

# An Exploration of the Connections Between Institution Type and Perceived Levels of Stereotype Threat in African American Engineering Students

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*To distinguish the similarities and differences in coping strategies of African American engineering students, a quantitative study was conducted which examined their perceptions of stereotype threat at three academic institution types: predominantly White institutions, ethnically diverse, and Historically Black Colleges and Universities (HBCUs). The researcher collected demographic information as well as survey data using the Stereotype Vulnerability Scale (SVS). Results were analyzed using a one-way ANOVA and Pearson's correlational statistical analyses. Findings revealed that no statistical differences exist between students' scores on an assessment of stereotype vulnerability at the three university types, nor did the percentage of African American students at a university correlate with their scores on the SVS. Future research should expand the number of survey participants at the current universities, add more HBCUs to the study population, run similar experiments in different parts of the country, and compare stereotype threat in private and elite universities.*

*Keywords:* Engineering, equity, STEM, stereotype threat, stereotype vulnerability

Many experts believe that the United States is still not producing enough engineers, and some say that the current number of 65,000-75,000 new engineers each year needs to be 115,000-125,000 to fuel the U.S. economy (Frehill, Brandi, Di Fabio, Keegan, & Hill, 2009). Attracting more men and women of color to physical sciences, mathematics, and engineering would provide career access for these individuals while filling the needs of the increasingly scientific and technological workforce (Freehill et al., 2009). If engineering has reached a critical mass of White men, the United States needs to do a better job of recruiting other groups, especially females and ethnic minorities. This need is important in times of both economic prosperity and deficit. Even during recessions, engineering jobs, such as mechanical engineering, are virtually recession-proof and can help shield minorities from unemployment (Frehill et al., 2009).

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The success and retention of African American students in engineering programs may be dependent on the climate to which they are exposed as well as their ability to withstand the stresses of being an underrepresented minority in a science, technology, engineering, and mathematics (STEM) field. Although there has been much research about African American students at both Historically Black Colleges and Universities (HBCUs) and Predominantly White Institutions (PWIs; Aronson, Fried, & Good, 2002; Brown, Morning, & Watkins, 2005; Fries-Britt & Griffin, 2007; Hendricks, 1996), few studies have looked at a third school designation, ethnically diverse. For the purposes of this research, PWIs have an African American population of 10% or less, an ethnically diverse university is one that has an African American population of between 11% and 20%, and HBCUs include universities with an African American population of over 80%. This research focused on comparing the presence of stereotype vulnerability in students at PWIs, HBCUs, and ethnically diverse universities.

This study had two purposes. First, it sought to identify how African American engineering students cope with adversity as they approach graduation to understand how colleges and universities can retain African American students in engineering programs. Second, the study sought to distinguish similarities and differences in coping strategies, specifically perceptions of stereotype threat, in African American students at three different classifications of universities: PWIs, ethnically diverse institutions, and HBCUs. The goal of this research was to see if differences exist in the perceptions of stereotype threat for African American students at the three institution types. It also looked at the correlation between the percentage of African American students on the campus and their perceptions of stereotype threat. Using the null hypothesis, the first hypothesis was that there would be no differences between the perceptions of stereotype threat in African American engineering students at the three university types. The second hypothesis was that there was no correlation between the percentage of African American students at the universities and the perceptions of stereotype threat in African American engineering students.

### **Significance of the Study**

The low number of African American engineering students in the United States is troubling. According to Frehill, Di Fabio, and Hill (2008) and Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, and Gary (2009) only 5.8% of all engineering majors are African American; of these students, 1.6% are female and 4.2% are male. Additionally, only 36% of engineering degrees awarded to African American students were to females. Data on student retention in engineering is also an area of concern because of the low graduation rates of African American students in general. According to the National Center for Education Statistics (NCES, 2009), White and African American students enter STEM fields at four-year institutions at similar rates. However, White STEM students exhibit a much higher six-year graduation rate (43.9%) compared to African American (31.7%; NCES, 2009). More than two-thirds of all African American male students leave college before finishing their undergraduate degree (NCES, 2009). This trend has not changed in a quarter of a century. Trenor, Yu, Waight, Zerda, and Sha (2008) pointed to four factors that are unique to students of color and have contributed to their attrition in STEM fields: “(1) differences in ethnic values and socialization, (2) internalization of stereotypes, (3) ethnic isolation and perceptions of racism, and (4) inadequate support systems” (p. 450).

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Another factor to consider is the demographics of the institution. Rodgers and Summers (2008) showed that African American students at PWIs reported lower academic self-concept and lower achievement than did their counterparts at HBCUs. Rodgers and Summers found that addressing African American students' coping skills could reduce stress and increase self-confidence. Perna et al. found that HBCUs graduated 22% of all African American students nationwide, but only 30% of all bachelor's degrees awarded to these students were in STEM fields. Research on African American students who attend HBCUs has revealed that these students have higher grade-point averages (GPA), more positive perceptions of campus climate, and higher academic self-efficacy and self-concept compared to African American students at PWIs (Cokley, 2000; May & Chubin, 2003). African American students who attend HBCUs also demonstrate less social isolation, alienation, personal dissatisfaction, and overt racism than do their counterparts who attend PWIs (Harper, Carini, Bridges, & Hayek, 2004). Even though a number of studies point to less stereotype threat at HBCUs (Cokley, 2000; Harper et al., 2004; May & Chubin, 2003), more research is needed to determine whether this trend is true.

### **What is Stereotype Threat?**

While it has been established that minority students are underrepresented in science, technology, engineering, and mathematics (STEM) fields, (Frehill et al., 2009; Perna et al., 2009) the causes for this underrepresentation are largely unknown. However, one factor may be stereotype threat. Steele (1997) defined stereotype threat as “[t]he event of a negative stereotype about a group to which one belongs becoming self-relevant, usually as a plausible interpretation for something one is doing, for an experience one is having, or for a situation one is in, that has relevance to one's self-definition” (pp. 616-617). A negative stereotype, Steele noted, becomes threatening when it is self-relevant and the individual has the sense of being treated or judged by that stereotype.

Steele (1997) believed that stereotype threat has been neglected as a possible causal factor in differing test scores between White and African American students. Specifically, Steele stated, “tests used to measure students' potential for some subsequent level of schooling, under a common set of testing conditions, can underestimate the actual potential of stereotyped students” (p. 189). Aronson and Inzlicht (2004) conducted a longitudinal study and found that students who were vulnerable to stereotypes showed lower performance in laboratory testing and were less accurate when asked to assess their test performance. The researchers suggested that the tendency not to understand fully the reasons behind their lower performance (i.e., inaccurate performance assessment) might account for some variation in achievement gaps. A meta-analysis by Walton and Spencer (2009) showed that individual difference in stereotype vulnerability predicted between 9% and 10% of variation in grades and helped account for the entire gap in GPA between White and African American students.

Research has also shown that the threat of being evaluated, judged by, or treated in terms of a negative stereotype can cause individuals to perform worse in a domain in which negative stereotypes exist for a group in which they are members (Singletary, Ruggs, Hebl, & Davies, 2009). Additionally, students do not need to believe the stereotype to feel its burden. Rather, they only need to be “aware of the stereotype and care enough about performing well in the domain to want to disprove the stereotype's unflattering implications” (Aronson et al., 2002, p. 114). This awareness and burden is known as stereotype vulnerability.

Stereotype vulnerability is the tendency to “expect, perceive, and be influenced by negative stereotypes about one’s social category” (Aronson & Inzlicht, 2004, pp. 829-830). Specifically, stereotype vulnerability impairs self-knowledge by increasing the level of mistrust of performance feedback and by increasing the level of stereotype threat perceived by the individual. When such mistrust occurs, students can develop inaccurate academic self-concepts, especially in areas in which they are deeply invested. In other words, stereotype vulnerability impairs self-knowledge by increasing the tendency of the target of the stereotype to distrust their own performance feedback in domains in which the stereotype is made clear (Aronson & Inzlicht, 2004). It is possible that stereotype threat is applied to oneself when the individual has a strong identification with the stereotyped group (Schmader & Beilock, 2012), which means that the individual will be more vulnerable to the stereotype.

### **Predominantly White Institutions**

Rodgers and Summers found that African American students who attend PWIs reported lower academic achievement in college and exhibited lower academic self-concept than did students who attended Historically Black Colleges and Universities (HBCUs). Dodson-Sims (2005) examined African American students who attended a PWI and found that these students felt less supported and less identified with the university. These students also experienced more stereotype threat than did similar students at an HBCU. Steele (2011) believed this lack of support and identification is because students at PWIs experience more identity threatening cues such as an elite academic program, a low number of minority faculty members, and a small number of minorities enrolled at these universities. He suggested that schools need fewer identity threatening cues, more ways for students to be successful, an abundance of minority leadership, and a critical mass of students and faculty.

Fries-Britt and Griffin (2007) examined students at PWIs who reported experiencing subtle and less overt forms of racism known as microaggressions, which they defined as “subtle and unconscious racist acts that cumulatively add stress to the experience of people of color” (p. 511). They found that African American students felt compelled to dispel myths and stereotypes about their peers, felt pressure to behave in non-Black ways, and constantly tried to prove that were accepted into an honors program by their own merit, and not by Affirmative Action. African American students at PWIs felt their energy was always averted from academics by constantly having to educate their White peers about minority stereotypes. African American students also felt that they needed space where their minority status was not made aware because they worried that their peers and faculty members might consider their academic skills as less than the other students.

### **Historically Black Colleges and Universities**

An analysis of the Integrated Postsecondary Education Data System in 2004 revealed that HBCUs were the source of 22% of all bachelor’s degrees awarded to African-Americans; however, only 30% of all bachelor’s degrees awarded to African Americans were in STEM fields (Perna et al., 2009). Additionally, HBCUs graduated 31% of the African Americans who earned degrees in the *hard sciences*, which include biology, computer science, earth sciences, mathematics and statistics, physical sciences, and engineering. Twelve institutions that graduated engineers were among the top 20 institutions that produce African American

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baccalaureate degree recipients who go on to obtain doctoral degrees. In 2005, of the 166 African Americans who received bachelor's degrees in Physics, 85 (51%) were from HBCUs (National Science Board [NSB], 2007).

Research on self-efficacy and self-concept of African American students suggests that those who attend HBCUs may have a positive edge in GPA, perceptions of campus climate, academic self-efficacy, and self-concept over African American students who attend PWIs (Cokley, 2000; May & Chubin, 2003). Harper et al. (2004) found that, compared to their counterparts at PWIs, African American students who attend HBCUs experience less social isolation, alienation, personal dissatisfaction, and overt racism. Hence, African American engineering students at HBCUs have favorable perceptions of college, experience less racism, have higher GPAs compared to their African American counterparts at PWIs (Brown et al., 2005), and exhibit strong racial identity (Hendricks, 1996).

### **Survey Instrumentation**

This study was designated as a quantitative investigation. To measure the perception of stereotype threat, a modified Stereotype Vulnerability Scale (SVS) was administered (Spencer, Steele, & Quinn, 1999). Barnard, Burley, Olivarez, and Crooks (2008) used the SVS (see Appendix) and found an overall internal consistency of  $\alpha = .60$ ; when administered with a specific domain (i.e., mathematics), the SVS revealed an internal consistency of  $\alpha = .82$ . Although Barnard et al. (2008) did not specifically use the SVS for African American students to test the validity of the instrument, they did use a group of minority students. The instrument was also used in a study to test for stereotype threat among the female population, which was relevant to the current study (Spencer, 1993). Spencer (1993) and Steele, James, and Barrett (2002) also found good internal consistency of the SVS. The SVS includes eight items that are rated using a Likert scale that ranges from 1 = strongly disagree to 7 = strongly agree. For this study, the items were separated into two dimensions for scoring purposes. Dimension 1 included items 1, 4, 6, and 8, which were related to negative personal experiences. Dimension 2 included items 2, 5, and 7, which focused on racial group characteristics. Item 3 was not included in this analysis because it did not align with the other two categories (Dodson-Sims, 2005). Each student also filled out a standard demographic form.

### **Sample Selection**

The survey was offered to the entire population of African American engineering students enrolled at the campuses selected. The selected universities included two PWIs, two ethnically diverse universities, and one HBCU. Because the overall population of African American male and female engineers is small, a convenience sample of as many students as possible was used from the entire population of male and female African American engineering students at the selected universities. Of the students who were contacted, 48 returned the completed survey (38 male and 10 female). A total of 17 students were from the PWIs, 20 from ethnically diverse universities, and 11 from a HBCU. As stated earlier, Frehill (2009) found that only 5.8% of all engineering majors are African American, including 1.6% female and 4.2% male. This contributed to the relatively small sample size. Demographic analysis showed that the average age of respondents was 21 years. Additionally, respondents included 13% freshman, 27% sophomore, 33% junior, and 27% senior. All of the universities were designated as public

universities. The percentage of African American students at the tested universities averaged 4.0% at the PWIs, 18% at the ethnically diverse universities, and 96.8% at the HBCU.

### Treatment of Data

For the quantitative portion of the study, a statistical analysis was conducted to test the first hypotheses for significance between the levels of stereotype vulnerability of students at the three types of universities. The hypothesis that no significant difference exists between African American engineering students at the universities in the area of stereotype threat was tested using a one-way ANOVA protocol in SPSS (Trochim, 2006). Although there is some discussion of the applicability of using ordinal data for ANOVA analysis, it was justified in this case for the purposes of comparison because the scores were not considered equally important or rigid in their scale values (Velleman & Wilkinson, 1993). A one-way ANOVA was used in this study because three institution types were compared in both male and female groups on the questions in the SVS. For the purposes of this research, the results related to female African American engineering students will not be discussed. Also, a Pearson's onetailed bivariate correlational analysis (Table 2) was performed to compare the scores on the survey instrument to the percentage of African American students at PWIs, ethnically diverse universities, and HBCUs.

### Analysis of Results

A one-way ANOVA (Table 1), conducted in SPSS, was used to examine differences between the survey responses and institution type. Dimension 1 was tabulated together using institution type as the fixed variable and the responses to the survey items as the dependent variable. HBCUs were coded as 1, ethnically diverse universities coded as 2, and PWIs coded as 3. The findings revealed no significant differences between the SVS and the three colleges for Dimensions 1 and 2 (Table 1). The results for Dimension 1 were as follows: item 1:  $F(2, 84.00) = .004, p = .958$ ; item 4:  $F(2, 84.00) = .235, p = .800$ ; item 6:  $F(2, 84.00) = .063, p = .951$ ; and item 8:  $F(2, 84.00) = 1.120, p = .374$ . The result of the Box's Test of Equality of Covariance Matrices was .291, which demonstrates homogeneity between the institutions on Dimension 1. Additionally, the Wilk's Lambda = .915,  $F(8, 84.00) = X, p = .195$  and further solidified the evidence that no significant differences existed between institutions. Item 8 showed some potential for a significant difference between the three types of institutions. Levene's Test of Equality of Error Variances = .046,  $F(2, 45) = 3.297, p = .046$  for item 8, which demonstrates differences between HBCUs and PWIs as shown by a standard deviation of 2.292 for HBCUs compared to a standard deviation of 1.495 of PWIs. The overall analysis for Dimension 1 (negative personal experiences) showed an overall significance of .633 with  $F(2,45) = .463$ .

Results for Dimension 2 were as follows: item 2:  $F(2, 86.00) = .604, p = .550$ ; item 5:  $F(2, 86.00) = .832, p = .832$ ; and item 7:  $F(2, 86.00) = 2.996, p = .060$ . For Dimension 2, the Box's Test of Equality of Covariance Matrices was .683, which indicates homogeneity between the institutions. Additionally, the Wilk's Lambda = .311,  $F(6, 86.00) = 1.203, p = .068$ , which demonstrates no significant differences between the institutions. Overall, these results show that no significant differences existed between participants enrolled in the different institutions. However, in an analysis of each question, differences were revealed, specifically for items 5 and 7. The Levene's Test of Equality of Error Variances = .047,  $F(2, 45) = 3.279, p = .47$ , which demonstrates variance in the standard deviation between HBCUs and PWIs on that item. Item 7

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showed a significance of .060, which is close to meeting the level of  $\alpha = .05$ . The item also yielded an F statistic of 2.996; combined with the low significance, the results of item 7 can be further discussed. The overall analysis for Dimension 2 (racial group characteristics) showed an overall significance of .086 with  $F(2,45) = 2.597$ .

Table 1

ANOVA Significance Test of Three Types of Institutions on the SVS Instrument

Survey Item	HBCU		Ethnically Diverse		PWI		Sig.	F
	M	SD	M	SD	M	SD		
1	2.36	2.01	2.40	1.50	2.53	1.51	.958	.044
2	1.82	1.08	2.35	1.39	2.06	1.39	.520	.604
4	3.18	2.09	2.95	1.61	3.35	1.62	.800	.253
5	3.27	2.20	3.85	1.90	3.12	1.36	.512	.832
6	3.91	2.17	3.75	1.62	3.94	1.56	.951	.063
7	4.00	2.41	4.40	1.85	2.88	1.62	.087	2.996
8	3.64	2.30	3.20	1.88	4.12	1.50	.374	1.120

A Pearson's one-tailed bivariate correlation was conducted to compare the percentages of African American students at each type of university to the average scores on each survey item (Table 2). The percentage of African American students at the tested universities averaged 4.0% at PWIs, 18% at ethnically diverse universities, and 96.8% at the HBCUs. Item 1 yielded a Pearson's correlation of  $-.778$ , which reflects a negative relationship between the percentage of African American students at each campus and the perception of stereotype vulnerability. This finding shows higher levels of stereotype threat at PWIs for item 1. Item 2 yielded a Pearson's correlation of  $-.753$ , which denotes a negative relationship between type of institution and average scores on this item. These results conflict with those for item 1 because a lower score denotes more stereotype threat. In this instance, HBCU students showed a higher level of stereotype threat.

Table 2

Pearson's One-Tailed Correlation: SVS Scores and Percentage of AA Students

Survey Item	r <sup>2</sup>	p
1	-.778	.216
2	-.753	.229
4	-.054	.483
5	-.186	.440
6	.234	.425
7	.396	.370
8	-.165	.447

**Significance of the Results**

The comparison of the engineering students showed subtle differences in their perception of stereotype threat. The results of all three tests failed to reject the null hypothesis in every case. Item 7 yielded a low significance score ( $p = .060$ ), although this result did not meet the threshold to be considered significant. Item 7 was, “My race does not affect people’s perception of my academic achievement.” For this item, it appears that African American students at PWIs felt strongly that their race has an effect on their perceptions of the academic environment. The scores from PWIs on item 8 averaged 4.12 (denoting high stereotype threat), while the scores at the other campuses were fairly similar to each other, HBCUs ( $M = 3.64$ ) and ethnically diverse ( $M = 3.20$ ).

Similar conclusions can be drawn from the Pearson’s correlational analysis. This portion of the study compared the average scores on the SVS at the three types of campuses to the percentage of African American students at these universities. However, it is worth noting that here is a discrepancy with the results of one of the items as it relates to stereotype threat and the percentage of African American students. Most of the questions showed no relationship between minority presence and stereotype threat. However, item 2 showed ( $r = -.773$ ) a complete opposite pattern of item 1 ( $r = -.778$ ). Item 2 stated: “My academic success may have been easier for people of my race.” A lower score on this item denotes a stronger perception of stereotype threat. The mean score on item 2 at HBCUs was 1.82 in contrast to ethnically diverse universities ( $M = 2.35$ ) and PWIs ( $M = 2.06$ ). This finding could relate to the way the question is phrased. This item does not reflect the institution where students are enrolled; rather it reflects the personal feelings they have that academic success is not easy, regardless of where they attend college. To students at HBCUs, race is salient, even though they are surrounded by a majority of African American engineering students. While these students do not feel threatened, they are cognizant of their race and society’s view of their race. Overall, the correlational study showed a weak relationship between the percentage of African American students and their scores on the SVS instrument (excluding items 1 and 2). Therefore, these results also failed to reject the null hypothesis that no relationship exists.



## **Implications**

Overall, there appears to be very small differences between the perceptions of stereotype threat between the three types of institutions, PWIs, ethnically diverse institutions, and HBCUs. This lack of difference could be due partly to the small sample size and partly to the ambiguity of some survey items. However, upon closer analysis of the data, slight differences emerged. Items that reflect personal feelings seemed to show slight differences across the three groups (specifically, items 7 and 8). Differences appear to emerge when participants were pushed to judge their personal feelings of stereotype threat.

Since the development of the theory of stereotype threat in the 1990s (Steele, 1997; Steele & Aronson, 1995), there has been much research related to its effects on achievement in the African American population (Steele & Aronson, 1995; Strayhorn, 2010; Walton & Cohen, 2007; Whiting, 2009). Many studies have also looked at the different levels of stereotype threat at PWIs and HBCUs (Aronson et al., 2002; Brown et al., 2005; Fries-Britt & Griffin, 2007; Hendricks, 1996). However, few have looked at the role of the third category of universities, ethnically diverse. Ethnically diverse universities are comprised of between 11% and 20% of African American students. The ethnically diverse universities in this study averaged 18%. It is possible that this critical mass of African American students is beneficial to other minority students, by giving them a greater number of role models, study group relationships, and greater minority class composition. When comparing the average scores of the SVS of HBCUs to ethnically diverse campuses, no significant differences were found in the level of stereotype vulnerability.

If HBCUs and ethnically diverse institutions are successful in helping students overcome feelings of stereotype threat, the question remains, “Is there any possibility that PWIs can effectively serve their African American students?” At first glance, it seems the odds are stacked against these institutions. However, after analyzing the result of this study, it appears there a few reasons for hope. First, the difference between the institutions on the level of perceived stereotype in this study was minimal. Except for a few survey items, the average measure of stereotype vulnerability was not substantially different between the three institution types. It is possible that the universities chosen for this study has adequate institutional support, collegial study groups with high minority participation, and strong support from organizations such the National Society of Black Engineers that help mitigate the effects of stereotype threat.

## **Recommendations for Future Research**

This study answered some questions. It also opened up numerous possibilities for future research and expansion of the current project. The research did not clearly find a relationship between stereotype threat and university composition. For clearer results, two improvements should be made to the current study. The first recommendation is to expand the number of participants at the current universities to determine whether the conclusions derived from the current study still hold true. Related studies could also be developed to test similar hypotheses. A number of universities in different parts of the country could be assessed and compared to the current results. Research questions of interest may include (1) Does the geographic location of a university have any connection to stereotype threat among its students? And (2) Does the total population of the university affect stereotype threat? Similar studies could also look at the amount of stereotype threat at private and Ivy League universities such as Harvard.

Additionally, researchers could examine schools that have a substantial population of African American engineering students and compare university level (freshman, sophomore, junior, and senior) to level of stereotype threat. Considering this variable, researchers could determine whether students' vulnerability to stereotype threats increase or decrease as they progress toward graduation. This type of research could be accomplished using a longitudinal study that follows a group of African American engineering students from their freshman year until graduation and periodically assess their perceptions of stereotype threat.

It may also be important to assess students who drop out of these programs. A quantitative analysis of scores on the SVS among students who drop out could be revealing and help researchers understand whether students drop out because of stereotype threat. Such a study should be combined with qualitative methods in which students are interviewed to shed more light on their reasons for dropping out or changing majors. Future studies could also focus on African American engineering students who recently graduated as well as those in engineering careers to see how their level of stereotype threat compares to that of undergraduate students and non-finishers. Schmader and Croft (2011) said, "We might learn a great deal from specifically studying those individuals who attain great success despite frequent exposure to stereotype threat clues. Perhaps in success stories, we can backward engineer the recipe for advancement and resilience" (p. 802). Research is needed to determine the similarities and differences at HBCUs, ethnically diverse universities, and PWIs as they relate to student development, institutional support, and academic achievement.

Steele (2010) believed that stereotype threat is pervasive and salient to all African American students; it is not a matter of whether they feel the threat, it is related more so to how they face the threat and how it affects their success. The current survey instrument only measured stereotype vulnerability, which means that it measured how much students were aware of their perceptions of the threats around them. How participants responded to the survey is a different story entirely. This difference is why a focus on engineering graduates and professionals is so important; students who overcome negative influences and finish their programs could serve as role models to the larger population of African American students.

### **Conclusions**

One possible area of focus for future research may be to expose African American students in engineering programs at PWIs to the same networking opportunities and vicarious role-model experiences that are available to African American engineering students at HBCUs. Researchers need to ask why the retention of STEM students who attend HBCUs is higher than the retention of these students at PWIs. Researchers should also consider how PWIs can simulate the success of HBCUs by forming organizations and small groups to mirror the ethnic diversity found at HBCUs (Rodgers, 2009). In this regard, Perna et al. (2009) asked the following question: "How can institutions with more heterogeneous populations and without a historical institutional commitment to ensuring the academic success of all students develop a peer culture that encourages the attainment of African Americans in STEM fields?" (p. 18).

It appears that the increasing number minority students in STEM careers involves both recruitment (getting students interested) and retention (keeping students in the program and helping them graduate). Therefore, universities should emphasize both recruitment and retention; focusing on only one factor could be detrimental to the success of an engineering program. In other words, without recruiting, a program has no students to retain, and without

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retention, a program will lose the ones it does have. Additionally, the secondary educational system cannot be solely responsible for recruitment. Colleges need to be proactive in their recruiting processes while secondary schools can help with the process of identifying female and minority students who are academically capable and interested in engineering. Steele (2011) found that an abundance of minority professors were helpful in relieving identity-related pressures. Further, role models should be made available to women and minorities in hopes of increasing their production in the sciences. This process is cyclical and serves to prove itself as the number of underrepresented groups in science and engineering increases.

Once members of the stereotyped group feel that they are no longer judged in the light of stereotypes, they will know that the learning environment is safe. This sense of safety could lead to more African American students entering STEM fields because students are more willing to remain in situations where they feel safe to disprove stereotypes. Students may also be more likely to avoid stereotype-relevant situations when they become aware that they are stereotype safe. This domino effect could lead more minorities into STEM fields because of the presence of students who have learned to deal with stereotype threat (Logel, Peach, & Spencer., 2012). Minority students who can overcome the effects of stereotype threat will have a greater chance of success and increased self-awareness. As Crisp and Turner (2011) described,

Diversity must be experienced in a way that challenges stereotypical expectations ... Individuals must be motivated and able to engage with resolving the stereotypical inconsistencies ... When these preconditions are met, the experience will have cognitive consequences that will resonate across multiple domains. (p. 242)





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