Charles H. Houston Center for the Study of the Black Experience in Education

Research Brief

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Developing Talent in Science and Technology: Institutional Factors and Minorities in the STEM Disciplines

Cindy Roper

"Because other nations have, and probably will continue to have, the competitive advantage of a low wage structure, the United States must compete by optimizing its knowledge-based resources, particularly in science and technology…." (Committee on Prospering in the Global Economy of the 21st Century, 2007, p. 4).

In 2005, at the request of Congress, the National Academy of Sciences created the Committee on Prospering in the Global Economy of the 21st Century. The committee's mandate was to study and report on America's competitiveness in rapidly changing social, economic, and technological environments. These reports catalogue the risks inherent in not being adequately prepared for a future in which the U.S. faces increasing competition from abroad. They repeatedly call attention to the importance of education in building and maintaining a prosperous economy, especially in the science, technology, engineering, and math (STEM) fields. The committee also proposes a number of actions centering on math and science in higher education including increasing the participation of minority students enrolled in the STEM fields (Committee on Prospering in the Global Economy of the 21st Century, 2007; Committee on Prospering in the Global Economy of the 21st Century, 2010).

Historically, non-Hispanic white males have dominated the fields of science and engineering. However, this segment of the population is projected to decline significantly in the near future while minority populations will be increasing substantially (National Science and Technology Council, 2000). Without the efforts of policy makers to bring about a significant increase in minority graduates, the STEM workforce will lack the necessary scientists and technologists to maintain and expand the competitiveness of the American economy (Committee on Prospering in the Global Economy of the 21st Century, 2007; National Science and Technology Council, 2000).

Producing STEM Graduates

Research results suggest a variety of factors that may influence the production of STEM graduates. Controlling for SAT scores, students attending Historically Black Colleges and Universities (HBCUs), for example, are more likely to earn a STEM degree, relative to a non-STEM degree (Eagan, Hurtado, & Chang, 2010). Persistence in science majors is also related to attending an HBCU although this finding does not hold for Hispanic Serving Institutions (HSIs) (Chang, Cerna, Han, & Saenz, 2008). A study of persistence in STEM fields suggests that higher SAT scores reflect better pre-college preparation and, by extension, a higher likelihood of graduating from the more rigorous STEM fields (Eagan et al., 2010; Griffith, 2010). However, aggregate SAT scores are negatively related to retention in certain STEM majors (Chang et al., 2008).

Institutional selectivity has been found to be positively related to STEM completion rates in some circumstances but not in others. Institutional control does not appear to influence STEM graduation rates (Eagan et al., 2010) while school size has been cited as an influence for some HSIs (Quintana-Baker, 2001).

Additional factors incorporated into this analysis include Carnegie classification and student spending. These variables are thought to reflect aspects of institutional environments focusing on undergraduate student experiences that may impact STEM major choices.

Findings

Of the 1,535 STEM granting colleges and universities in this study, the majority are in the private not-for-profit sector, and most are baccalaureate institutions. HBCUs or HSIs make up 7% or less of the sample (See Table 1). Schools range in size from 49 undergraduate FTE students to 241,832. Eleven percent of the colleges and universities in the sample have open admissions policies while the remainder admit from 8% of their applicants to over 99%. Student-related expenses vary from a low of $1,171/FTE to $175,693/FTE.

Table 1
STEM Granting Institutions: Descriptive Statistics

Sector	Public	35%
	Private not-for-	57%
	Private for-profit	8%
Carnegie Classification	Bachelor's	43%
	Master's	40%
	Research	17%
Minority Serving Institutions	HBCUs	5%
	HSIs	7%

Note. n = 1535. Data calculated from College Results Online, 2011, The Education Trust

From 2002-2009, STEM degrees averaged 16% of the total bachelor's degrees awarded, with those going to underrepresented minorities being about 2% of all degrees (See Figure 1).

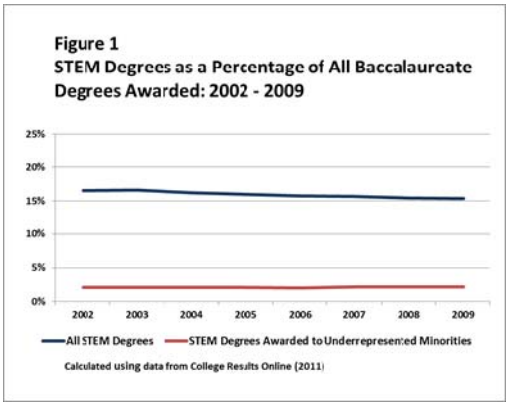


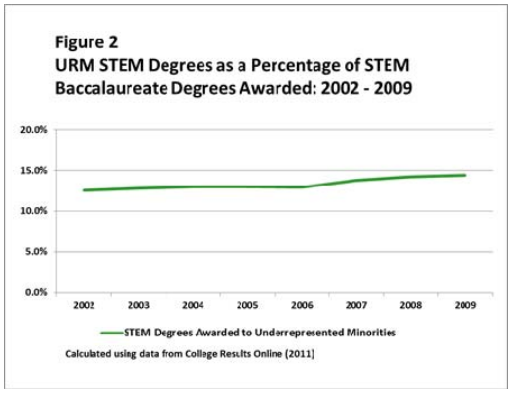
Table 2

Institutional Factors and STEM Degrees by Underrepresented Minority Students

			Percentage of Schools Graduating STEM Candidates By Production Level Quintiles				
Institutional Factors		n	Very Low	Low	Medium	High	Very High
Sector	Public	541	13	23	22	24	18
	Private Not-for-Profit	875	24	21	19	18	18
	Private for-Profit	119	22	8	8	21	42
Carnegie Classification	Bachelor's	663	30	19	14	14	23
	Master's	607	16	21	19	24	21
	Research	262	5	24	35	25	11
Minority Serving Institutions	HBCUs	79	0	3	0	1	96
	HSIs	111	0	0	0	15	85
Estimated Median SAT/ACT Scores	Very Low	280	21	9	9	23	38
	Low	224	21	18	21	25	14
	Medium	242	22	27	22	21	8
	High	244	24	27	25	18	6
	Very High	245	11	32	38	16	4
Selectivity	Open Admissions	163	24	13	6	17	41
	Very Low	273	9	16	28	19	28
	Low	273	13	20	24	22	20
	Moderate	277	20	24	19	26	11
	High	271	28	23	20	18	11
	Very High	271	27	25	16	16	17
Size	Very Small	307	34	8	11	16	32
	Small	307	27	23	15	20	16
	Medium	307	21	26	20	17	17
	Large	307	12	20	23	22	23
	Very Large	307	7	26	29	26	12
Student Related Expenses	Very Low	282	20	15	12	24	30
	Low	284	23	19	15	22	22
	Medium	281	21	22	19	19	20
	High	283	23	25	21	19	11
	Very High	282	13	28	37	15	8

Note. Row totals may not equal 100 due to rounding. Data from *College Results Online*, The Education Trust (2011)

Of the STEM degrees awarded between 2002 and 2009, an average of just over 13% were earned by underrepresented minority (URM) students (See Figure 2). In this sample, private for-profit schools are more likely to perform in the top 20% of STEM producing institutions than private not-for-profit or public schools (See Table 2). Bachelor's level colleges and universities are also more likely than master's level schools and considerably more likely than research universities to produce very high percentages of underrepresented minority STEM degrees. Counterintuitively, higher SAT scores and greater selectivity are not strongly related to "very high" underrepresented minority STEM degree production rates. Very small schools in this sample were much more proficient in generating underrepresented minority STEM degrees than were small and medium schools. Schools having smaller student related expenditures (per FTE) also performed better than those spending larger amounts. The most notable relationship in this analysis is that between very high production rates of STEM degrees and Minority Serving Institutions (MSIs), especially HBCUs. Attending a Minority Serving Institution appears to be significantly related to graduating with a STEM degree with HBCUs outperforming HSIs somewhat at the "very high" level.



Four of the top five universities generating the largest numbers of underrepresented minority STEM degrees in this sample are Hispanic Serving Institutions; seven of the top ten are Minority Serving Institutions. In addition, 70% of the top ten are research universities with the remaining being master's level institutions. All of the institutions producing the largest numbers of underrepresented minority STEM graduates are in the public sector (See Table 3).

Conclusion

Although many of the institutional factors examined here are relatively weak, some merit additional attention due to the magnitude of the differences noted or because of the counterintuitive nature of the findings. This is especially true with regard to the minority serving institutions, both HBCUs and HSIs. Given the critical need for the development of scientific talent, especially in growing minority populations, researchers and policymakers should closely examine areas highlighted here and in other studies with the goal of allocating scarce resources where they will be most effective.

Table 3

Largest Institutional Producers of STEM Degrees by Underrepresented Minorities: 2009

Institution	Total Degrees Awarded	Total STEM Degrees Awarded	Total URM STEM Degrees Awarded	Percent STEM Degrees	Percent STEM Degrees by URM	Sector	Carnegie Class.	HBCU?	HSI?
University of Puerto Rico – Mayaguez	1,523	959	957	63	100	Public	Master's	No	Yes
Florida International University	5,663	763	526	13	72	Public	Research	No	Yes
The University of Texas – El Paso	2,969	502	370	17	74	Public	Research	No	Yes
The University of Texas-Austin	8,747	2,117	354	24	17	Public	Research	No	No
Texas A&M University[a]	8,377	2,413	333	29	14	Public	Research	No	Yes
North Carolina A & T State University	1,372	359	320	26	89	Public	Research	Yes	No
University of Florida	9,207	1,805	319	20	18	Public	Research	No	No
The University of Texas – San Antonio	3,801	665	319	18	48	Public	Master's	No	Yes
The University of Texas – Pan American	2,660	359	298	14	83	Public	Master's	No	Yes
University of South Florida – Main Campus	6,067	1,147	267	19	23	Public	Research	No	No

Note. Percentages are rounded to the nearest whole number. Data is calculated using the *College Results Online* (2011) data set.

[a]Texas A&M, while not designated as such in *College Results Online* (2011), is listed as an accredited postsecondary minority institution by the U.S. Department of Education (n.d.)

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