

AC 2010-30: AN INVESTIGATION OF AFRICAN AMERICAN HIGH SCHOOL STUDENTS' CAREER DECISION SELF-EFFICACY

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An Investigation of African American High School Students' Career Decision Self-efficacy

Underutilization of minorities in science and engineering is a national problem¹. If America is to maintain its global competitiveness, we must educate our populace in high priority areas. African Americans continue to be hesitant to undertake the more rigorous math and science courses that provide a base for preparation in engineering. Research states that this cause is due to lack of encouragement and support from teachers and family. Specifically, there is an absence of evidence focusing on the reasons African Americans avoid subjects relating to engineering. The purpose of this study was to investigate causal factors underlying the avoidance of engineering opportunities by African American students.

The idea of disproportionate education is not a recent phenomenon. This concept has been around for decades. Although schools have progressively become integrated, the content students learn and achievement outcomes are still largely determined by race and class²⁻⁵. This demarcation follows students into higher education and the labor market, influencing the choices they make. At a time in which the United States is becoming more diverse⁶, globalization has made it disadvantageous to continue to foster inequality of educational opportunity along ethnic lines. A hazardous cycle has been created, reinforcing the idea that African American students are better suited for manual than for academic pursuits. The National Academy of Engineering (NAE), an honorific organization of engineers that advises the government on issues concerning engineering, states that "if the U. S. is to maintain economic leadership and be able to sustain its share of high-technology jobs, it must prepare for a new wave of change"⁷. This new wave of change refers to the education of more minority students in engineering as the minority population increases in order to ensure global competition^{7, 8}.

Current research shows that a disproportionately small number of African American students obtain engineering degrees. The proportion of African Americans earning bachelor's degrees in engineering in 2004 was 5.3% in contrast to the 20.5% of white students who earn engineering degrees⁸. This differentiation follows students into the labor market, influencing the choices they make.

The career decision self-efficacy of African American students is not well understood. The purpose of this study was to gain insight into the career decision self-efficacy of African American students. From this insight, educators might gain a better understanding of ways to enhance educational efforts intended to prepare African Americans for the field of engineering. Also, educators could improve their understanding of African American students' perception of their ability to successfully enter engineering careers.

Self-efficacy

Self-efficacy, as defined by Bandura⁹, refers to the body of beliefs about one's ability to be successful in performing a given task or specific behavior. Various studies have sought to ascertain which efficacy beliefs contribute to career development and to what extent the process aligns with Bandura's theory. The four major components of self-efficacy are: performance accomplishments, vicarious experiments, verbal persuasions, and physiological states. Personal

performance accomplishments include one's pattern of successes and failures at particular tasks or activities; vicarious learning refers to the observation of other peoples' performance attainments; verbal persuasion involves the encouragement or discouragement that one receives from significant others for engaging in particular activities; and physiological states and reactions include both pleasant or unpleasant emotional and physical sensations¹⁰.

Lent, Brown, and Larkin¹¹ note that expectations of personal efficacy are hypothesized to influence one's choice of behavioral settings and activities. Bores-Rangel et al.¹² state that self-efficacy is likely to influence a person's choice, effort, persistence, and achievement, assuming they have sufficient ability and incentives to choose or perform the relevant activities. Lent, Brown, and Larkin¹³ assert that student's beliefs about their educational ability to complete the educational requirements of various science and engineering fields are predictive of academic performance. Hackett and Betz¹⁴ suggest that self-efficacy could assist in the understanding of career development. Tang, Fouad, and Smith¹⁵ note that self-efficacy is a major determinant of career choice. Ginakos¹⁶ observes that when past behaviors lead to successful and desirable outcomes, a person develops strong self-efficacy insights for the behaviors and persists in them.

Career decision self-efficacy

Career decision self-efficacy refers to the extent to which a student has confidence in his or her ability to engage in occupational and educational decision making¹⁷. Career decision self-efficacy, which was originally defined by Taylor and Betz¹⁸, is measured in terms of self-appraisal, occupational information, goal selection, planning, and problem-solving¹⁹. Quality exploration of career development is the basis for career decision self-efficacy¹⁶. Research has used the Social Cognitive Career Theory (SCCT)²⁰ and outcome expectations to predict behavioral influences in careers. Ojeda et al.²¹ reported that high levels of confidence are related to positive career behaviors and outcomes. Thus, there is no debate that behavior strongly influences career decision self-efficacy. The interest comes when one measures the transferability among ethnicities. Gloria and Hird²² state that minority students experience lower career decision self-efficacy than their white counterparts. When specifically looking at African American students, there are few research results to help identify causes of this negative level of career decision self-efficacy. However, O'Brien et al.²³ and Bores-Rangel et al.¹² note that for students of color, low career self-efficacy was associated with limited occupational alternatives.

Existing studies suggest that firmly held career goals, characterized by choice certainty, decidedness, and commitment, may promote the likelihood of choice entry behavior^{20,24}. Germeijs and Verscheren²⁵ postulate that there are six core aspects of the career decision making process: orientation of choice (awareness of the need to make a decision and motivation to engage in the decision making process); self exploration (gathering information about oneself); broad exploration of the environment (gathering general information about career alternatives); in-depth exploration of the environment (gathering detailed information about a reduced set of career alternatives); and commitment (strength of confidence in the attachment to a particular career alternative). Given these concepts, they explored whether all or some of the stages in this process affected the decision of choice. The researchers found that although the six core concept stages were shown to affect decision making, more research should be done because they did not explore the level of confidence about the choice the students made. O'Brien et al.²³ found

that students who lack career decision self-efficacy may avoid exploratory activities, give up easily, and fail to reach their occupational potential. Brown et al.²⁶ and O'Brien et al.²³ also suggest that since minorities and students in at-risk environments have been shown to have lower self-efficacy, interventions may be helpful in increasing levels of career decision self-efficacy.

Sample

The participants in this study were 396 African American high school students from two schools in middle income communities in the southeastern United States. School one reported that just over 50% of the students received free/reduced price lunches. The enrollment for the year 2008 was 843 students in grades 9-12. The school received good and excellent ratings on the state's report card and has met Annual Yearly Progress (AYP) in 2005-2006 and 2006-2007, as defined by No Child Left Behind (NCLB). School two reported that 54% of students received free/reduced price lunches. The enrollment in grades 9-12 for the year 2008 was 879 students. Beginning in the 2008-09 year, this school became a STEM (Science, Technology, Engineering and Math) theme school. During the 2009-2010 school year the school added an aerospace engineering program to its engineering academy. School one contributed 222 (56.1%) students and school two contributed 174 students (43.9%) to the total sample. Both schools had Project Lead the Way (PLTW) programs. The sample consisted of 182 males (46%) and 214 females (54%). The dominant ethnic background was African American (~94%). Grades of the students ranged from 9 to 12. Only African American students were included in the sample population.

Instrument Development

Background information was obtained regarding the student's age, gender, and year in school. Information about their living situation, mother's and father's education level, and mother's and father's occupation was gathered in order to calculate a SES score according to Hollingshead²⁷. Information was also obtained regarding current GPA, their grades in 8th grade math and science classes. Specific questions related to achievement were chosen due to their known correlation with career decision and choice. All missing data for the following sections were replaced with a mean score. The researchers understood that in some instances replacing missing data for dependent variables does have the potential to produce questionable data. However, the researchers assumed that data were missing at random (MR)²⁸. Batista and Monard²⁹ showed that replacing data with the mean still obtained good results and illustrated a low error rate.

Socioeconomic Status

The Hollingshead Four factor score was used to determine the student's socioeconomic status (SES). This score is determined using four factors, namely education, occupation, sex, and whether student's live in a single or two-parent home. The education factor is measured on a seven point scale, with the lowest being less than seventh grade (1) going to the highest which is graduate professional training or a graduate degree(7). The occupational factor is determined by using the U.S. Census Bureau assigned Census codes. The total calculation is figured by taking the occupation factor (Census score \times factor weight (5) than taking the education factor (scale score 1-7 \times factor weight (3)). After that calculation the total factor score is determined depending on the marital status reported of the parents. As suggested by Hollingshead²⁷ the total

is left as is for a single parent home and for a two parent home the total is divided by two. According to Hollingshead²⁷ computed scores range from a high of 66 to a low of 8. It is assumed that the higher score of a family or nuclear unit, the higher the status of its members.

Career Decision Self-Efficacy

These questions are based on the career decision self efficacy (CDSE) short form³⁰. It contains 25 items measured on a 5-point Likert-type scale, with questions ranging from 1= no confidence at all, 2=very little confidence, 3= moderate confidence, 4=much confidence, 5=complete confidence. The CDSE was developed by Taylor and Betz¹⁸ and the original 50 item scale was based on a 10-point Likert scale. The purpose of the scale is to measure an individual's belief that he or she is capable of making successful career decisions. The scale is based on five career maturity competencies developed by Crites 1978³¹. In keeping with those competencies the short form is based on five sub-scales, namely 1) accurate self appraisal; 2) gathering occupational information; 3) goal selection; 4) making plans for the future; and 5) problem solving³⁰.

Brown et al.²⁶ state that the CDSES was originally validated on 346 students in a private liberal arts college and 193 students in a large public college. Taylor and Pompa³² reported an alpha coefficient of .97. Congruently, a prior study using a sample of high school students indicated a Cronbach alpha of .97^{33,34}. Additionally, Luzzo's³⁵ comprehensive review of the CDSES's psychometric properties provides evidence of its reliability and validity. Taylor and Betz¹⁸ also reported a Cronbach alpha of .97. Reliabilities calculated for the five subscales of goal setting, occupational information, problem-solving, planning, and self-appraisal yielded respective values of .87, .89, .86, .89, and .88. Validity estimates were provided by Taylor and Pompa³². Robbins³⁶ found that validity estimates for CDSE scores were moderately related to scores on measures of self-esteem, career decidedness, and vocational identity.

Descriptive Data

Living situation

Results in this study showed that the highest percentage of students lived with their mother only (43%). The second highest living situation was students living with their mother and father (29.0%). The remaining 28% of students lived with either: mother and male guardian, father and female guardian, father only, mother and sometimes father, other relatives or other adults.

Parents/Guardians Educational Level

Students were asked to identify their parent's education level. The educational levels ranged from "did not complete high school to "Graduate degree (Ph.D., J.D., M.D.)". Literature has increasingly shown that students who have parents with high levels of education attain a higher level of achievement. The responses of 48.7% of the students indicated that their fathers' highest level of education was completion of high school, while 39.7% of their mothers completed high school. A four year degree was reported for 22.5% of the mothers and 15.9% of the fathers. Only 2.4% of the mothers and 2.5% of the fathers were reported as holding "Graduate degree (Ph.D., J.D., M.D.)."

Socio-economic status

The largest reported SES using Hollingshead is that 28.6% of the students' parents would be classified as; unskilled laborers, menial service workers, and 25.8% of the parents are classified under; medium business, minor professional, technical strata. The lowest reported SES was 9.4% which is classified as major business and professional (i.e. high executive, government officials). The second least reported score at 14.9% was classified as machine operators, and semiskilled workers. Lastly 21.3% of students reported their parents as skilled craftsmen, clerical, or sales workers.

Eighth Grade Math/Science Scores and Current GPA

Among the participants in this study the majority of students reported receiving the grade of "C" or higher in eighth grade math or science. More importantly ~ 44% of them received a "B" in math and almost 50% of students received a "B" in science. Roughly 17% of students reported receiving an "A" in both eighth grade math and science. This is important signifying that students performed above average in these core courses. According to the school district's definition a "C" is considered an average grade.

The average grade point average (GPA) was 3.00 on a five-point scale (SD = .717). The majority of the participants (53%) reported a GPA between 3.0 and 4.85. Twenty-five percent of the students were in 9th grade, while 19% of the students were in the tenth grade. Within the higher grades 18% of the students were in the eleventh grade, while 38% reported being in the 12th grade. The highest individual range of students (29.1%) reported having between a 3.0-3.49 GPA. In addition to the previous number 24.6% of students report having between a 3.5-4.0, which indicates that over 50% of the students had a 3.0 GPA or above.

Results

Demographic data (gender, year in school, socio-economic status [SES], performance in 8th grade math and science, and overall GPA) were obtained from students, then coded and correlated with career decision self-efficacy. Results show that among this population, SES was the only significantly correlated variable with CDSE. In this study gender and performance in 8th grade math and science courses not significantly correlated with career decision self-efficacy. Although there is extensive literature demonstrating that achievement is a key determinant of selection, grade performance, and success in the science and technology fields³⁷⁻⁴⁰. However, none of the achievement variables were shown to predict or even highly correlate with career decision self-efficacy.

Factor Analysis

The purpose of a factor analysis is to study the patterns of relationships among many dependent variables, reducing them into clusters that help explain the independent variable. The purpose of the alpha coefficient should be to examine internal consistency of the items in the subscales, therefore the recommendation is that the alpha be 0.8 or above⁴¹. The alpha coefficient is a measurement of the internal consistency of the items within a scale to make sure they assess constructs accurately.

Factor analysis on the Career Decision Self-Efficacy short form was done using varimax rotation with Kaiser normalization to identify the factors appearing in this administration of the instrument which could be used to define subscales. In this study the subscales and items within each subscale were compared to the results to those obtained by Betz, Klein, and Taylor⁴². Principal components analysis was used because the primary purpose was to reduce the number of variables assuming all variability in an item should be used. The cut off point for this study was .44 based on Sedlmeir and Gigerenzer's⁴³ 24 year analysis of power.

It was found 24 of 25 items correlated at least .3 with at least one other item, suggesting reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.9, well above the recommended value of 0.6, and Bartlett's test of sphericity was significant ($\chi^2(321) = 300.00, p < .05$). The communalities were all above 0.3 (see Table 1); further confirming that each item shared some common variance with other items.

The exploratory factor analysis results identify three factor coefficients. Taken together, the three factors explain 59% of the variance (Table 1). Cluster One, Identifying a Career, includes seven items that relate to information about occupations, majors, and lifestyles, as well as procedures for obtaining that information. Cluster Two, Entering a Career, includes nine items specifically related to occupational goal planning. These items deal with preparing a resume, assessing abilities, and navigating through difficulties related to career access. Cluster Three, Succeeding in a Career, is specifically related to career adaptability. The nine items in this cluster deal with changing occupations if dissatisfied, figuring out what one is willing to do to achieve goals, deciding what is most valued in an occupation, and identifying alternatives if the first career option is not satisfactory.

Table 1: Factors and Contributing Items

Items/Statements	Components			Communalities
	1	2	3	
	% of Variance			
	22.23	41.10	59.34	
CDt Choose a major or career that will fit your interest	.744			.683
CDa Use the internet to find information about occupations that interest you	.721			.605
CDv Define the type of lifestyle you would like to live	.693			.613
CDs Talk with a person already employed in a field you are interested in	.674			.630
CDb Select one major from a list of potential majors you are considering	.617			.535
CDw Find information about graduate or professional schools	.565			.590
CDf Select one occupation from a list of potential occupations you are considering	.466			.512
CDk Find out what the employment trends for an occupation over the next ten years		.700		.642

CDj	Choose a career that will fit your preferred lifestyle	.652	.661
CDI	Prepare a good resume	.632	.546
Cdi	Determine what your ideal job would be	.631	.648
CDd	Determine the steps to take it you are having academic trouble with an aspect of your chosen major	.606	.614
CDh	Persistently work at your major or career goal even when you get frustrated	.604	.633
CDg	Determine the steps you need to take to successfully complete your chosen major	.557	.637
CDe	Accurately assess your abilities	.528	.524
CDc	Make a plan of your goals for the next five years	.441	.547
CDp	Make a career decision and then not worry whether it was right or wrong	.720	.555
CDq	Change occupations if you are not satisfied with the one you enter	.697	.630
CDy	Identify some reasonable major or career alternatives if you are unable to get your first choice	.655	.636
CDm	Change majors if you did not like your first choice	.582	.574
CDn	Decide what you value most in an occupation	.577	.626
CDo	Find out about the average yearly earnings of people in an occupation	.543	.509
CDx	Successfully manage the job interview process	.524	.578
CDr	Figure out what you are and are not ready to sacrifice to achieve your career goals	.462	.540
CDu	Identify employers, firms, and institutions relevant to your career possibilities	.462	.566
Eigenvalues		5.56	4.72
		4.56	

Discussion of Findings

Differences between genders were not significant in this study, a finding that is similar to what that of Brown and Lavish⁴⁴ who studied Native Americans was and found no significant gender difference as it related to career decision self-efficacy. Gender differences in this study were consistent with Gianakos'⁴⁵ finding that women reported having stronger levels of career decision self-efficacy overall, the differences did not attain statistical significance in this study.

A high percentage of students (over 70%) reported a living situation other than a nuclear family. A low percentage of parents were reported as holding four year degrees: 22.3% of mothers and 16% of fathers. The reported level of education is important because Hollingshead²⁷ suggests that people who possess different levels of education tend to exhibit different

behavior patterns. Sirin⁴⁶ points out that parental education may be an indicator of parent's income because the two factors are highly correlated in the U.S. Parents are the basis for the financial capital the children receive; most children are not independent, therefore the sources of their finances help to determine their SES⁴⁷.

Betz, Klein, & Taylor⁴² reported an alpha of .94 for total CDSE-SF scale; Self Appraisal (.73), Occupational Information (.78), Goal Selection (.83), Planning (.81), and Problem Solving (.75). This study found an alpha of .96 for the total CDSE-SF scale; Cluster 1(.89), Cluster 2(.91), Cluster 3(.91). Although this study identified only 3 factors, their alpha levels all were consistently high. Further investigation should be done on the population and the facets that contributed to these results. It seems particularly important to look more closely at African American high school students and their career decision self-efficacy.

Cluster One, "Identifying a Career," includes seven questions. The factor explains 22 percent of the variance. The large amount of variance explained demonstrates the importance of having good career information available to African American students. As it stands one can assume that African Americans know fewer engineers since most parents reported little to no college and parents are considered one gateway to careers. Cluster Two, "Entering a Career," relates to job finding activities. Again, almost 20 percent of the variance is accounted for. These items describe experiences that are outside the environments of most high school students. Specifically, students may lack the resources because these are areas that may be hard for high school students to navigate without adult assistance. Therefore, schools need to make sure they are addressing these issues through counselors or mentors. Cluster Three "Succeeding in a Career," explains 18 percent of the variance. None of the items are a part of the standards based curriculum, which means that schools are not required to address them. Most of the items relate to SES (race and class) and require that families be relatively mobile and college educated. Although a student's SES cannot be changed schools could offer exposures to a wide range of careers by inviting parents and community members as resource persons. It is imperative that approaches be developed that include constructs closely related to self-efficacy. Examples include providing role models or exemplars in fields that students might aspire to enter.

The factor analysis results differ somewhat from earlier results using the CDSE-short form^{42, 48}. Those studies identified five subscales, while the current study identifies only three. Previous research on the CDSE short form instrument using factor analysis suggests the existence of one or two broad factors rather than five^{49, 50}. Other researchers using the same instrument found four-factor solutions in their samples^{18, 19}. However in the present study a three factor solution was found to work best. Hampton⁵¹ reported consistent findings for Chinese students but the results showed some inadequacy based on the results of CFA. For South Africans the dominant factors (decision making) were Goal Selection and Planning⁵².

One of the possible reasons for the variance in number of factors identified may have to do with the differences among populations studied. In saying that, the compared studies did not have a predominately African American high school population. The researcher also made sure to conduct the factor analysis in a similar manner; using principal components with varimax rotation; with a large enough sample size to ensure greater comparability.

Conclusions

The results have a number of implications for future educational research and practice. Career choice is an important component of self-efficacy as found in the study and needs to be continually fostered at the secondary level, particularly among minority populations in the United States. In relation to career choice, self-efficacy needs to be studied and cultivated as a central priority. The understanding of the confidence students need in order to make career choices will lead to the development of interventions to encourage positive career self-efficacy. Examples of interventions need to be much more explicit, identifying the target audience, designing curriculum that is of interest to the target audience, and finding ways to link mentors to those students.

It is important to point out that the questions about 8th grade math and science grades did not specifically ask the type of math or science class. It might be more helpful to ask questions about specific math and science classes which relate to engineering, such as algebra, trigonometry, calculus, and physics. Also, it would be helpful to improve the precision of the data gathered about socioeconomic status and the relationships between socioeconomic status and exposure to and opportunities for access to careers.

It may be that the type of school (whether it is math or science focused) may influence responses to questions relating to career decision self-efficacy. It seems important to initiate dialog regarding more effective ways to contribute to career decision self-efficacy and to increase interest into engineering and math/science related fields for minorities. Additional studies might focus on how living situation, SES, and school courses affect career decision self-efficacy of minority students. Also, it would be helpful to study the effects of parental occupations and the influences of role models on career decisions of high school students.

This study contributed to the research literature by first examining a population that has historically been absent in the field of engineering and related fields. The study then looked at African American students in high school and attempted to measure their overall self-efficacy influencing decisions. The intention of this study was not to give a baseline of the career decision self-efficacy of African American students but merely to be an exploratory investigation of a circumscribed sample that has not been studied in detail. Therefore, findings from this study may be useful for those in predominantly African American schools, for directors of math and science or engineering in afterschool or summer programs, and for parents in helping to strengthen initiatives promoting the inclusion of the African American population in engineering careers.

The findings in this study should inform recruitment and outreach efforts and be used to initiate dialog regarding more effective ways to contribute to career decision self-efficacy and illustrate the importance of self-efficacy for minority students interested in entering engineering other and math/science related fields.

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