low SAT scores) to the contrary. For example, students who score poorly on standardized mathematics achievement tests, yet do well in their math courses (especially where application of concepts may be encouraged and/or emphasized) may have appropriately high efficacy expectations for the particular academic domain (e.g., mathematics). Social cognitive career

theory, like most discussions that address achievement, aptitude, ability, or performance, assume that measures of these variables (i.e., standardized tests, course grades) are reliable and valid indicators of that construct in all students. Fortunately, the propositions of the Lent et al. (1994) model place greater emphasis on people's perceptions of their ability rather than their test results.

Consistent with the majority of research on math self-efficacy and gender, Black men reported higher self-efficacy expectations than Black women. These differences were partly mediated by differential learning experiences of Black men and women. Although Black culture is viewed as having flexible gender-role expectations (Greene, 1990a, 1990b, 1994), it appears that traditional sex-role stereotyping socialization processes may have an impact on differences in math self-efficacy between Black men and women. The results of this study indicate the possibility that traditional sex-role socialization impacts the efficacy expectations of Black men and women, in some ways similar to that of White men and women. Sex-role socialization has been found to be related to Black students' math-related career choices (Hall & Post-Kammer, 1987).

Hackett and Byars (1996) recently outlined how culturally-specific socialization experiences may influence each of the four sources of efficacy information and subsequently contribute to the development of higher or lower career-related efficacy expectations in African American women. For example, Black girls may experience subtle racism in the form of differential performance feedback in elementary and high school.

Although they may be performing as well as or better than their White peers, Black girls often do not receive the same positive reinforcement and encouragement. These experiences can then result in decreased levels of academic self-efficacy despite successful academic performance. On the other hand, Hackett and Byars (1996) assert that higher and stronger preexisting efficacy expectations can provide Black girls with the ability to correctly attribute such situations to discrimination.

It would be interesting to explore whether similar gender differences in self-efficacy emerge in Blacks who are not originally from the United States. A number of Black students at the university at which this study was conducted are recent immigrants either from Africa or the West Indies and therefore do not identify themselves as African American. Although there were no differences in the social cognitive variables between Black students born and raised in the United States and those who were not, further exploration may prove informative from an African diasporic perspective. One possible research question might be: Do similar gender-role socialization patterns influence the development of efficacy beliefs in non-U.S. Blacks as they do in African Americans?

Contrary to existing studies, Black men and women did not differ significantly in their outcome expectations or in their intentions to take math and science courses in college. While Black men may report feeling more efficacious about their abilities to do well in math and science courses than Black women, and Black women may express greater

interests in math and science activities than Black men, neither group reported higher intentions to pursue math and science college courses. Therefore, differences in math self-efficacy and math-related interests between Black men and women do not necessarily translate into differences in intentions to take math and science courses in college. It seems plausible that outcome expectations serve to balance out these differential internal processes. Because of their knowledge and experiences with oppression and the recognition that traditional rewards operate differently in this society for Blacks and other people of color (Leung, 1995), Black men and women may share similar expectations about the likelihood that their efforts will result in successful and desired outcomes. Therefore, regardless of their confidence in their math and science abilities or their level of interests in math-related activities, Black men and women may express similar levels of intentions to take math and science courses in college.

Implications for Racial Identity Development Theory

The present study also attempted to shed light on the role of racial identity attitudes on Black college students' career development. Although as in previous studies (Evans & Herr, 1994; Woods, 1991), racial identity attitudes did not emerge as greatly affecting math- and science-related career development in Black college students, the current results have some important implications for continued development of the theory. Despite the current lack of supportive evidence, it continues to seem logical to believe that racial identity development theory would enhance our understanding of the career

development process for African Americans. As the philosophy of science dictates, failure to find significant results does not necessarily mean that such results do not in fact exist (R. W. Lent, personal communication, February 5, 1997). In addition, lack of diversity in racial identity attitudes among research participants may obscure the complete picture of how racial identity impacts the career development. Closer examination of racial identity theory may help to uncover previous roadblocks to understanding the relationship between racial identity and career development.

Recent revisions of both the Cross (Cross, 1995a, 1995b) and Helms (Helms, 1994a, 1995) models of Black racial identity development have addressed the increasing complexity of the concept of racial identity. Cross (1995a, 1995b), for example, addressed previous misconceptions of Pre-encounter racial identity as a solely anti-Black or self-hate orientation. Drawing from relevant research, it is clearer that Pre-encounter Blacks are not necessarily deficient in psychological areas like maturity or mental health. Therefore, Pre-encounter racial identity should not be presumed to be associated with negative self-concept or low self-efficacy. Cross (1995b) also highlighted that the Nigrescence process involves changes in the "group identity or reference group component of Black self-concept more than it does one's general personality" (p. 114). Racial identity is viewed as the "group level" of Black self-concept. Self-efficacy, outcome expectations, and interests are not necessarily reference group constructs (at least not as currently measured). Therefore, relationships among racial identity

and these (and other) social cognitive variables given current measures should not necessarily be expected.

Bandura's (1986) concept of "collective efficacy" may have some relevance here. Collective efficacy is a group's belief "that they can solve their problems and improve their lives through concerted effort" and "influences what people choose to do as a group, how much effort they put into it, and their staying power when group efforts fail to produce results" (p. 449). Discussed by Bandura (1986) primarily as a mechanism for social change, collective efficacy is rooted in self-efficacy. Therefore, personal efficacy does not necessarily reflect the individualistic bias traditionally purported by Western psychology (Bandura, 1986). Racial identity attitudes, as a reference group identity, may relate more to collective efficacy than to personal efficacy. To the extent that pursuing math and science courses and careers may be seen by Black students as a form of social action, collective efficacy might explain the math- and science-related career behaviors of Black college students.

Helms (1994a, 1995) has advocated conceptualizing the process of racial identity development in terms of ego statuses instead of stages. She recognized the inadequacy of the use of the term stages to describe the developmental processes concerning racial issues. This includes the tendency of researchers to view stages as static categories despite her operational definition of stages as "mutually interactive dynamic processes" (Helms, 1995, p. 183). Helms (1995) has contended that the

notion of ego statuses more clearly highlights the dynamic cognitive, emotional, and behavioral processes involved in racial identity. Ego statuses refer to "successive differentiations of the ego" (Helms, 1994a, p. 301). Racial identity ego statuses are presumed to develop and mature sequentially. Later statuses (e.g., Internalization) are more cognitively complex than early statuses (e.g., Pre-encounter). The behavioral expression of racial identity is determined by which racial identity ego status is most dominant. Dominant statuses are those that are reinforced most consistently in the environment. A secondary status is also accessible as a coping strategy when the need arises (Helms, 1995). In this sense, racial identity could be considered multidimensional.

The current and earlier studies investigated the relationship of racial identity to academic/career development from a unidimensional or global perspective (Helms, 1989). Parham (1989) and Helms (1989) had previously noted that racial identity development may be multidimensional and, therefore, vary depending upon the particular domain under consideration (e.g., personal relationships, vocational aspirations) and the developmental life stage of the individual (i.e., late adolescence/early adulthood, middle adulthood, late adulthood; Parham, 1989, 1990). If racial identity development is multidimensional, then "a person's racial identity concerning the world of work [or academics] might be governed by one stage [or ego status] of racial identity, whereas his or her racial identity concerning social relationships might reflect another" (Helms, 1989, p. 242). Perhaps,

then, it is time to begin formulating a theory of vocational racial identity development whereby "the extent to which race and culture play an integral role in career development and behavior" (Parham & Austin, 1994, p. 140) is explained.

Helms and Piper (1994) discussed how racial identity may influence certain vocational outcomes (e.g., interest, values) and processes (e.g., decision-making, vocational identity development). Reviewing predominately unpublished research, the authors concluded that racial identity may be more predictive of the career development process than to vocational content. Racial identity theory is intended to explain the process of racial group identity development and the nature of the racial environment in which that development takes place (Helms & Piper, 1994). Therefore, racial identity may serve a mediator role between the objective racial environment and a person's vocational behavior in response to that environment. Further, racial identity attitudes share common themes with occupational identity development; that is, "stability in one's racial inner world might be related to the quest or need for stability in one's occupational world" (Helms & Piper, 1994, p. 130).

Parham and Austin (1994) speculated how racial identity may influence work values, perceptions of opportunities, occupational stereotyping, career decision-making, and workforce diversity. For example, Blacks with Pre-encounter attitudes may attribute being denied a career opportunity to lack of qualifications, while those with Immersion/ Emersion attitudes may assume that the same situation represents blatant

racism (Parham & Austin, 1994). Racial identity may influence perceptions of career barriers which may then impact outcome expectations.

In summary, despite the current literature, racial identity development theory may prove useful to career development to the extent that racial identity may be (a) more related to collective efficacy than to personal efficacy, (b) considered multidimensional and therefore require construct-specific measures for a clearer understanding of its role in career choice and development, and (c) more useful in explaining career development processes (e.g., vocational identity development) rather then certain career-related outcomes (e.g., interests or intentions). The new conceptualizations of racial identity development of Cross (1995a, 1995b) and Helms (1994a, 1995) may improve the design and interpretation of vocational racial identity research.

Limitations of the Study

Interpretation of this study's findings needs to consider several important conceptual and methodological limitations. First, generalizability of the results is limited in that participants consisted of predominately working and middle class Black college students in their first year of college at a predominately White university in the northeast region of the United States. Results must therefore be generalized only cautiously to other samples, such as upper-class Black college students attending a historically Black college in the southeast. Women also comprised a large proportion of

the sample (69.5%). In addition, it should be noted that the admissions office's list from which the mailing was drawn consisted of those students who self-identified as African American or Black on their college applications. Black students who do not indicate their race or ethnicity when applying to college may have significantly different levels of the social cognitive variables and racial identity attitudes than students who readily identify their race or ethnicity. That is, this sample may be biased toward Black students who are more comfortable indicating their race or ethnicity on college applications. Other extraneous variables distinguishing those who indicate their race on university records from those who do not may have also affected the results.

A second limitation concerns the use of the mail survey for part of the sample. Mail surveys can be a relatively easy way to gather information from large numbers of people (Hackett, 1981). However, they are limited in obtaining a random sample, assuring that questions were understood by the participants, or assuring that the addressee was the one who actually answered the questions (Isaac & Michael, 1995). In addition, for the present study, a higher response rate may have been obtained if the procedures of Dillman's (1978) Total Design Method for conducting mail surveys had been followed more closely (e.g., printing the questionnaire as a booklet). Although separate analyses were not conducted for each group, mailing participants were significantly different from directly recruited participants on math self-efficacy, outcome expectations, emotional arousal, math-related interests, and

Immersion/Emersion racial identity attitudes. Directly recruited participants had higher levels of emotional arousal (t = 2.22, p = .028), math self-efficacy (t = 2.26, p = .025), outcome expectations (t = 2.69, p = .008) and Immersion/Emersion attitudes (t = 2.24, p = .027), while mailing participants indicated higher math-related interests (t = -3.80, p = .000). (A significant Hotelling's T^2 [.125, p = .017] provided statistical justification for examining these differences using univariate t tests.)

Third, several factors may have influenced the response rate for both the direct and mailing recruitment procedures. A number of students could not be approached because key intermediary people (e.g., program administrators, student organization presidents) either did not respond to efforts to make initial contact or declined to cooperate after contact was made. Potential participants may also have read the article appearing in the Black and Latino student newspaper (see Appendix C). Despite the actual information given to the interviewer, a particular slant was taken that slightly misrepresented the purpose of the research. In addition, conducting the mailing earlier in the semester may have improved the response rate. Due to the research design, it was not possible to compare mail responders to mail nonresponders; the only information available on nonresponders was their campus addresses.

Fourth, high residual coefficients in the path analysis results may indicate that potentially important variables were not included in the model tested. Chipman and Thomas (1987) presented a dauntingly complex path model consisting of 25 variables that contribute to the

participation of women and people of color in math and science pursuits. The authors stated that the complexity of their proposed model may help to explain why inconclusive results exist in the broader research on factors that influence the participation of women and minorities in math and science. Thus, although the tested model provided a good fit to the data, other factors not included in this study (e.g., contextual affordances like financial resources and competing demands of family and work) may also play integral roles in the career development process.

Fifth, contrary to reliability findings noted in the racial identity literature, a low coefficient alpha was obtained for the Internalization subscale (see Table 6). Lemon and Waehler (1996) also found a low Chronbach's alpha for Internalization ($\underline{r}$ =.48). They speculated that low coefficients on this scale may be because items in this stage measure more than one dimension. Examination of the items for the Internalization subscale suggest the plausibility of this explanation. A number of items scored as Internalization could also reflect Immersion/Emersion or even Pre-encounter racial identity attitudes. For example, item 30 of the RIAS-B ("I believe that because I am Black, I have many strengths") could describe the intense pride or either/or thinking of the Immersion/Emersion stage. Similarly, Item 22 ("People, regardless of their race, have strengths and limitations") could reflect the low salience for race now understood as part of Pre-encounter racial identity.

Lastly, measurement specificity of the RIAS-B may have affected the results. The RIAS-B is global in its focus and therefore may offer

little in the way of understanding racial identity attitudes as they apply to a specific content domain (i.e., vocational development). The pilot study for the present investigation tested an attempt to revise the RIAS-B to assess racial identity as it may influence career considerations. Limited resources prevented the development of a new measure that would achieve this purpose.

Implications for Counseling Practice

Despite these limitations, the results of the study have important implications for counseling psychologists and other educators who work with Black students. The data are consistent with assumptions that math self-efficacy and outcome expectations lead to interests in math-related activities. These interests subsequently influence Black students' intentions to take math and science college courses. Intentions to engage in a particular behavior have been associated with the likelihood of exhibiting that behavior (Fishbein & Azjen, 1980). Therefore, development of positive and accurate math- and science-related efficacy beliefs can greatly enhance Black students' participation in math and science.

It has been recommended that career counseling with Black students (and other minority groups) begin with a self-assessment by the counselor of their own biases and stereotypes about the values of Black culture. Counselors also need to recognize how these biases inform their perceptions of the vocational opportunities available to Blacks (Bowman, 1993, 1995). As with any counseling intervention, career

counseling of Black students should also include a thorough understanding of the client. The career counselor needs to be a "culturally relevant" counselor. That is, he or she "must . . . know and understand the complex, dynamic, interactive, and multifaceted historical, sociopolitical, sociocultural, family, and psychological systems and processes which together influence the career paths of visible racial/ethnic group members" (Carter & Cook, 1992, p. 212). This includes understanding the unique ways in which learning experiences and environmental circumstances influence the self-efficacy and subsequent career behaviors of Black college students. The success of specific career interventions will be enhanced if these steps are addressed before implementing the interventions.

As social learning/cognitive models, Bandura's (1986) and Lent et al.'s (1994) frameworks explicitly contain elements for designing and implementing effective interventions. That is, the causes of the problem (i.e., deficits in the learning experiences that impede the development of strong self-efficacy) also imply a remedial approach (Betz, 1992b). Therefore, interventions designed to develop and improve strong efficacy expectations should begin with the four sources of efficacy information (Betz, 1992; Brown & Lent, 1996).

Of course, the first step of any counseling intervention is assessment of the problem. The counselor must first determine if low self-efficacy is the source of a client's difficulties in career development (Betz, 1992b; Lent & Brown, 1996). Once the problem has been identified as efficacy-oriented, interventions that structure

successful performance experiences, provide exposure and access to successful race- and/or gender-similar math/science images and role models, develop anxiety management strategies, and provide reinforcement and encouragement for goal achievement can then be developed (Betz, 1992b; Brown & Lent, 1996).

Equally important to assessing the problem, is the importance of being clear about what we expect from our interventions (Spokane, 1991). Is the objective for the Black student (assuming sufficient ability) to ultimately pursue a math or science career? Or is increased exposure to math/science experiences, regardless of career choice, a desirable outcome?

Once the problem has been accurately assessed and the therapeutic goals are clear, the counselor needs to make a full and accurate assessment of the Black student's learning experiences. It is important to understand this from a sociopolitical and historical context (Carter & Cook, 1992). This could mean extending one's discussions about familial influences with a Black student beyond several generations to understand more fully the messages and experiences that have fostered or hindered the student's career development. The counselor may learn, for example, that the client's most influential work-related role models are great-great grandparents, uncles, or aunts. Further, given the cultural significance of "kinship" ties in Black communities (Stack, 1974), the counselor should also explore influences that extend beyond biological family ties (e.g., minister, neighbor).

Even though the results of the current and previous studies indicate

the differential strength of one or a subset of the sources (over all four) in facilitating positive self-efficacy and outcome expectations, incorporation of all four sources in any intervention may capitalize on the strengths of the individual's current resources as well as add to the Black student's experiential repertoire. Findings of the present investigation suggest that increased exposure to math and science successes, decreased anxiety associated with math and science, and encouragement from the counselor may strengthen Black students' confidence in their abilities to do well in math/science activities or careers. Encouragement can also increase Black students' expectations that their efforts to pursue math and science will lead to successful outcomes. Although vicarious learning did not emerge as a strong predictor of math self-efficacy or outcome expectations, exposure to racially-similar math and science role models may serve to enhance negative efficacy beliefs and outcome expectations.

Brown and Lent (1996) recommended three theory-derived counseling strategies for counseling people with career development difficulties. First, the counselor and the client should identify foreclosed occupational options, including those in which the client expresses lower interests. The experiences and beliefs which form the basis for the low interests should be fully analyzed. Second, perceived barriers to attainment of career goals need to be identified and explored. Strategies for coping with possible barriers can then be generated.

Lastly, Brown and Lent (1996) recommended modifying negative efficacy

beliefs by helping the client structure new successful performance experiences (e.g., remedial or previously unconsidered courses), given research evidence that performance accomplishments is the strongest source of self-efficacy information. Results of supplemental analyses in this study suggest that Black women may develop greater math self-efficacy if they participate in application-oriented activities. Therefore, interventions for Black women may include more hands-on or practical experiences.

A comprehensive effort by the science faculty at Xavier University, a small historically Black Catholic college located in New Orleans, represents an impressive example for addressing declining interests in science. Xavier's success stems from careful implementation and improvement of a series of enrichment programs that form an "educational pipeline" beginning with junior high school students (most of whom were African American) and continuing throughout the students' college careers (Carmichael & Sevenair, 1991).

The program's offered by Xavier incorporate the four sources of efficacy information. Each program consists of features that create successful performance experiences, provide support and encouragement, provide adult and peer role models and mentors, and although not discussed directly, address the emotional barriers (e.g., anxiety, fear) that impede students' choice, performance, and persistence in science-related career pursuits.

In creating successful programs for preparing Blacks and other students of color for math and science careers, other educational

institutions (secondary and post-secondary) should heed the lessons learned by the faculty and administration at Xavier. Such lessons include, but are not limited, to: using student performance as a measure of program effectiveness, maintaining support for the faculty throughout the life of the program, and avoiding the temptation of incorporating current "educational fads" (e.g., purchasing numerous computers; Carmichael & Sevenair, 1991).

Leung (1995) recommended a holistic, multicultural model of career intervention for ethnic minorities. It consists of three modes of career intervention addressing education- and career-related outcomes. In this model, attention is paid to the educational attainment level because of the direct implications for the occupational attainment level (Leung, 1995). Modes of career intervention include system intervention, group counseling, and individual counseling. The following examples for each intervention mode are presented with reference to the present study.

At the system level, career interventions for ethnic minorities involve activities that seek to change their environments to eliminate obstacles to their educational and career development. Relevant to the current study, this might include collaborating with school teachers and administrators regarding how to structure educational programs and teaching strategies to foster positive efficacy beliefs, outcome expectations, and subsequent interests in math and science areas. Counseling psychologists can assist school personnel in creating a comprehensive and positive environment for developing and maintaining

the math- and science-related interests and perhaps career aspirations of Black (and other minority) students. Such programs should emphasize the four sources of efficacy and outcome expectations explored in this study. Xavier's efforts represents a system-level career intervention.

The results of this study indicated lower math-related efficacy beliefs for Black women when compared to Black men. A group counseling career intervention (also suggested by Bowman, 1993, 1995), consisting of a structured workshop for Black college women, could follow the general suggestions for improving self-efficacy outlined by Brown and Lent (1996). The workshop could assist the women in identifying foreclosed career options, addressing perceived barriers, and participating in successful performance experiences. Black college men with lower levels of math self-efficacy might also benefit from such a group experience. However, the opportunity for exploring gender-role socialization experiences within the context of a homogeneous group could enhance the success of the group experience for Black women.

For Black students, direct, personal experiences (i.e., performance accomplishments, verbal persuasion, and emotional arousal) had stronger relations to self-efficacy than did vicarious learning. Therefore, individual counseling with a Black college student experiencing negative math-related efficacy beliefs could be structured to provide the student with successful performance experiences, positive encouragement, and strategies for reducing their anxieties and fears. Based on the current findings, images of people who have overcome this problem would not

necessarily need to be emphasized to the same degree as the direct experiences.

Although research to date has failed to show any consistent findings indicating an influence of racial identity on career development, Bowman (1993, 1995) has suggested that racial identity may affect career intervention strategies with ethnic minorities. The literature on racial identity indicates a client's stage (or ego status) of racial identity relates to his or her preference for counselor race (Helms, 1986; Helms & Carter, 1991; Parham & Helms, 1981). For example, a Black student having predominately Immersion/Emersion racial identity attitudes may find a particular career intervention more useful when provided by a Black counselor. Further, stage of racial identity may influence the impact of race- (and gender-) specific math/science role models. A Black student with high Pre-encounter racial identity may find White role models more appealing. Level of racial identity needs to be considered when implementing any career intervention with Black students (Bowman, 1993, 1995).

Recommendations for Future Research

Further research is needed to more clearly understand the career development processes of Black college students, particularly as these mechanisms relate to math and science participation. Social cognitive career theory offers great promise toward achieving these goals. A number of suggestions for future research are outlined here.

First, replication of the current study using both the proposed model and perhaps a modified model (developed based on the current findings)

with other samples of Black college students may prove informative in further clarifying the relationships among the social cognitive variables in this population. A modified model eliminating the nonsignificant paths (e.g., math self-efficacy to enrollment intentions; see Figure 4) may contribute valuable information that could point to the need for theoretical refinement of social cognitive career theory, at least as it may apply to Black college students. Model modification is not advocated for use with the same sample because it can lead to false interpretations of sample idiosyncrasies as reliable findings (MacCallum, 1995). However, replicating a study with a new sample to test the modified model can prove informative and contribute to the advancement of social cognitive career theory.

Results of the current study highlight three areas in need of replication. First, such studies should explore the differential effects of performance accomplishments, verbal persuasion, vicarious learning, and emotional arousal on math-related efficacy beliefs and outcome expectations before drawing definitive conclusions that these learning experiences operate differently for Black college students. Second, the relative strength of outcome expectations (as compared to efficacy expectations and interests) on course enrollment intentions needs to be clarified before refining the theory as it may pertain to Black students. Third, gender differences in math-related outcome expectations and course enrollment intentions within Black college student populations should also be explored. Contrary to Lent et al.'s (1994) propositions such gender differences were not found in the

present study.

Replication and elaboration of the current study should also be conducted with Black college students who attend historically Black colleges and universities. Black college students attending traditionally Black institutions of higher education are reportedly more likely to attend graduate and professional schools particularly in math and technological fields (Thomas, 1984). Factors affecting the career development of these students may differ from that of Black college students attending predominantly White institutions.

Studies also need to be conducted with Black middle and high school students and working adults in math- and nonmath-related fields. Results from such investigations could provide useful information that would address the developmental process of career-related interests, choice, and performance from adolescence (when learning experiences are beginning to form efficacy beliefs, outcome expectations, and interests) to adulthood (when career choice is being implemented).

A second suggestion for future research concerns outcome expectations. Lopez et al. (1996) recommended that future research explore the sources of outcome expectations. This seems like a reasonable avenue to pursue not only in general, but also specifically with Black students. Social cognitive theory assumes that outcome expectations develop from direct and vicarious experiences similar to those that give rise to efficacy expectations (Lent et al., 1994). The current study found verbal persuasion to play a stronger role in outcome

expectations than did the other three source experiences. Further exploration of outcome expectations would allow researchers and counselors to better understand how positive and negative expectations about the potential success of one's efforts are fostered and developed.

Another important focus for future research, especially with Blacks, should be on contextual affordances or the perceived supports, opportunities, or barriers in the environment. As Lent et al. (1994) hypothesized racial and cultural factors may be associated with the opportunity structure within which career goals are formulated and implemented. Byars and Hackett (1995) found that perceptions of barriers to career choice were predictive of both science and nonscience career considerations in their ethnically diverse sample. However, Evans and Herr (1994) did not find perceptions of discrimination to be predictive of traditionally Black career aspirations in their sample of Black college students. Clearly, this area warrants further investigation. Such information may provide useful information in assisting Black students in identifying, analyzing, and preparing for potential barriers to their career pursuits and success (Lent, Brown, & Hackett, 1996).

In the initial design of the current study, SES (both as perceived by the individual and as coded objectively using parental occupation) was viewed as a contextual affordance, possibly having a direct effect on course enrollment intentions and a moderating effect on the interests/intentions relationship. However, reconsideration of this idea clarified that SES was a global concept that represented a poor

operational definition of a contextual affordance as articulated by Lent et al. (1994). In hindsight, another variable, such as perceptions of barriers to pursuing math/science courses or careers might have been more informative and more theoretically consistent with the social cognitive career model. A psychometrically sound measure, like the Career Barriers Inventory (Swanson & Daniels, 1991; Swanson, Daniels, & Tokar, 1996), may prove useful in assessing such contextual affordances. This measure may be particularly useful with diverse populations as it assesses relevant factors including perceived racial and gender discrimination, job market constraints, and discouragement from nontraditional careers.

Assessing the role of contextual affordances on career development of Black students, needs to incorporate "culturally equivalent" measures. Cultural equivalence refers to "the extent to which the measure assesses the same career constructs across cultural groups" (Helms, 1994b, p. 206). Helms (1994b) purported that career assessment measures

> need to take into account either the cultural dimensions of career decision-making (e.g., collectivism versus individualism), the environmental constraints under which career decisions must be made (e.g., access to career information), or racial salience (e.g., the person's knowledge of the employment history of his or her socioracial group as an influence on his or her responses to inventory items; p. 206).

Griffith (1980) asserted that real and perceived opportunity structures are quantitatively and qualitatively different for Blacks than those available for Whites. This supports the use of a measure for assessing perceptions of racial and gender discrimination and their impact on career choice and development in Black students. Using

systems theory as the primary basis for their arguments, Carter and Cook (1992) conceptualized the experiences and challenges that influence the career paths of visible racial/ethnic groups. Their ideas may also be useful in identifying other environmental influences (e.g., family structure) worth integrating into the social cognitive model. Incorporating culturally equivalent measures in social cognitive career research with Black students may help to account for variables not reflected in the current model.

Fourth, intervention programs designed to facilitate the career development of Black college students need to be evaluated. Betz and Hackett (1986) discussed the importance of conducting program evaluation research on the effectiveness of theory-based preventive and remedial interventions. "Self-efficacy may not lead to new counseling procedures, but it may be very useful in redesigning interventions or in guiding the development of treatment packages consisting of multiple interventions, which will eventually prove to be more effective in facilitating satisfying career choices and career development in general" (Betz & Hackett, 1986, p. 287). Assisting Black college students with negative efficacy expectations does not necessarily require a reinvention of the wheel. However, ongoing program evaluation research is necessary to ensure the relevance of theory to practice.

Lastly, research on racial identity and career development needs to continue. As discussed earlier racial identity attitudes may have more relevance with regard to collective efficacy than to personal efficacy. Racial identity development may better explain the process of career

development more than the outcomes of career development. Future research on racial identity and vocational behavior should explore these areas.

Previous research has reflected a lack of diversity among racial identity attitudes among the studies' participants. It may be that a heterogeneous representation of racial identity attitudes is difficult to achieve when the research participants are self-selected. For example, African Americans with predominately Pre-encounter racial identity attitudes may be likely to avoid research of a race-related nature, while African Americans with predominately Encounter attitudes may find such research suspect. Future research should use research designs and methodologies that increase the likelihood of participants who reflect a broader range of racial identity attitudes.

It may also be true that Black college students are more confident and secure in their racial identity than when racial identity theory was first developed. Hence, other racial identity attitudes may exist within an individual Black college student, but to a lesser degree. Conducting future research with participants other than Black college students (e.g., children, adolescents, middle-aged adults) will help to clarify the existence of diversity in racial identity attitudes and make for better of understanding of the role of racial identity in vocational development.

To the extent that racial identity is a multidimensional construct, future research might steer away from using global measures of racial

identity and instead utilize measures which assess racial identity as it applies to vocational and career development. This construct-specific approach to investigating the relationship of racial identity to career development would, therefore, require specific vocational measures of racial identity, with content relevant to the developmental level of a particular population (Helms, 1989). This is also consistent with calls for assessment specificity advocated by Helms (1994b) with regard to racial identity and career assessment and by Parajes and Miller (1994) concerning math self-efficacy and math performance (or other math-related outcome variables, like interests). An item designed to tap into Pre-encounter vocational racial identity attitudes, for example, may read as: "I will succeed at my chosen career regardless of my race." An Immersion/Emersion vocational racial identity attitude item might be phrased: "I am considering only those careers that I think will directly benefit Black people." Even greater measurement specificity can be obtained by developing instruments for tapping specific content areas of vocational racial identity (e.g., math-related vocational racial identity).

Concluding Remarks

As we approach the new millennium, it is crucial that we recognize the importance of all of our citizens being full participants in an increasingly technological labor force. African Americans have a documented history of making important scientific and technological contributions to our society. Yet today, many Black students are not gaining the math and science preparation needed to have a wide range of

career opportunities available to them. We can no longer allow potential talents to remain lost and untapped. We must make every effort to encourage all students to be positive and successful contributors to society. Sufficient successful performance experiences, encouragement from others, positive role models, and positive emotional reactions to math and science experiences can contribute to the development of positive efficacy beliefs and outcome expectations which, in turn, contribute to the necessary levels of math/science-related interests for Black college students to increasingly pursue math and science options in college and beyond.

APPENDICES

APPENDIX A

Description of Pilot Study

Pilot study participants were recruited through the residence halls of a large northeastern predominately White state university, where a significant number of first-year African American students resided. A Black female undergraduate research assistant was trained to assist in recruiting participants for the study. When possible, group administrations were conducted. Students were invited to make written comments on a separate feedback form as well as on the instruments themselves. Pilot study participants did not receive incentives for their participation.

Table A1 shows the initial reliability coefficients computed from the results of the pilot study. Except for the Vicarious Learning subscale of the SMSE, the Math Course Enrollment Intentions Scale, and the Internalization subscale of the RIAS-B, all reliability coefficients were adequate and consistent with prior research.

Initially, Stricker's (1988) measure of socioeconomic status was to be used in the study as an objective measure of SES. Stricker's measure provides a list of occupational categories from which participants select based upon their understanding of the occupation of the "main person who supports them." Feedback from the pilot participants indicated that the measure did not allow for two or more main sources of support. One participant thought that the measure assumed single-parent families for all participants.

Table A1. Internal Consistency of Scales from Pilot Study

Scale	No. of Items	Coefficient Alpha
PERF	10	.9264
VICA	10	.4641
VERB	10	.7661
AROU	10	.9369
MSE	15	.9552
OE	10	.9095
INTC	15	.8059
INTA	20	.8768
MCEI	15	.5430
PRE	18	.7690
ENC	6	.6320
IMM	12	.7192
INT	14	.1855

Note. PERF = personal performance accomplishments, VICA = vicarious learning , VERB = verbal persuasion, AROU = emotional/physiological arousal, MSE = math-related self-efficacy, OE = outcome expectations, INTC = math-related course interests, INTA = math-related activities interests, MCEI = math-related course enrollment intentions, PRE = pre-encounter racial identity attitudes, ENC = encounter racial identity attitudes, IMM = immersion/emersion racial identity attitudes, INT = internalization racial identity attitudes.

Therfore, after examining the results of the pilot study, it was decided to use Stevens and Featherman's (1981) revised scale of socioeconomic status. Participants are asked to describe, in as much detail as possible, the current occupation of one or both parents. The occupations are then assigned codes similar to Duncan's (1961) index of socioeconomic status. Stevens and Featherman's index allowed for a reduction in time needed to complete the research packet. Participants are not required to read all or most of a two-page list of occupational categories before indicating the occupation of their parents.

The pilot study was also conducted to determine the measure to be used to assess math-related interests (math course interests vs. general math and science interests). Table A2 presents the correlations of both interest measures to math-related course enrollment intentions. The INTC and the INTA reflect overlapping yet unique aspects of math-related interests (r^2 = .26); however, course interests accounted for more variance (37%) in course enrollment intentions than did activities interests (8%). Although course interests corresponded better with the intentions measure in terms of level of measure specificity (cf. Lent et al., 1994), activities interests shared less variance with enrollment intentions. Therefore, it was decided that the Math-related Activities Interests Scale (INTA) would be used as the measure of interests when analyzing the data for the study proper. (With few exceptions, both measures seemed to yield similar intercorrelations with the other theoretical variables.)

Table A2. Intercorrelations and Coefficients of Determination for Measures of Interests and Course Enrollment Intentions from Pilot Study

Measure	1	2	3
1. INTC	---	.26	.37
2. INTA	-.51**	---	.08
3. MCEI	.61***	-.29	---

Note. Intercorrelations appear below the diagonal, coefficients of determination above the diagonal. INTC = math-related course interests, INTA = math-related activities interests, MCEI = math-related course enrollment intentions.
** $p < .01$, *** $p \leq .001$.

The pilot study also tested a revised version of the Racial Identity Attitudes Scale designed to assess vocational racial identity. The instrument was modified with the title, "Vocational and Social Attitudes." A change in the instructions asked participants to respond to each statement as it may influence their career considerations. Feedback from the pilot study participants indicated that the instructional set was difficult to maintain while answering the fifty items. Therefore, the RIAS-B was used in the study proper without changes in the instructions.

A power analysis was conducted to determine the number of participants required for this study (Cohen, 1988, 1992; Fagley, 1985; Green, 1990). Results of this analysis indicated that approximately 160 participants were need for sufficient power ($\underline{P}$ = .80) at a significance level of .05 with a medium expected critical effect size of .50 (Cohen, 1988).

APPENDIX B

Letter to Black Student Organization Presidents

3 October 1995

Dear Black Student Organization President:

As part of a doctoral dissertation in Counseling Psychology at Michigan State University, I am conducting research on Black students' attitudes about a variety of academic and social concerns. The purpose of this study is to examine factors that may or may not influence students' choice of courses and majors in college. I hope to learn more about how to expand the range of academic and career options that Black students consider.

I am asking your organization for assistance in collecting data for my study. I am seeking first-year students for their contribution. Involvement will consist of completing questionnaires about academic and career interests, educational experiences, academic beliefs, social attitudes, as well as background and demographic information. I believe that group administrations would be the most efficient way to proceed. Therefore, I would like 20 - 30 minutes of your group's time before or after one of your next meetings.

In exchange for your participation, I will be available to return to discuss the results of the study with your group. I think such a meeting could make for a very enlightening and informative discussion. If you prefer, I can also send you a written summary of my results.

Either myself or my research assistant, Lumishka Cooper, will contact you within the next several weeks to arrange a convenient time for one of us to attend your meeting. In the meantime, if you have any questions, please feel free to contact me at the above number.

Thank you for your anticipated cooperation.

Sincerely,

Kathy A. Gainor, M.A.

APPENDIX C

Article Describing Research Study Appearing in the Campus Black and Latino Student Newspaper

A Progressive Questionaire

Ph.D. Candidate Finds Out What Black Is and Aint

by Jennifer R. Young
BV/CL staff writer

A new case study focuses on first-year African-American students of Rutgers University. The study evaluates aspirations and values of today's Black young adults. Kathy Gainor, the principal investigator and creator of the questionaire says, "this is an effective way to see the overall objectives and plans for the future before the students have been influenced by many college courses."

Gainor devised the "Academic Career Goal Study" in the spring of 1995 as part of her dissertation for a Ph.D. in clinical psychology. The study has circulated through the EOF summer program, Black student orientations and individual organizations. Her goal is to get 200 questionairs before the end of Spring semester 1996.

The questionaire takes approximately 30 minutes to fill out.
Questions pertain to students' educational experience, academic and career goals, their demographic background and social concerns that directly relate to them. Gainor's research assistant, Lumishka Cooper, who is also a Douglass College senior, often oversees the students as they complete the questionaires. However, Gainor stresses, "the research is strictly confidential. I am the only one who reads them."

Yet it's hard to get students to participate [in the survey] because they are apathetic and protective of their personal information, she said. Cooper added that because there are so many questionairs geared to exploit young Black men and women, students are not interested in participating. So far 25 percent of the research is complete.

Gainor is optimistic that her new approach will gain a greater response. First-year students have four chances to win $50, she said. Students who fill out the questionaire packet and return it with their self addressed envelope may receive money if their envelope is one of the four randomly chosen.

"The Academic Career Goal Study" is not a victim research nor comparison study, Gainor said. "I'm not here to figure out what's wrong with Black people and why they can't help themselves. That is insulting and unheard of," she added. "This is simply positive research that has an impact on students here and abroad."

"Interested students should contact Kathy Gainor at 932-7884"

APPENDIX D

Advertisement Calling for Participants

FIRST-YEAR
AFRICAN AMERICAN STUDENTS
STILL NEEDED FOR PH.D.
STUDY
NOW 4 CHANCES TO WIN ....

African American
Ph.D. candidate needs
1st-year African
American students
to complete
questionares
about their academic
and career interests,
educational
experiences,
academic beliefs,
plus some background information.

$50

CALL NOW!!
Kathy Gainor
932-7884
Ask about the
Academic/Career Goals

APPENDIX E

Request for Participation Script

Good morning / afternoon / evening. My name is _____. I'm here to ask you to participate in a study about Black students' academic and social attitudes. This study is being conducted as part of a doctoral dissertation in Counseling Psychology. The purpose of this study is to explore factors that may or may not influence how Black students' choose their college courses and their college major. With your help, we hope to learn more about how to expand the range of academic and career options that Black students consider.

All we need you to do is complete some questionnaires about your academic and career interests, educational experiences, academic beliefs, social attitudes, as well as some background and demographic information. It will only take about 30 minutes of your time.

By helping us with our research, you will not only get an opportunity to reflect on your career interests and goals, YOU COULD ALSO WIN $50.00. In fact, you will have TWO chances to win $50.00.

All the information collected for this project will be kept confidential. The results will be reported for groups and not individual participants.

Of course, you don't have to participate. You can also refuse to answer any of the questions. However, because it is difficult to analyze data with missing information, we would appreciate it if you would answer all of the questions.

Each research packet contains a consent form which gives you some more information about the study. If you would like to help us out, please read and sign the consent form. There is also a copy for you to keep.

After you complete the questionnaires, I will give you an envelope for you to write your name and campus address. All of these envelopes will be placed in a box and two will be randomly selected by Dean Ganges at Rutgers College. If your envelope is selected, $50.00 will be mailed to you. The drawing which will take place when the data collection is complete -- hopefully before the end of the semester.

Are there any questions? (BRIEFLY ADDRESS ANY QUESTIONS.)

If you'd like to participate in our study, please let me know and I will give you a packet. (DISTRIBUTE PACKETS.)

APPENDIX F

Informed Consent Form

PLEASE READ CAREFULLY

You are invited to participate in a study regarding Black students' attitudes about a variety of academic and social concerns. The purpose of this study is to examine factors that may or may not influence students' choice of courses and majors in college. We hope to learn more about how to expand the range of academic and career options that Black students consider.

If you agree to participate in this study, you will be asked to fill out some questionnaires which will take approximately 45 minutes to complete. These are not tests, therefore, there are no right or wrong answers. In addition, you will be asked for permission to obtain your ACT and/or SAT scores from your academic record. To obtain these scores, your student number (i.e., your social security number) is necessary. Your student number may also be used to obtain information regarding the types of courses you take during your college years.

Your participation in this study is completely voluntary. You may chose not to participate. Refusal to participate will involve no penalty. You are also free to withdraw from this study at any time or to refuse to answer any of the questions being asked without penalty. We would, however, appreciate it if you would answer all questions as it is difficult to analyze data with missing information.

Participation in this study is not expected to involve any risks of harm any greater than those ordinarily encountered in daily life. In fact, you could benefit by having an opportunity to reflect on your career interests and goals. Please feel free to ask the investigator or research assistant any questions you may have.

All the information collected for this project will be kept confidential. Each research packet has been assigned a research number. This consent form will be the only connection between you and your research number and will be kept separate from the data in a locked file accessible only to the project investigator. The data itself will also be kept in a locked file. Once information about your test scores and college courses are obtained, the consent forms will be physically destroyed. Reporting of the project's results will be in terms of group findings; individual results will not be reported.

This study is part of a doctoral dissertation in Counseling Psychology at Michigan State University in East Lansing, Michigan. If at any time, you have any questions about this study, you are encouraged to contact Kathy A. Gainor, Academic/Career Goals Study, c/o 50 College Avenue, New Brunswick, New Jersey 08903 (908-932-7884) or Dr. Robert W. Lent, Department of Counseling, Educational Psychology, and Special Education, College of Education, Michigan State University, 437 Erickson Hall, East Lansing, Michigan 48824 (517-355-6684). You may request a summary of the research results by contacting Ms. Gainor.

Please sign below to indicate your willingness to participate in this study and that you have read and understood the information in this consent form. A copy of this consent form will be provided for you.

Print your full name: _____

Student Number (or Social Security Number): _____

Signature: _____

APPENDIX G

Personalized Letter for First Mailing

CHANCE TO WIN $50.00 ! ! !

March 21, 1996

Dear

As a first-year African American student, you understand the importance of a college education in becoming a full and successful participant in the work force. You know that the courses you take in college directly influence the range of career opportunities available to you. However, African Americans continue to be underrepresented in the fields that afford the greatest chance for occupational success.

As an African American doctoral candidate, I believe that it is important to understand the factors that may contribute to the decisions Black college students make about their academic careers. Therefore, the purpose of my study is to examine factors that may or may not influence the courses and majors that Black college students select. I hope to generate information that will be of direct use to Black college students in expanding the range of academic and career options they consider. I would greatly appreciate your help in achieving this goal.

Your participation would involve completing the questionnaire enclosed. Your responses will be kept completely confidential. (The questionnaire has an identification number for the purposes of mailing and data collection only.) As an additional thank you for your time and assistance, there will be a lottery drawing where you have four chances to win $50.00. You will also receive a summary of the results.

If you would like to participate, please read and sign the informed consent statement enclosed in the questionnaire packet. (Also enclosed is a copy of the consent form for you to keep.) When you have completed the questionnaire, write your name and campus address on the small white envelope. (This envelope will be used in the drawing for the $50.00 cash prize.) Then, place the completed questionnaire, the signed consent form, and the small envelope into the large white envelope, seal the envelope, and return it through campus mail.

Please note that the lottery cannot be conducted until I have completed my study. Therefore, please act fast. If you decide not to participate, simply return the packet through campus mail.

Thank you for your assistance.

Sincerely,

Kathy A. Gainor

APPENDIX H

Follow-up Postcard

28 March 1996

Dear Student,

Last week, a questionnaire concerning factors that may contribute to African American students' decisions about college courses and majors, was mailed to you. The information gathered will assist in understanding how to expand the range of academic and career options that Black students consider and in increasing their chances for occupational success.

If you have already completed and returned the questionnaire, please accept my sincere thanks. If not, please do so today. Your participation is extremely important. The more people participate, the more representative the results can be. In this way, the information gathered can be of more direct use to African American students.

If by chance, you did not receive the questionnaire, or it got misplaced, please call me right now (932-7884) and I will get another one in the mail to you today.

Sincerely,

Kathy A. Gainor

APPENDIX I

Personalized Letter for Third Mailing

THERE'S STILL TIME TO WIN $50.00 ! ! !

April 12, 1996

Dear

About three weeks ago, I wrote to you asking your assistance in completing my doctoral dissertation research. As of today, I have not yet received your completed questionnaire.

I have undertaken this study because of the belief that the courses we take in college have a significant impact on our career choice and subsequent occupational success. Because of my commitment to African American people, I have decided to conduct a study that would explore factors that may be most relevant to African American college students.

I am writing to you again because of the significance each questionnaire has to the usefulness of the study. In order for the results to be generalizable to other African American college students, it is essential that I get at least **50 more participants**, preferably more.

I would like to conduct the lottery for the $50.00 case prize by **Friday, May 3**. However, I cannot do that until I have enough participants to complete the study. Otherwise, the lottery will be postponed until the fall semester. Therefore, if you still wish to participate in this study, please complete and return your packet as soon as possible.

As mentioned in my earlier letter, if you would like to participate, please read and sign the informed consent statement enclosed in the questionnaire packet. (The copy is for you to keep.) When you have completed the questionnaire, write your name and campus address on the small white envelope which will be used in the drawing for the $50.00 cash prize.) Then, place the completed questionnaire, the signed consent form, and the small envelope into the large white envelope, seal the envelope, and return it through campus mail.

In the event that your questionnaire has been misplaced, I have enclosed a replacement. If you have any questions about the study, please feel free to give me a call at 932-7884.

I greatly appreciate your cooperation.

Cordially,

Kathy A. Gainor

APPENDIX J

Background Questionnaire

We are interested in obtaining some information about your background and educational plans. The information we gather will be useful in understanding students' educational behavior, and in developing programs to maximize success in college. Please print your answers clearly.

1. Gender: _____ (1) Female _____ (2) Male

2. Age: _____

3. Were you born and raised in the United States? _____ (1) Yes _____ (2) No

4. Ethnicity (e.g., Ethiopian, Jamaican, Haitian): _____

5. Year in college: ___ (1) First-year ___ (2) Sophomore ___ (3) Junior

   ___ (4) Senior ___ (5) Graduate Student

   ___ (6) Other (specify) _____

6. Please indicate your best guess of the percentage of students in your high school who were of your ethnicity.

   ___ (1) 0 - 20% ___ (2) 21 - 40% ___ (3) 41 - 60%

   ___ (4) 61- 80% ___ (5) 81 - 100%

7. Please indicate your best guess about the socioeconomic status of most of the students in your high school.

   ___ (1) Lower class ___ (2) Working class ___ (3) Middle class

   ___ (4) Upper middle class ___ (5) Upper class

8. Please indicate your perception of your socioeconomic status both currently and when you were younger (that is, during your elementary school years).

   Currently: ___ (1) Lower class ___ (2) Working class ___ (3) Middle class

   ___ (4) Upper middle class ___ (5) Upper class

   When younger: ___ (1) Lower class ___ (2) Working class ___ (3) Middle class

   ___ (4) Upper middle class ___ (5) Upper class

9. Please indicate the highest educational level that your mother has obtained:

   ___ (1) some high school ___ (2) a high school diploma ___ (3) some college

   ___ (4) a college degree ___ (5) some graduate school ___ (6) a graduate degree

10. Please indicate your mother's current occupation (Be as specific as possible, e.g. *English* teacher, *mining* enginneer, *medical* secretary, *self-employed* farmer):

_____

11. About how many years has your mother been at her current occupation? _____

12. Please indicate the highest educational level that your father has obtained:

___ (1) some high school ___ (2) a high school diploma ___ (3) some college

___ (4) a college degree ___ (5) some graduate school ___ (6) a graduate degree

13. Please indicate your father's current occupation (Be as specific as possible, e.g. *English* teacher, *mining* enginneer, *medical* secretary, *self-employed* farmer):

_____

14. About how many years has your father been at his current occupation? _____

15. Have you chosen a major? _____ (1) Yes _____ (2) No

If **Yes**, what is your major? _____

If **No**, what majors are you seriously considering at present?

_____

16. Please indicate the occupation(s) that you are seriously considering at present:

_____

_____

17. Please list the math and science courses you took during high school:

_____

_____

_____

_____

APPENDIX K

Academic Confidence

Please rate the following college courses according to how much confidence you have that you could complete the course with a final grade of B to A. Use the scale below to indicate your degree of confidence.

	No confidence at all		Very little confidence		Some confidence		Much confidence		Complete confidence	
1. Intermediate Algebra	0	1	2	3	4	5	6	7	8	9
2. Economics	0	1	2	3	4	5	6	7	8	9
3. Statistics	0	1	2	3	4	5	6	7	8	9
4. Physiology	0	1	2	3	4	5	6	7	8	9
5. Precalculus	0	1	2	3	4	5	6	7	8	9
6. Business Management	0	1	2	3	4	5	6	7	8	9
7. Elementary Algebra	0	1	2	3	4	5	6	7	8	9
8. Philosophy	0	1	2	3	4	5	6	7	8	9
9. Geometry	0	1	2	3	4	5	6	7	8	9
10. Computer Science	0	1	2	3	4	5	6	7	8	9
11. Accounting	0	1	2	3	4	5	6	7	8	9
12. Zoology	0	1	2	3	4	5	6	7	8	9
13. Calculus	0	1	2	3	4	5	6	7	8	9
14. Biochemistry	0	1	2	3	4	5	6	7	8	9
15. Advanced Calculus	0	1	2	3	4	5	6	7	8	9

APPENDIX L

Educational Experiences

Using the scale listed below, circle the number which represents your level of agreement.

	Strongly Disagree				Strongly Agree
1. I got high scores on the math part of my college entrance exams (e.g., ACT, SAT).	1	2	3	4	5
2. My favorite teachers were usually math teachers.	1	2	3	4	5
3. My friends have discouraged me from taking math classes.	1	2	3	4	5
4. I get a sinking feeling when I think of trying hard math problems.	1	2	3	4	5
5. I received good grades in my high school math classes.	1	2	3	4	5
6. While growing up, many of the adults I most admired were good at math.	1	2	3	4	5
7. Other people generally see me as being poor at math.	1	2	3	4	5
8. I would be upset if I had to take more math courses.	1	2	3	4	5
9. In math classes, I rarely get the answer before my classmates do.	1	2	3	4	5
10. Most friends of mine did poorly in high school math courses.	1	2	3	4	5
11. I get really uptight while taking math tests.	1	2	3	4	5
12. My adviser has singled me out as having good math skills and has encouraged me to take college math courses.	1	2	3	4	5
13. Among my friends, I'm usually the one who figures out math problems (e.g., like dividing up a restaurant bill).	1	2	3	4	5
14. My parents have encouraged me to be proud of my math ability	1	2	3	4	5

	Strongly Disagree				Strongly Agree
15. My mind goes blank and I am unable to think clearly when working mathematics.	1	2	3	4	5
16. I have received special awards for my math ability.	1	2	3	4	5
17. My career role models (i.e., those people I'd like to be like) are mostly in fields that do not involve math.	1	2	3	4	5
18. My friends have encouraged me to take higher level math classes.	1	2	3	4	5
19. Math has always been a very difficult subject for me.	1	2	3	4	5
20. I almost never get uptight while taking math tests.	1	2	3	4	5
21. My friends tended to avoid taking high school math courses.	1	2	3	4	5
22. My parents are not very good at math.	1	2	3	4	5
23. Teachers have discouraged me from pursuing occupations that require a strong math background.	1	2	3	4	5
24. I am rarely able to help my classmates with difficult math problems.	1	2	3	4	5
25. People I look up to (like parents, friends, or teachers) are good at math.	1	2	3	4	5
26. I usually don't worry about my ability to solve math problems.	1	2	3	4	5
27. I was often encouraged to join clubs in high school which required math ability (i.e., Math Club, Computer Club).	1	2	3	4	5
28. I took fewer high school math courses than most other students did.	1	2	3	4	5
29. Some of my closest high school friends excelled on the math part of their college entrance exams.	1	2	3	4	5

	Strongly Disagree				Strongly Agree
30. Mathematics makes me feel uneasy and confused.	1	2	3	4	5
31. People I look up to have told me not to consider a math-related major.	1	2	3	4	5
32. When I come across a tough math problem, I work at it until I solve it.	1	2	3	4	5
33. Many of the adults I know are in occupations that require a good understanding of math.	1	2	3	4	5
34. I have usually been at ease during math tests.	1	2	3	4	5
35. I have always had a natural talent for math.	1	2	3	4	5
36. High school teachers rarely encouraged me to continue taking math classes.	1	2	3	4	5
37. Mathematics makes me feel uncomfortable and nervous.	1	2	3	4	5
38. Many of my friends are in, or intend to enter, fields that do not require strong math skills.	1	2	3	4	5
39. My parents have encouraged me to do well in math.	1	2	3	4	5
40. I have usually been at ease in math classes.	1	2	3	4	5

APPENDIX M

Expectations

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Disagree		Disagree		Unsure		Agree		Strongly Agree	
1. Doing well at math will enhance my job/career opportunities.	0	1	2	3	4	5	6	7	8	9
2. Taking a math course will increase my overall grade point average.	0	1	2	3	4	5	6	7	8	9
3. People I look up to will approve of my taking college math courses.	0	1	2	3	4	5	6	7	8	9
4. Taking math courses will help me to keep my career options open.	0	1	2	3	4	5	6	7	8	9
5. Doing well at math will increase my sense of self-worth.	0	1	2	3	4	5	6	7	8	9
6. Choosing a math-related major will lead to the kind of career I most want.	0	1	2	3	4	5	6	7	8	9
7. Good math performance is valued by my family.	0	1	2	3	4	5	6	7	8	9
8. Taking college math courses will likely produce positive consequences for me.	0	1	2	3	4	5	6	7	8	9
9. My friends will respect me if I enrolled in math classes.	0	1	2	3	4	5	6	7	8	9
10. Pursuing a math-related major will enable me to meet the kind of people I value most.	0	1	2	3	4	5	6	7	8	9

APPENDIX N

Interests

Please indicate your degree of interest in taking the following college courses. Use the scale below to show how interested you are in each course.

	Strongly Disinterested		Disinterested		Indifferent		Interested		Strongly Interested	
1. Intermediate Algebra	0	1	2	3	4	5	6	7	8	9
2. Economics	0	1	2	3	4	5	6	7	8	9
3. Statistics	0	1	2	3	4	5	6	7	8	9
4. Physiology	0	1	2	3	4	5	6	7	8	9
5. Precalculus	0	1	2	3	4	5	6	7	8	9
6. Business Management	0	1	2	3	4	5	6	7	8	9
7. Elementary Algebra	0	1	2	3	4	5	6	7	8	9
8. Philosophy	0	1	2	3	4	5	6	7	8	9
9. Geometry	0	1	2	3	4	5	6	7	8	9
10. Computer Science	0	1	2	3	4	5	6	7	8	9
11. Accounting	0	1	2	3	4	5	6	7	8	9
12. Zoology	0	1	2	3	4	5	6	7	8	9
13. Calculus	0	1	2	3	4	5	6	7	8	9
14. Biochemistry	0	1	2	3	4	5	6	7	8	9
15. Advanced Calculus	0	1	2	3	4	5	6	7	8	9

APPENDIX O

Activities

Please indicate your degree of interest in each of the activities listed below by circling the number underneath the most appropriate column.

	Like	Indifferent	Dislike
1. Reading scientific books or magazines.	1	2	3
2. Taking a math class.	1	2	3
3. Working on a scientific project.	1	2	3
4. Solving a math puzzle.	1	2	3
5. Taking a physics course.	1	2	3
6. Taking a chemistry course.	1	2	3
7. Taking a statistics course.	1	2	3
8. Taking a biology course.	1	2	3
9. Visiting a science museum.	1	2	3
10. Building a rocket model.	1	2	3
11. Attending a lecture by a famous scientist.	1	2	3
12. Solving computer problems.	1	2	3
13. Attending a science fair.	1	2	3
14. Joining a science club.	1	2	3
15. Working on a chemistry set.	1	2	3
16. Touring a science lab.	1	2	3
17. Reading about a new scientific discovery.	1	2	3
18. Solving a card/magic trick.	1	2	3
19. Using math to solve a practical problem.	1	2	3
20. Trying new computer programs.	1	2	3

APPENDIX P

Intentions

Please indicate how likely it is that you will take each of the following college courses during your college career. Use the scale below to show how strongly you feel about your intentions to take these courses.

	Extremely Unlikely		Unlikely		Undecided		Likely		Extremely Likely	
1. Intermediate Algebra	0	1	2	3	4	5	6	7	8	9
2. Economics	0	1	2	3	4	5	6	7	8	9
3. Statistics	0	1	2	3	4	5	6	7	8	9
4. Physiology	0	1	2	3	4	5	6	7	8	9
5. Precalculus	0	1	2	3	4	5	6	7	8	9
6. Business Management	0	1	2	3	4	5	6	7	8	9
7. Elementary Algebra	0	1	2	3	4	5	6	7	8	9
8. Philosophy	0	1	2	3	4	5	6	7	8	9
9. Geometry	0	1	2	3	4	5	6	7	8	9
10. Computer Science	0	1	2	3	4	5	6	7	8	9
11. Accounting	0	1	2	3	4	5	6	7	8	9
12. Zoology	0	1	2	3	4	5	6	7	8	9
13. Calculus	0	1	2	3	4	5	6	7	8	9
14. Biochemistry	0	1	2	3	4	5	6	7	8	9
15. Advanced Calculus	0	1	2	3	4	5	6	7	8	9

APPENDIX Q

Social Attitudes Scale

This questionnaire is designed to measure people's social and political attitudes. There are no right or wrong answers. Use the scale below to respond to each statement.

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I believe that being Black is a positive experience.	1	2	3	4	5
2. I know through experience what being Black in America means.	1	2	3	4	5
3. I feel unable to involve myself in White experiences and am increasing my involvement in Black experiences.	1	2	3	4	5
4. I believe that large numbers of Blacks are untrustworthy.	1	2	3	4	5
5. I feel an overwhelming attachment to Black people.	1	2	3	4	5
6. I involve myself in causes that will help all oppressed people.	1	2	3	4	5
7. I feel comfortable wherever I am.	1	2	3	4	5
8. I believe that White people look and express themselves better than Blacks.	1	2	3	4	5
9. I feel very uncomfortable around Black people.	1	2	3	4	5
10. I feel good about being Black, but do not limit myself to Black activities.	1	2	3	4	5
11. I often find myself referring to White people as honkies, devils, pigs, etc.	1	2	3	4	5
12. I believe that to be Black is not necessarily good.	1	2	3	4	5
13. I believe that certain aspects of the Black experience apply to me, and others do not.	1	2	3	4	5
14. I frequently confront the system and the man.	1	2	3	4	5

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
15. I constantly involve myself in Black political and social activities (art shows, political meetings, Black theater, etc.).	1	2	3	4	5
16. I involve myself in social action and political groups even if there are no other Blacks involved.	1	2	3	4	5
17. I believe that Black people should learn to think and experience life in ways which are similar to White people.	1	2	3	4	5
18. I believe that the world should be interpreted from a Black perspective.	1	2	3	4	5
19. I have changed my style of life to fit my beliefs about Black people.	1	2	3	4	5
20. I feel excitement and joy in Black surroundings.	1	2	3	4	5
21. I believe that Black people came from a strange, dark, and uncivilized continent.	1	2	3	4	5
22. People, regardless of their race, have strengths and limitations.	1	2	3	4	5
23. I find myself reading a lot of Black literature and thinking about being Black.	1	2	3	4	5
24. I feel guilty and/or anxious about some of the things I believe about Black people.	1	2	3	4	5
25. I believe that a Black person's most effective weapon for solving problems it to become part of the White person's world.	1	2	3	4	5
26. I speak my mind regardless of the consequences (e.g., being kicked out of school, being imprisoned, being exposed to danger).	1	2	3	4	5
27. I believe that everything Black is good, and consequently, I limit myself to Black activities.	1	2	3	4	5

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
28. I am determined to find my Black identity.	1	2	3	4	5
29. I believe that White people are intellectually superior to Blacks.	1	2	3	4	5
30. I believe that because I am Black, I have many strengths.	1	2	3	4	5
31. I feel that Black people do not have as much to be proud of as White people do.	1	2	3	4	5
32. Most Blacks I know are failures.	1	2	3	4	5
33. I believe that White people should feel guilty about the way they have treated Blacks in the past.	1	2	3	4	5
34. White people can't be trusted.	1	2	3	4	5
35. In today's society if Black people don't achieve, they have only themselves to blame.	1	2	3	4	5
36. The most important thing about me is that I am Black.	1	2	3	4	5
37. Being Black just feels natural to me.	1	2	3	4	5
38. Other Black people have trouble accepting me because my life experiences have been so different from their experiences.	1	2	3	4	5
39. Black people who have any White people's blood should feel ashamed of it.	1	2	3	4	5
40. Sometimes, I wish I belonged to the White race.	1	2	3	4	5
41. The people I respect most are White.	1	2	3	4	5
42. A person's race usually is not important to me.	1	2	3	4	5
43. I feel anxious when White people compare me to other members of my race.	1	2	3	4	5

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
44. I can't feel comfortable with either Black people or White people.	1	2	3	4	5
45. A person's race has little to do with whether or not he/she is a good person.	1	2	3	4	5
46. When I am with Black people, I pretend to enjoy the things they enjoy.	1	2	3	4	5
47. When a stranger who is Black does something embarrassing in public, I get embarrassed.	1	2	3	4	5
48. I believe that a Black person can be close friends with a White person.	1	2	3	4	5
49. I am satisfied with myself.	1	2	3	4	5
50. I have a positive attitude about myself because I am Black.	1	2	3	4	5

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