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African Americans Studying STEM: Parsing the Numbers

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United States
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In 2006, 34% of African-American freshmen intended to major in science, technology, engineering, and mathematics (STEM) fields, according to [data](#) from *Science and Engineering Indicators 2008*. That number is larger than the percentage of incoming white freshmen--29.5%--who planned to major in science or engineering.

Given the abundance of stories in the media about the underrepresentation of minority students in STEM fields, these data are encouraging and surprising, but the trend is not especially new. Data going back to 1985 show African-American freshmen consistently specifying STEM majors at a higher rate than their white peers. African Americans also enroll in college at rates roughly on par with their representation in the population, so at the very beginning of college, the representation of African Americans in STEM fields is slightly in excess of their representation in the general population.

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But students often change their plans, and the attrition rates--from a STEM major and from college itself--are greater for African Americans than they are for the average college student. That leaves African Americans underrepresented among those with bachelor's degrees in STEM fields and even less well represented at every subsequent phase of the career path.

THE NUMBERS

African Americans made up 13.3% of freshmen starting college in 2001, but African Americans received just 9% of the bachelor's degrees, and a nearly identical 8.8% of the bachelor's degrees in STEM fields, granted 4 years later. The number of African-American degree

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recipients in 2005 was 60% of the number of incoming freshmen 4 years earlier; a slightly lower 53% of the number that announced an intention to study science and engineering in 2001 took STEM degrees in 2005.*

In comparison, white students made up 74.8% of incoming freshmen in 2001 and received 70.2% of all bachelor's degrees, and 67.3% of the STEM bachelor's granted, in 2005.

African Americans represented 5.3% of graduate enrollment in STEM fields in 2001 (down from 8.8% of bachelor's degree recipients), compared with 51% for whites. They earned just 2.5% of all STEM doctorate degrees granted in 2005, compared with 43% for whites. Some 61.3% of Ph.D.s awarded to whites were in STEM fields, compared with only 45% for African Americans.

WHAT ISN'T WORKING

African-American high school students and college freshmen are slightly more interested in STEM fields than their white peers, but the numbers show that this interest doesn't translate into a similar representation of college graduates in these fields. And although the attrition rate of African Americans is high in all fields, it's especially high in science and engineering. The reasons why are not well understood, and the answers put forward by experts are mostly anecdotal and sometimes contradictory.

Catherine Riegler-Crumb, a sociologist and assistant professor in the Population Research Center at the University of Texas, Austin, studies the psychological factors that influence racial differences in science course-taking in high school. She believes the main problem is the failure of our K-12 system to educate minority youth, especially in STEM disciplines. "What is holding minority students back is not a lack of interest in science but rather the fact that educational disadvantages are cumulative in nature, so that failures or low performance early on in school make it difficult for them to attain the prerequisites they need to continue," she says.



Catherine Riegler-Crumb

Mathematician Roger Perry-Stovall sees the effect of this cumulative disadvantage every day in the remedial mathematics classes he teaches to predominantly minority and international students at the City College of New York. Changes in the high school math curriculum, he says, mean that although students have seen a lot of math, their exposure isn't very deep. "By the time they reach the college level, they have built very poor habits, have seen almost everything somewhere in the high school experience, but know very little about how to solve basic problems," he says. Their mathematical preparation is insufficient for the rigors of the college curriculum.

In addition to better preparation, students need encouragement and support from parents and teachers, and they need to be exposed to scientists of any color who can fire their imaginations and demonstrate the real-world relevance of science and engineering, says biologist Art Hicks, director of the Louis Stokes Alliances for Minority Participation program at the National Science Foundation (NSF). STEM role models, teachers with STEM backgrounds, visits to STEM labs and departments, science fairs, and after-school and summer programs in STEM fields all help students catch the excitement of science and understand how it relates to their world, Hicks says.

Although mentors and role models of any stripe are welcome, Perry-Stovall says that the lack of African-American faculty members at the university level "sends the subconscious message that we don't belong there." Economics also plays a part. "My assessment is that most African-American students are in public schools to make a major and secure shift in their quality of life." Perry-Stovall believes that many low-income African-American students are looking for the quickest, easiest route to an economically stable career path, and the sciences are perceived as too difficult and the payoff too uncertain and too far in the future.

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Also essential, says Billy Joe Evans, a chemistry professor at the University of Michigan, Ann Arbor, are support structures for African-American students. Evans, the 1998 recipient of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring and a longtime advocate for African-American representation in the sciences, sees many problems with the minority undergraduate experience. "The students are generally neglected and do not become a part of the deeply penetrating association with a faculty member that is necessary for them to override peer pressure and develop the personal discipline for high-level achievements," he says.

Evans is skeptical of undergraduate research programs, which, he says, degenerate into résumé-building activities and turn faculty members off from personally investing in the students. Intervention programs aren't effective either, he says, because they train students to turn to others, often those without science backgrounds, instead of faculty members for counsel and advice. As a result, students drift away from the sciences, he says.

WHAT WORKS



Billy Joe Evans

There are exceptions to the minority undergraduate experience put forward in Evans's bleak assessment, and these exceptions offer models that can be emulated.

Howard Hughes Medical Institute biochemist Michael Summers and Freeman Hrabowski, president of the University of Maryland, Baltimore County (UMBC), wrote about the [UMBC Meyerhoff Scholars Program](#) in an Education Forum piece in the 31 March 2006 issue of *Science*. Reviewing the literature, Summers and Hrabowski wrote that factors such as academic and cultural isolation, low expectations that erode motivation and performance, unsupportive peers, and discrimination can all cause undergraduate

students to drop out or transfer out of STEM fields.

The Meyerhoff program neutralizes these factors through a combination of orientation programs for incoming freshmen, early involvement in scientific research, engagement with active research faculty members, and merit-based scholarships. The program graduates 86% of its undergraduates, more than half of which are African American, and sends 87% of those students on to graduate or professional programs. Meyerhoff students were about twice as likely to earn STEM bachelor's degrees as white students with similar preparation and intentions, they wrote in *Science*.

Although keeping African-American students interested in science and engaged in undergraduate studies is important, no amount of interest can overcome financial problems. A 1998 survey by Nellie Mae, a nonprofit provider of education loans, found that 69% of African Americans who dropped out of college blamed insurmountable loan debt.

This may explain why well-funded universities that provide generous financial aid packages, such as Princeton University, have better retention rates, says a [recent report](#) in *The Journal of Blacks in Higher Education (JBHE)*. In 2007, Princeton graduated 93% of its African-American students, compared with 97% of whites. Other elite institutions that offer less generous financial aid packages, the report says, are less successful in retaining African-American students.

According to the [report](#) in *JBHE*, other factors boosting graduation rates include a favorable racial climate on campus, established orientation and retention programs (including mentoring), geographic location--urban universities graduate a higher percentage of African Americans than do rural institutions--a strong and relatively large African-American student population, and supportive, nonbiased faculty members.

Colleges that offer the right chemistry in fact consistently graduate African-American students at higher rates than whites. The *JBHE* report cites six such colleges: Mount Holyoke College,

Pomona College, Smith College, Wellesley College, Wake Forest University, and the California Institute of Technology.

The success of programs that seek to increase the participation and retention of minorities in STEM fields, such as the Meyerhoff Scholars Program and the NSF-funded Louis Stokes Alliances for Minority Participation, along with the high African-American graduation rates at some of the nations high-ranking institutions, demonstrate that given the right environment, African Americans excel in STEM fields in numbers far larger than the current national averages.

**These NSF data do not track the 2001 freshman cohort and include, in the 2005 numbers, 2005 degree recipients who started college in other years. Consequently, the percentage of students from the 2001 freshman cohort who finish their degrees in 2005 will be lower.*

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