Persistence of African American Females in Engineering: The Identity Factor

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Abstract

African American females remain underrepresented in engineering careers, earning only 1% of the bachelor's degrees. While existing research examines African Americans' persistence in engineering careers, limited empirical studies exist on the impact of identity on persistence for this group. This exploratory study examines the effect of social, professional, and ethnic identities to the persistence of African American women in undergraduate engineering programs. Additionally, the study compares African American and other females on ethnic, professional and social identity variables. Data was collected from a sample of female engineering students at an Historically Black University (HBU). A Multiple regression analyses was conducted to examine the effect of social, ethnic and professional identity on persistence of African American female engineering students. A multivariate analysis of variance (MANOVA) will be completed to examine effects of racial identity on social, group, and professional identity in African American female undergraduate engineering students.

Keywords

African American, engineering, female, identity, persistence

Introduction

While many studies[1-3] evaluate persistence based on one aspect of identity (science, racial, ethnic, gender or social), very few studies assess the effect of multiple identities as a framework to the persistence of African American female college students in engineering programs.[4-6] The proposed study is based on Gee's[7] theory that individuals have a core identity comprised of identities associated with one's ethnicity, race, religion, gender, sexual orientation, life-history, and current realities.[7,8] These multiple identities are shaped by interpretation of experiences[9-11] which impact persistence[6,22]. This research explores the persistence (as measured by intent to persist) of African American female engineering students at Tennessee State University through social, professional and ethnic identities and evaluates how these identities differ among other female races.

Literature

Engineering historically has been identified as a predominately "White, middle-aged male's career."[1,12-13] America has vigorously focused on the retention of African Americans and minorities in STEM fields[14-19], but despite these concerted efforts, gender and racial disparities remain. In 2012, only 1% of engineering bachelors' degrees were awarded to African American females.[20]

Professional Identity. An engineering identity is based upon individual's perception of themselves, roles, responsibilities[21-23] and competence in their field.[24] African American female engineering students typically enroll confident and competent in math and science[22, 25-29] although highly vulnerable to non-persistence during the first-year as a result of their lack of understanding of the engineering profession.[30]

Social Identity. Social identity theory is the role of self-conception in group membership, processes, and relationships and can include race, gender, religion/spiritual, physical ability, socio-economic status, and sexual orientation.[29] It is based upon the actual or perceived perceptions of others.[30] While a strong social identity results in an increase of African American female engineering students' confidence in their ability to be successful,[31] stereotype threat (fear of being viewed through a negative stereotype or demonstrating behaviors that confirm the stereotype)[32] could produce ramifications in the form of a negative identity,[32,33] lowered confidence in professional identity[26,31,32,34] and isolation[33,35] which impedes a sense of belonging[26,37] and leads to academic disidentification[27-29,39] and withdrawal from engineering programs typically during their first year of college.[27-29,38-39]

Racial identity. Research indicates that a strong racial identity promotes self-esteem, and increased ability to tolerate negative environments.[4,6,22] Racial identity development models were initially constructed for African Americans' understanding of their cultural experience in the United States through explanation of progressions ranging from a lack of awareness of racial identity to acceptance of the dominant culture to acceptance of one's individual culture.[40-45] African American women possess multiple identities including three identities historically connected to oppression (gender, race, and class).The Multidimensional Identity Model (MIM) presents four stages for assessing identity of persons belonging to multiple oppressed groups.[45] These stages consist of: individuals allowing others to determine primary group (passive identification) to African American female engineering students suppressing certain aspects of their identity (race, gender) for acceptance by others (conscious identification) followed by embracing all aspects of their identities although living them as separate and unconnected (segmented identification) and finally evolving into an identity comprised of the intersections of all identities as one contextual relationship (identity intersection).

Method

The study employed a descriptive design with a convenience sampling of female engineering students at a Historically Black University (HBU) to analyze the relationship of social, racial and professional identity to the persistence of African American female engineering students.

Participants

Of the 150 female students enrolled in the College of Engineering, the sample consisted of 26 (17%) participants: African American (69%); White, (15%) Asian (4%), Other (8%), mostly between the ages of 18 – 24 years (89%). The academic classifications were as follows: 5 Freshman (19%), 4 Sophomores (15%), 9 Juniors (35%), and 6 Seniors (23%) majoring in Architectural (31%) Civil (27%) Electrical/Computer (23%), Mechanical Engineering (15%) and Computer Science (4%).

Instrumentation

In this study, professional, social and racial identity was used as independent variables and intent to persist was the dependent variable. Participants completed a demographic questionnaire and a self-administered assessment tool comprised of four instruments: *Group Identification Scale* (GIS)[30], *Social Identity Attitudes Scale* (SIAS)[47], *My Vocational Situation Scale* (MVS)[48], and the *Social Group Identification Measure*[49]. The GIS is a 28-item measure based on the *Multidimensional Inventory of Black Identity* (MIBI)[50] which focuses on: the student's identification of herself as an engineer ("centrality"); the degree to which the student feels positively or negatively about engineering or engineers ("private regard"); the degree of the student's perception of how others feel about engineers ("public regard"); and identification with the engineering group ("group identification"). High reliability[50,51] was found for MIBI scales: centrality (α = .77), private (α = .78) and public regard (α = .78) and scale internal reliability (α = .74)[50] The SIAS[47] is a 30-item measure that assesses stereotype threat based on math identification, ethnic identification, ethnic stigma consciousness, gender identification, gender stigma consciousness, and negative affect. Psychometric properties were considered "strong and stable across samples" with factor loading ranging from .62 to .96. The MVS[48] is an 18 item true/false measure comprised of three scales, *Vocational Identity* (VI), *Occupational Information* (OI) and *Barriers* (B). The MVS scale showed excellent (r =.93) test - test reliability for women[52]. The scale's reliability (KR- 20) ranged from .65 (B) to .79 (OI) to .88 (VI) for female college students[53] and .84 for African American undergraduate students[54]. The SGIM[55] assesses an individual's identification with their university and their co-workers. Persistence was determined by intent to persist as measured by the self-reported question, "I will obtain a bachelor's degree from this university"[56] using a 7-point Likert scale (l-strongly disagree to 6-strongly agree).

Results

Data was cleaned and exploratory data analysis was conducted to ensure data met statistical assumptions with adequate results. Descriptive statistics found scores on math identification (MathId, M = 6.24, SD = 0.73) higher than ethnic (EthnicID, M = 5.74, SD = 1.31) and gender identification (GenderID, M = 4.55, SD =1.38). The value placed on being an engineer and belonging to this group (group identification, M = 45.81, SD = 8.01) was higher than the extent students defined themselves as engineers (centrality, M = 38.42, SD = 7.01) and the degree they felt about engineering (private regard, M = 38.04, SD = 4.42), as well as their perceptions of others' viewpoints regarding engineering and engineers (public regard, M = 35.58, SD = 5.33). An enter multiple regression analysis was conducted and results indicated an overall model of three predictors (professional identity, negative affect, and stereotype threat) significantly predicted intent to persist [R2 = .346, R2adj = .256, $F(3,22) = 3.875$, $p < .023$]. This model accounted for 58.8% of variance in intent to persist.

Discussion

Results are similar to research based implications of African American women not persisting in engineering programs due to stereotype threat, weaker professional identities, and a lack of a sense of belonging. Efforts to assess college climates may highlight the need for multicultural based improvements. A limitation of this study was a small sample size.

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