

# Historically Black Colleges and Universities as Leaders in STEM

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## Dear friends,

In 2014, we stepped into the world of STEM and Historically Black Colleges and Universities (HBCUs) with the goal of understanding the contributions of these institutions to the STEM labor force in both higher education and the corporate sector. For years, we had looked at national data and knew that HBCUs were over-performing in STEM but ignored as significant contributors to our nation's expanding need for a more STEM-literate workforce. With a grant from The Leona M. and Harry B. Helmsley Charitable Trust, we conducted extensive case studies at ten HBCUs to find out exactly what has led to this legacy of achievement. The institutions in our study have a strong track record for preparing students in the STEM fields.

HBCUs graduate 20 percent of African American undergraduates. These institutions witness disproportionate success because their primary mission is the provision of opportunity and equity for all, especially Black students, so that these students can more fully realize their potential as future leaders, educators, and innovators. With this report, we share institutional stories that showcase how these HBCUs' missions manifest in their approaches to supporting student achievement in STEM. While we situate their accomplishments within a larger national context to emphasize their success, we also consider the challenges that these HBCUs face.

We offer thanks to the faculty, staff, and students at the ten HBCUs that participated in this research study: Xavier University of Louisiana, Dillard University, Morgan State University, Delaware State University, North Carolina Central University, Claflin University, Prairie View A&M University, Huston-Tillotson University, Lincoln University, and Cheyney University. Without these dedicated individuals, many students would not be able to reach their full potential.

We are grateful to The Leona M. and Harry B. Helmsley Charitable Trust for sponsoring our research and supporting HBCUs. We also offer thanks to Educational Testing Service and The Kresge Foundation for supporting the work of the Penn Center for Minority Serving Institutions (CMSI) where this research took place. Lastly, we could not have done this work without the support of the research and programming staff at CMSI; special thanks to all of our #centerlove family members.

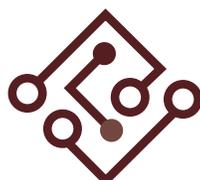
All our best,



MARYBETH GASMAN  
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# About the Authors



**MARYBETH GASMAN** is Professor of Higher Education in the Graduate School of Education at the University of Pennsylvania. Her areas of expertise include the history of American higher education, Minority Serving Institutions (with an emphasis on Historically Black Colleges and Universities), STEM education among students of color, and racism and diversity. Marybeth is the founding director of the Penn Center for Minority Serving Institutions, which works to strengthen, support, and amplify the contributions of MSIs and those scholars interested in them. Marybeth is the author or editor of 22 books, including *Educating a Diverse Nation: Lessons from Minority Serving Institutions* (Harvard University Press, 2015 with Clif Conrad), *Envisioning Black Colleges* (Johns Hopkins University Press, 2007), *The Morehouse Mystique: Educating the Nation's Black Doctors* (Johns Hopkins University Press, 2012, with Louis W. Sullivan), and *Academics Going Public* (Routledge Press, 2016). She has written over 200 peer-reviewed articles, scholarly essays, and book chapters. Marybeth has penned 350 opinion articles for the nation's newspapers and magazines and is ranked by *Education Week* as one of the most influential education scholars. She has raised \$22 million in grant funding to support her research and that of her students, mentees, and MSI partners. Marybeth serves on the board of trustees of The College Board as well as Paul Quinn College, a small, urban, historically Black College in Dallas, Texas.



**THAI-HUY NGUYEN** is Assistant Professor of Education in the College of Education at Seattle University as well as a senior research associate at the Penn Center for Minority Serving Institutions. His areas of expertise include racial minority achievement in STEM and health professional education, the contributions of Minority Serving Institutions and community colleges to racial minority success in STEM, and diversity in the STEM workforce. Thai-Huy's work has been published in several academic outlets, including *Teachers College Record*, *Journal of Diversity in Higher Education*, *Urban Education*, *Nursing Outlook*, and *History of Education*. He is currently the co-principal investigator on a national study on HBCUs and STEM education, funded by the Helmsley Charitable Trust for \$1.5 million. He has previously served as project manager for national studies related to racial minorities in nursing education (funded by the Robert Wood Johnson Foundation) and student success and Minority Serving Institutions (funded by Lumina Foundation, The Kresge Foundation, and USA Funds). Thai-Huy received his PhD in Education with a concentration in higher education from the University of Pennsylvania.

Realizing a society in which achievement abounds for all people requires that the nation continue to preserve institutions that give back to many students what has been taken away from them before their birth: opportunity and support. Amidst persistent and poor educational outcomes for Black students, Historically Black Colleges and Universities (HBCU) represent one type of institution that was developed and primed to nurture Black student success and ultimately uplift Black communities.

HBCUs continue to lead the nation in graduating Black STEM students. As shown in table 1, eight HBCUs were among the top 20 institutions to award the most Science & Engineering (S&E) bachelor's degrees to Black graduates from 2008-2012. Founded to educate Blacks during a time of intense oppression and segregation, HBCUs remain critical in the effort to minimize racial disparities in STEM education achievement.



TABLE 1

Top 20 Academic Institutions Awarding Science & Engineering Bachelor's Degrees to Black Graduates: 2008-2012

NUMBER OF BACHELOR'S DEGREES

**ALL INSTITUTIONS** **222,537**

**Top 20 institutions** **33,974**

University of Phoenix, Online	3,105
Ashford University	2,582
Georgia State University	2,307
University of South Florida, Main Campus	2,085
University of Maryland, College Park	1,987
<b>Howard University</b>	<b>1,946</b>
<b>North Carolina A&amp;T State University</b>	<b>1,874</b>
University of Florida	1,685
<b>Florida A&amp;M University</b>	<b>1,676</b>
Troy University	1,569
Florida State University	1,533
<b>Spelman College</b>	<b>1,503</b>
<b>Hampton University</b>	<b>1,377</b>
Ohio State University, Main Campus	1,318
University of Maryland, University College	1,305
<b>Southern University and A&amp;M College</b>	<b>1,273</b>
<b>Morgan State University</b>	<b>1,256</b>
<b>Alabama A&amp;M University</b>	<b>1,226</b>
Rutgers University, New Brunswick	1,187
Virginia Commonwealth University	1,180

**Other institutions** **188,563**

Note: **Bold** font indicates Historically Black College & University

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 2008–12.

The purpose of this national study is to hone in on the institutional mechanisms—philosophies, programs, and practices—that explain the achievements of Black students at HBCUs. The following tables present national data and provide much-needed context to understand the significance of HBCUs’ contributions to STEM achievement in the United States.

According to data from the National Science Foundation as listed in Table 2, Black and White students intend to pursue STEM degrees at similar rates with little variation by STEM field upon entering their first year in college (2014). However, disparities in achievement between these two groups emerge and widen along the pathway to the completion of a STEM degree. That is, Black students in any STEM field struggle to achieve comparable representation in degree attain-

ment—take for instance, engineering, where Black students earned only 4.2% of bachelor’s degrees in 2012 across the United States while White students earned 68.1%. Table 3 shows the distribution of Black and White students who earned STEM degrees in 2012, and the disparity among these figures is even wider when you take demographic proportions into account.

Blacks make up 14% of the U.S. populace, so the 4.2% of engineering baccalaureate degrees conferred in 2012 to Black students demonstrates their stark underrepresentation in the field, whereas Whites are overrepresented by nearly six percentage points (Humes, Jones & Ramirez, 2011). This is a uniform pattern across all STEM fields. There is promise, however, to be found in HBCUs.

TABLE 2

### Intentions of Freshmen to Major in Science & Engineering (S&E) Fields, 2014

FIELD	INTENTIONS
<b>ALL S&amp;E MAJORS</b>	
Black	36.4%
White	37.0%
<b>BIOLOGICAL/AGRICULTURAL SCIENCES</b>	
Black	12.5%
White	11.8%
<b>ENGINEERING</b>	
Black	7.5%
White	10.4%
<b>MATHEMATICS/STATISTICS/COMPUTER SCIENCE</b>	
Black	3.2%
White	2.8%
<b>PHYSICAL SCIENCES</b>	
Black	1.6%
White	2.6%

SOURCE: Higher Education Research Institute, University of California at Los Angeles, special tabulations (2014) of the Survey of the American Freshman.

TABLE 3

### Black and White Distribution of Bachelor’s Degrees Awarded to U.S. Citizens and Permanent Residents by Field, 2012

FIELD	DISTRIBUTION
<b>ALL S&amp;E MAJORS</b>	
Black	8.8%
White	62.7%
<b>BIOLOGICAL</b>	
Black	7.3%
White	60.2%
<b>ENGINEERING</b>	
Black	4.2%
White	68.1%
<b>MATHEMATICS/STATISTICS</b>	
Black	5.4%
White	70.1%
<b>PHYSICAL SCIENCES</b>	
Black	6.7%
White	66.1%

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Post-secondary Education Data System, Completions Survey, 2002–12.

Despite collectively making up only 3 percent of all postsecondary institutions, HBCUs awarded 17 percent of all STEM baccalaureate degrees earned by Black students (National Science Foundation, 2014). This achievement is emphasized in high-demand fields such as the biological, mathematical, and physical sciences, as well as engineering. (See Table 4)



**TABLE 4**

Contributions of HBCUs to National Distribution of Bachelor’s Degrees Awarded to Black U.S. Citizens and Permanent Residents by Field, 2002-2012 (Percentages)

**HBCUs**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>ALL FIELDS</b>	<b>22.6</b>	<b>22.1</b>	<b>21.4</b>	<b>20.7</b>	<b>19.9</b>	<b>19.4</b>	<b>19.0</b>	<b>18.5</b>	<b>17.6</b>	<b>17.2</b>	<b>16.7</b>
<b>S&amp;E</b>	<b>24.7</b>	<b>23.6</b>	<b>23.0</b>	<b>22.0</b>	<b>21.4</b>	<b>21.2</b>	<b>20.3</b>	<b>20.0</b>	<b>19.2</b>	<b>19.1</b>	<b>17.8</b>
<b>SCIENCE</b>	<b>24.9</b>	<b>23.8</b>	<b>23.2</b>	<b>22.0</b>	<b>21.6</b>	<b>21.3</b>	<b>20.5</b>	<b>20.0</b>	<b>19.1</b>	<b>19.0</b>	<b>17.7</b>
Agricultural sciences	50.4	48.2	42.0	41.2	44.9	38.5	37.9	37.6	37.1	35.0	32.1
Biological sciences	39.4	35.7	35.8	34.6	32.3	31.9	30.1	29.7	29.0	28.9	28.1
Computer sciences	25.2	24.4	25.0	24.2	22.4	21.1	18.0	18.6	17.6	16.1	14.3
Earth, atmospheric, and ocean sciences	6.5	11.7	12.3	16.2	10.3	11.4	10.1	10.2	12.3	11.4	7.6
Mathematical sciences	40.2	38.2	36.9	32.4	32.8	33.8	30.7	29.5	32.5	33.9	29.5
Physical sciences	41.9	40.3	39.5	37.3	35.3	37.4	34.2	38.8	36.6	32.9	33.4
Psychology	21.7	21.9	21.4	20.2	21.1	20.1	20.1	18.7	18.2	17.9	17.8
Social sciences	17.8	17.3	16.3	15.5	15.3	15.4	15.6	14.8	13.8	14.8	12.5
<b>ENGINEERING</b>	<b>22.4</b>	<b>21.0</b>	<b>20.1</b>	<b>22.1</b>	<b>19.9</b>	<b>20.5</b>	<b>18.3</b>	<b>20.6</b>	<b>20.1</b>	<b>19.8</b>	<b>19.0</b>
<b>NON-S&amp;E</b>	<b>21.7</b>	<b>21.4</b>	<b>20.7</b>	<b>20.1</b>	<b>19.2</b>	<b>18.6</b>	<b>18.5</b>	<b>17.9</b>	<b>17.0</b>	<b>16.4</b>	<b>16.3</b>

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 2002–12.

Given their ability to effectively produce Black STEM graduates, HBCUs represent meaningful sites of preparation for medical school or other professional health education degree programs. Table 5 presents the undergraduate institutions that produced 20 or more Black or African American applicants to U.S. medical schools in 2015-2016. Of the 62 institutions on the list, eight are classified as HBCUs. This accomplishment is especially noteworthy when taking into account that three of these HBCUs—Spelman, Morehouse and Oakwood—enroll student populations of less than 3,000.

**TABLE 5**

Undergraduate Institutions that Produced 20 or More Black or African American Applicants to U.S Medical Schools, 2015-2016

UNDERGRADUATE INSTITUTION	BLACK OR AFRICAN AMERICAN APPLICANTS FROM THE INSTITUTIONS	TOTAL APPLICANTS FROM THE INSTITUTION	% OF ALL BLACK OR AFRICAN AMERICAN APPLICANTS TO U.S. MEDICAL SCHOOLS
University of Florida	109	802	2.2
<b>Howard University</b>	<b>101</b>	<b>121</b>	<b>2.1</b>
<b>Xavier University</b>	<b>89</b>	<b>99</b>	<b>1.8</b>
<b>Spelman College</b>	<b>67</b>	<b>68</b>	<b>1.4</b>
Georgia State University	64	138	1.3
University of Georgia	61	491	1.3
Florida State University	59	341	1.2
University of Maryland—College Park	59	397	1.2
Rutgers University New Brunswick Campus	58	437	1.2
University of South Florida	57	366	1.2
Cornell University	49	514	1
University of Texas at Austin	49	783	1
University of North Carolina at Chapel Hill	47	439	1
Duke University	46	415	0.9
Johns Hopkins University	45	410	0.9
<b>Florida A&amp;M University</b>	<b>42</b>	<b>43</b>	<b>0.9</b>
University of Michigan—Ann Arbor	42	782	0.9
University of Illinois at Urbana Champaign	41	454	0.8
The Ohio State University Main Campus	40	461	0.8
Columbia University in the City of New York	39	243	0.8
<b>Morehouse College</b>	<b>39</b>	<b>40</b>	<b>0.8</b>
University of Central Florida	39	324	0.8
Emory University	37	371	0.8
<b>Oakwood University</b>	<b>36</b>	<b>39</b>	<b>0.7</b>
University of Maryland—Baltimore County	36	110	0.7
University of Miami, Coral Gables	35	373	0.7
Virginia Commonwealth University	35	173	0.7
Baylor University	34	298	0.7
University of South Carolina	34	207	0.7
<b>Hampton University</b>	<b>32</b>	<b>32</b>	<b>0.7</b>
Stanford University	32	269	0.7

Table 5 continued.

UNDERGRADUATE INSTITUTION	BLACK OR AFRICAN AMERICAN APPLICANTS FROM THE INSTITUTIONS	TOTAL APPLICANTS FROM THE INSTITUTION	% OF ALL BLACK OR AFRICAN AMERICAN APPLICANTS TO U.S. MEDICAL SCHOOLS
Florida Atlantic University – Boca Raton	31	128	0.6
Harvard University	31	280	0.6
State University of New York at Binghamton	31	216	0.6
Vanderbilt University	31	296	0.6
Michigan State University	30	371	0.6
University of Virginia—Main Campus	30	437	0.6
Yale University	30	266	0.6
University of Pennsylvania	29	322	0.6
The University of Texas at Arlington	28	119	0.6
University of California—Berkeley	27	819	0.6
University of California—Los Angeles	27	961	0.6
University of California—Riverside	27	178	0.6
University of Houston	27	178	0.6
Temple University	26	141	0.5
University of Pittsburgh	26	262	0.5
Arizona State University	25	381	0.5
Brown University	25	258	0.5
Louisiana St University and A&M College	25	326	0.5
Princeton University	25	168	0.5
City University of New York Hunter College	24	109	0.5
University of Alabama at Birmingham	24	136	0.5
Georgia Southern University	23	48	0.5
<b>Jackson State University</b>	<b>23</b>	<b>23</b>	<b>0.5</b>
State University of New York at Stony Brook	23	274	0.5
University of Tennessee—Knoxville	23	218	0.5
University of Connecticut	22	202	0.5
New York University	21	358	0.4
University of Arizona	21	419	0.4
Florida International University	20	189	0.4
Rice University	20	208	0.4
Washington University in St. Louis	20	379	0.4

\*Note: **Bold** font indicates Historically Black College & University

SOURCE: Association of American Medical Colleges Facts and Figures, 2015

HBCUs not only produce medical school applicants, but they also produce students who go on to become Black physicians. Table 6 shows the undergraduate institutions that produced eight or more African American medical school graduates in 2011. Six of the undergraduate institutions are HBCUs: Xavier University of Louisiana, Howard University, Spelman College, Morehouse College, Hampton University, and Oakwood University. Undergraduate HBCUs hold the top two spots for producing the most African American graduates.

**TABLE 6**

### Undergraduate Institutions Producing Eight or More African American Medical School Graduates, 2011

INSTITUTIONS	TOTAL
<b>Xavier University of Louisiana</b>	<b>60</b>
<b>Howard University</b>	<b>32</b>
University of Florida	26
Harvard University	22
Duke University	20
Stanford University	20
<b>Spelman College</b>	<b>18</b>
University of Michigan-Ann	18
University of North Carolina at Chapel Hill,	18
Yale University	18
<b>Morehouse College</b>	<b>15</b>
Emory University	14
<b>Hampton University</b>	<b>14</b>
Rutgers University New Brunswick Campus,	14
University of Georgia	14
Cornell University	13
Johns Hopkins University	13
University of California-Berkeley	13
University of California-Los Angeles	13
University of Maryland-College Park,	13
Washington University in St. Louis	13
New York University	11
<b>Oakwood University</b>	<b>11</b>
Florida State University	10
University of California-Davis	10
University of Miami-Coral	10
University of Texas at Austin	10
Princeton University	9
State University of New York at Stony Brook	9
Baylor University	8
Indiana University-Bloomington	8

\*Note: **Bold** font indicates Historically Black College & University

SOURCE: Association of American Medical Colleges, Diversity in Medical Education: Facts & Figures 2012

Graduate and professional HBCUs also hold the top three spots for medical schools that produce the highest number of Black medical school graduates. Table 7 shows the top ten medical schools that produced the most Black or African American medical school graduates in 2014-2015. The existence of these three institutions at the top of the list represents a legacy in which Black students were excluded from every stage of education, including medical school. To this day, they and their HBCU peers provide communities in which all, and especially Black, students are welcomed and valued.

**TABLE 7**

Top U.S Medical Schools Producing the Most Black or African American Graduates, 2014-2015

MEDICAL SCHOOL	# OF BLACK OR AFRICAN AMERICAN GRADUATES
<b>Meharry Medical College</b>	<b>75</b>
<b>Howard University</b>	<b>65</b>
<b>Morehouse School of Medicine</b>	<b>47</b>
University of Texas Medical Branch	39
University of Illinois	24
Ohio State University	19
Medical College of Georgia	18
Indiana University	17
Medical University of South Carolina	17
University of Pennsylvania- Perelman	17

\*Note: **Bold** font indicates Historically Black College & University

SOURCE: Association of American Medical Colleges Table B-6: Total Graduates by U.S. Medical School and Race/Ethnicity, 2014-2015



# Leaders in STEM Education: A Snapshot of the Success Models and Capacity Building Projects of 10 HBCUs

The heart of this report is the 10 HBCUs that participated in this national study. Below we provide descriptions of the success models in STEM housed at each of the institutions as well as descriptions of their capacity building projects, for which they were each awarded a \$50,000 grant to create a new program in STEM or build on their existing work.

## ICONS REFERENCED IN THIS SECTION



Success Model



Capacity Building Project



## DILLARD UNIVERSITY

In 1935, New Orleans University and Straight College combined to form Dillard University, a private historically black university located in New Orleans, Louisiana. Dillard University's mission is to create graduates who become world leaders, broadly educated, culturally aware, and concerned with improving the human condition by using a highly personalized and student-centered approach.

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TYPE

**4-year, private not-for-profit**

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YEAR ESTABLISHED

**1869**

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ENROLLMENT

**1,200**

---

HIGH SCHOOL GPA AMONG FIRST YEARS

**2.92**

---

AVERAGE SAT MATH & VERBAL

**860**

---

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**78%**

---

FULL-TIME, FIRST-YEAR RETENTION RATE

**75%**

---

SIX-YEAR GRADUATION RATE

**36%**



Three Dillard programs are highlighted in this research. In the Systemic Mentoring Program (SMP), faculty members are paired with students interested in STEM fields and students are awarded stipends that support their research. Peer Assisted Study Sessions (PASS) assist students majoring in STEM programs with courses that are paramount to their academic success. Also highlighted is the Research Experience for Undergraduates (REU), which gives support to students for research projects completed during the summer months. Students are given a stipend, which includes on-campus housing for room and board.



***Increase Capacity of Systemic Mentoring Program (SMP), Peer Assisted Study Sessions (PASS), and Research Experience for Undergraduates (REU)***

Across their three successful STEM programs, Dillard sought to expand their positive influence on student learning in gateway courses. Through the SMP program, faculty and students were provided with the resources to engage in meaningful research projects whose results were presented at national conferences in their STEM fields of study. The same students presented their work in the annual STEM conference at Dillard, which was also supported by funds from this study. Additional students were also hired for the PASS program. These new student leaders helped facilitate learning for their peers in general physics I and II. And lastly, Dillard supported six students to conduct 10 weeks of research during the summer. Coupled with a summer stipend, students were provided with on-campus housing, three meals per day, and a small allowance for travel to/from home. The structure of this summer undergraduate research program allowed students to focus on STEM without the worries associated with summer employment and housing.

## XAVIER UNIVERSITY OF LOUISIANA

Saint Katherine Drexel and the Sisters of the Blessed Sacrament founded Xavier University of Louisiana in 1915 and it is the only historically black college or university affiliated with the Catholic Church. Xavier contributes to the promotion of a more just and humane society by preparing its students to assume roles of leadership and service in a global society. The university's diverse learning and teaching environment incorporates research and community service throughout the curriculum.

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TYPE

**4-year, private not-for-profit**

---

ESTABLISHED

**1915**

---

ENROLLMENT

**2,976**

---

HIGH SCHOOL GPA AMONG FIRST YEARS

**3.37**

---

AVERAGE SAT MATH & VERBAL

**985**

---

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**57%**

---

FULL-TIME, FIRST-YEAR RETENTION RATE

**71%**

---

SIX-YEAR GRADUATION RATE

**43%**



Considered a leader in the STEM community, Xavier has two programs profiled in this research project: its peer- and instructor-led drill system and its peer-led student tutoring centers. Both programs were developed for students enrolled in General and Organic Chemistry, courses that see high attrition among minority students. The peer- and instructor-led drill system monitors student progress as well as provides constant reinforcement of concepts and skills with two-hour drill classes once per week. Peer-led tutoring is an institutionalized practice at Xavier. Selected by faculty, peer tutors are available throughout the day at centers on campus, ensuring students have ample and coordinated access to support.



### *Peer-Led Laboratory Assistance*

Drawing from the success of their peer- and instructor-led drill system in General and Organic Chemistry, Xavier replicated this model in their general chemistry laboratory course. Students retained faculty as their primary sources of support, but in this project their learning was supplemented by the added presence of teaching assistants. Benefits for students included more opportunities for questions to be asked and answered, increases in the supervision of safety in the labs, and more frequent one-on-one instruction. In fulfilling their roles, teaching assistants reinforced students' understanding of major concepts as they prepared for standardized exams for graduate education and gained experience in laboratory teaching and supervision. Ten undergraduate lab assistants per semester were hired and allocated across general and organic chemistry I and II labs.

**PRAIRIE VIEW A&M UNIVERSITY**

Founded in 1876, Prairie View A&M University (PVAMU) is the second oldest public institution of higher learning in Texas. The university has been recognized for its reputation for producing engineers, nurses, and educators. Prairie View A&M offers bachelor’s degrees in 50 academic majors, 37 master’s degrees, and four doctoral degree programs throughout its nine colleges and schools. A member of the Texas A&M University System, the university is dedicated to fulfilling its land grant mission of achieving distinction in teaching, research, and service.

TYPE

4-year, public

ESTABLISHED

1876

ENROLLMENT

8,429

HIGH SCHOOL GPA AMONG FIRST YEARS

3.10

AVERAGE SAT MATH & VERBAL

845

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

78%

FULL-TIME, FIRST-YEAR RETENTION RATE

67%

SIX-YEAR GRADUATION RATE

37%



PVAMU’s Department of Biology has created two successful programs to improve the achievement and retention of their students in the STEM fields. Premedical Concepts Institute (PCI) is a rigorous ten-week summer program for incoming freshmen interested in pursuing STEM careers. The Cardiovascular and Microbial Research Center provides undergraduate students with research projects and mentoring that support independent problem solving.



**Expanding the Premedical Concept Institute (PCI) and the Cardiovascular and Microbial Research Center (CMRC)**

PVAMU’s main aim in their Capacity Building Project was to sustain their successful practices while further investing in and enhancing undergraduate student opportunities. Due to an extensive track record of student achievement in STEM, PVAMU used their allotted project funds to sustain and enhance the influence of the PCI. Considered an effective pipeline for students majoring in STEM with aspirations to pursue graduate education in medicine and other professional health fields, PCI benefited from using the funds to pay for book vouchers, learning materials, students’ access to online textbook applications, and workshops for academic skills and standardized test (e.g. MCATs) taking training. To strengthen their efforts in undergraduate research, PVAMU also further developed their Cardiovascular and Microbial Research Center, which works closely with students to develop cutting-edge research. The project created opportunities for students to travel to national conferences, such as the Annual Biomedical Research Conference for Minority Students and the American Society for Microbiology and Experimental Biology.

“Prairie View A&M University was founded as an institution dedicated to teaching underserved populations in agriculture and engineering. Now, 140 years later, we are still committed to ensuring that our students have access to high-quality educational programs that provide them with an in-depth knowledge of the sciences, mathematics, and emerging technologies. All of our STEM-focused programs are designed to prepare students to be first-in-class nurses, doctors, engineers, architects, and agriculturalists in an increasingly competitive global marketplace.” —**GEORGE. C. WRIGHT, PRESIDENT, PRAIRIE VIEW A&M UNIVERSITY**

## NORTH CAROLINA CENTRAL UNIVERSITY

Founded in 1909, North Carolina Central University (NCCU) became the first public liberal arts institution of higher learning for African Americans in the country. NCCU offers bachelor's and master's degrees, a J.D., and a doctoral degree in Integrated Biosciences to a diverse student population. Located in Durham, the university advances research in various subjects, including the biotechnological, biomedical, informational, computational, behavioral, social, and health sciences.

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TYPE

**4-year, public**

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ESTABLISHED

**1909**

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ENROLLMENT

**7,687**

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HIGH SCHOOL GPA AMONG FIRST YEARS

**3.10**

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AVERAGE SAT MATH & VERBAL

**860**

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PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**79%**

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FULL-TIME, FIRST-YEAR RETENTION RATE

**77%**

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SIX-YEAR GRADUATION RATE

**47%**



As part of this research project, CMSI profiled the Peer Mentoring and Technology (PMT) program in the Departments of Biology and Mathematics and Physics as a model for enhancing persistence and success. PMT provides a research-based understanding for freshmen majoring in science and mathematics. Students participate in peer-led teaching and learning (PLTL) activities that are an important aspect of courses for the students. PLTL is considered a high-impact practice that is primarily a supplement to large enrollment classes. Its purpose is to ensure that students are engaged and learning the overall principles of their coursework.



### ***Peer Mentoring and Technology as a Model for Enhancing Success in Science and Mathematics Persistence***

Previously funded by the Howard Hughes Medical Institute, North Carolina Central sought to incorporate PLTL activities into the research-infusion component of General Biology I—Phage Hunters Advancing Genomics and Evolutionary Science (*PHAGES*). Through this initiative, students learned basic science skills, including familiarizing themselves with scientific equipment, maintaining bacterial cultures, and performing serial dilutions. With PLTL, students gained more opportunities to learn the content and skills from a variety of individuals, fellow students, teaching assistants, and faculty. Because not all students are receptive to faculty instruction, PLTL has become a model by which different pathways are available for students to achieve course learning outcomes.

## DELAWARE STATE UNIVERSITY

Delaware State University was founded in 1891 and is located in Dover, Delaware. Since 1957, the university has become a hub for teaching, research, and public service in the region. Delaware State serves a diverse student population. Undergraduate studies are organized into six colleges that contain a total of 20 academic departments offering 64 bachelor's degrees, 22 master's degrees, and five doctoral degrees.

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### TYPE

**4-year, public**

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### ESTABLISHED

**1891**

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### ENROLLMENT

**4,397**

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### HIGH SCHOOL GPA AMONG FIRST YEARS

**2.8**

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### AVERAGE SAT MATH & VERBAL

**895**

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### PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**53%**

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### FULL-TIME, FIRST-YEAR RETENTION RATE

**69%**

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### SIX-YEAR GRADUATION RATE

**43%**



Delaware State offers two effective programs profiled in this project: The Science and Math Initiative for Learning Enrichment (SMILE) Project and the Mathematics Preparation Program (MP2). The SMILE Project is a year-long STEM learning community, which includes an online summer developmental math course, a STEM training camp, peer mentoring, a mathematics workshop, and an undergraduate research program. The SMILE Project also sponsors peer mentors and leaders and offers students the opportunity to participate in undergraduate research. MP2 is an enrichment program that prepares high school students and pre-freshmen for college-level coursework through summer courses in Mathematics and English.



### *360 Degrees of Learning*

Building on their success with “flipped” classes, in which students watch lectures online outside of classroom hours and problem solving occurs in the classroom under the guidance of faculty, Delaware State has used their capacity building funds to enhance the effectiveness of this practice in two ways. First, faculty members have piloted Echo 360 in five lower-division courses in mathematics and chemistry. Presented as an active learning platform, it allows students access to the online lectures while providing them with learning tools to improve their engagement with and mastery of the topics. Second, this effort is coupled with Nfoshare, which is a predictive analytical program that captures students’ perceptions and feelings about the course content in real-time. This level of granularity in data provides faculty with information to better understand how material and assignments can be improved for student learning.

**MORGAN STATE UNIVERSITY**

Founded in 1867 as the Centenary Biblical Institute by the Baltimore Conference of the Methodist Episcopal Church, Morgan State University’s original mission was to train young men in ministry. In 1975, the Maryland Legislature designated Morgan State as a university and extended it the authority to offer doctoral and master’s degrees in addition to bachelor’s degrees. Morgan State is the leading public urban research university in Maryland, known for its quality in teaching, intensive research, successful public service, and community engagement.



TYPE

4-year, public

ESTABLISHED

1867

ENROLLMENT

7,689

HIGH SCHOOL GPA AMONG FIRST YEARS

3.0

AVERAGE SAT MATH & VERBAL

900

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

59%

FULL-TIME, FIRST-YEAR RETENTION RATE

75%

SIX-YEAR GRADUATION RATE

34%



Within the School of Computer, Mathematical and Natural Sciences, Morgan State has developed the Foundations of Mathematics (FOM) summer program for incoming freshmen engineering students. The five-week course is an online and in-person workshop that meets on Saturdays for four hours. Students work independently online during the week and in teams on Saturdays with upperclassmen coaches/tutors. The program uses Assessment and Learning in Knowledge Spaces (ALEKS) auto-adaptive mathematics software for instruction.



**Building a STEM Education Center for Excellence and Undergraduate Research Development Program**

Seeking to better understand the achievement of their students in STEM, Morgan State has used their provided funds to develop a clearinghouse that will lay the foundation for the development of a STEM Education Center for Excellence. This repository will capture data related to STEM testing in the gateway courses, course and program enrollment, student performance, faculty mentoring, research productivity, and graduate admissions. Funds have also been used to expand the capacity of two successful programs: Foundation of Mathematics and the Fundamentals of Engineering. Both programs aim to improve the transition to college by frontloading STEM interventions as early as possible, thereby providing additional time and resources for students to gain a strong grounding in concepts important to their pathways to degree. The capacity building grant also allowed Morgan State to extend the use of ALEKS, an auto-adaptive mathematics software that supports instruction in both programs.

“Coming into an Engineering field, you have to be up to par on your math skills. The Foundations of Math program helped me to stay sharp on my skills and the tutors here helped me improve my testing skills so I could place into the math classes I needed to be in. I am also glad to be applying to be a FOM tutor. The tutors here want to see us succeed just as much as we want to succeed and I want to be able to do that for others.”

—COREY VERNON, FRESHMAN

**CLAFLIN UNIVERSITY**

Founded in 1869, Claflin University is a small, private liberal arts college that offers 35 bachelor’s and two master’s degree programs. Located in Orangeburg, South Carolina, Claflin enrolls roughly 1,900 students and is affiliated with the United Methodist Church.

TYPE	<b>4-year, private not-for-profit</b>
ESTABLISHED	<b>1869</b>
ENROLLMENT	<b>1,866</b>
HIGH SCHOOL GPA AMONG FIRST YEARS	<b>3.28</b>
AVERAGE SAT MATH & VERBAL	<b>880</b>
PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS	<b>89%</b>
FULL-TIME, FIRST-YEAR RETENTION RATE	<b>71%</b>
SIX-YEAR GRADUATION RATE	<b>49%</b>



As part of the Pre-Freshman Year Summer Program, incoming freshmen take rigorous courses in math and chemistry and the results of this program have been highlighted in CMSI’s research project. The students have a peer tutor who lives, studies, and eats with them as a means to help them foster and strengthen their interests and skills in STEM. Peer tutors are upperclassmen who receive specialized training from Claflin faculty. Claflin also provides Supplemental Instruction (SI), which provides increased support and tutoring for students in STEM gateway courses.



***Strengthening Claflin’s STEM Program through Pedagogy, Technology, and Sharing of Success Stories***

Claflin University has witnessed increasing success with their STEM students due in part to their Supplemental Instruction (SI) and Pre-Freshman summer year programs. Capacity building funds were provided to enhance their work in these areas. Ten new SI student leaders were trained and dedicated to student success in STEM gateway courses. Claflin has reported that the influence of peers facilitating the process of mastering core concepts in STEM has led to increased confidence and performance among their students. The training of new SI leaders has also been coupled with the purchase of new instructional equipment in order to enhance the leaders’ abilities to teach more challenging concepts. Moreover, time and resources have been set aside for faculty to receive professional development in the area of STEM education and teaching. With funding from this project, the university was able to send several faculty and student leaders to a STEM education conference, hosted by the AAC&U. To capitalize on their successes, STEM faculty members have developed a quarterly Claflin STEM newsletter to better highlight and communicate their students’ accomplishments to prospective high school students, institutional donors, STEM education partners and organizations, fellow HBCU STEM programs, and STEM-related employers. The increased development of SI and the Pre-Freshman program have provided Claflin with much-needed institutional scaffolding to expand their capacity to support their STEM students.

## LINCOLN UNIVERSITY

Lincoln University was founded in 1854 and is a historically black university located 45 miles southwest of Philadelphia, Pennsylvania. Lincoln serves approximately 1,600 undergraduate students and 400 graduate students. More than 90 percent of Lincoln students are African American. As one of the country's first degree-granting historically black institutions, Lincoln has been a key component in educating African Americans in the region. Lincoln has several programs that have succeeded in improving STEM achievement.

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TYPE

**4-year, public**

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ESTABLISHED

**1854**

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ENROLLMENT

**1,819**

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HIGH SCHOOL GPA AMONG FIRST YEARS

**3.0**

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AVERAGE SAT MATH & VERBAL

**855**

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PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**66%**

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FULL-TIME, FIRST-YEAR RETENTION RATE

**76%**

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SIX-YEAR GRADUATION RATE

**41%**



As part of this research project, CMSI has profiled Lincoln's Excellent Academic Program in Science (LEAPS) program and its Supplemental Instruction (SI) program to retain and graduate students majoring in STEM. LEAPS is a six-week summer bridge program to support incoming freshmen through their transition to college STEM programs. SI provides additional tutoring for students in STEM gateway courses.



### *Increasing & Enhancing Access to Supplemental Instruction for Gate-Keeping STEM Courses*

After witnessing significant success with their Supplemental Instruction—in which the pass rate in mathematics exceeded 50% for the first time in 20 years—Lincoln used their capacity building funds to expand the program to cover more gateway courses in STEM. These additions are accompanied by a rigorous training and assessment plan, which includes interviews and annual surveys. The faculty members with courses involved in this program work closely with student instructors to ensure students achieve the intended learning outcomes. Goals for this programmatic expansion included improved retention, performance, and study habits for students in the STEM gateway courses.

**CHEYNEY UNIVERSITY**

Founded in 1837 as the Institute for Colored Youth, Cheyney University of Pennsylvania is the first institution of higher learning for African Americans. Cheyney offers bachelor’s degrees in more than 30 disciplines and a master’s degree in education.

TYPE

**4-year, public**

ESTABLISHED

**1837**

ENROLLMENT

**1,022**

HIGH SCHOOL GPA AMONG FIRST YEARS

**2.50**

AVERAGE SAT MATH & VERBAL

**NA**

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**77%**

FULL-TIME, FIRST-YEAR RETENTION RATE

**55%**

SIX-YEAR GRADUATION RATE

**26%**



Two programs that are helping students in STEM at Cheyney University are The Coach Approach and Aquaculture/Aquaponics research. The Coach Approach is a more intense approach to mentoring. Faculty and students are paired together from start to finish, and faculty provide continuous academic and professional advice, research opportunities, and emotional support during students’ tenure. Aquaculture/Aquaponics research includes the Aquaculture Research and Education Laboratory, which provides students with real-world industry experience. Students are exposed to the research and business development sides of the scientific community.



***Creating a Research-Based STEM Experience***

With the opening of the university’s new science center, Cheyney revisited the curriculum in their Biology I and II courses. Cheyney found that, as critical gatekeepers to upper-division courses, Biology I and II would benefit from a new set of modifications that situate undergraduate research as a core to the curriculum. Funds were provided for two faculty members to attend the biennial Council on Undergraduate Research conference in order to engage with faculty across the country and to make sense of new evidence-based practices and innovations that could be incorporated into their own courses. The same faculty spent a summer revising the curriculum, which included a plan to assess the effectiveness of these new changes on student learning outcomes. Additionally, students in these revised courses now have the opportunity to present their work during the annual Student Research Day, in which two students are selected to attend the National Conference on Undergraduate Research.

**HUSTON-TILLOTSON UNIVERSITY**

Huston-Tillotson University is a private, four-year historically black university located in Austin, Texas. Huston-Tillotson provides educational opportunity with an emphasis on academic excellence, spiritual and ethical development, civic engagement, and leadership to a diverse population of students. Through the College of Arts and Sciences and the School of Business and Technology, Huston-Tillotson offers bachelor’s degrees in biology, chemistry, mathematics, computer science, and computer information systems.

TYPE

**4-year, private not-for-profit**

ESTABLISHED

**1877**

ENROLLMENT

**1,031**

AVERAGE HIGH SCHOOL GPA AMONG FIRST YEARS

**2.79**

AVERAGE SAT MATH & VERBAL

**800**

PELL RECIPIENTS AMONG FIRST-YEAR STUDENTS

**74%**

FULL-TIME, FIRST-YEAR RETENTION RATE

**57%**

SIX-YEAR GRADUATION RATE

**31%**



As part of this research project, Huston-Tillotson is establishing an Integrative Teaching and Learning program and a Reading Comprehension program to increase the quality of preparation for students in STEM. Faculty will also participate in professional development opportunities throughout the academic year and in the summer. The initiative seeks to strengthen the ability of students studying STEM fields by incorporating cross-disciplinary material into key courses in the general education system.



***Promoting STEM through Integrative Teaching and Learning in Reading Comprehension***

Huston-Tillotson is focused on addressing systemic barriers to student achievement in STEM. Through their integrative plan, their project aimed to improve freshmen and sophomore STEM major retention by (1) improving their reading comprehension in STEM gateway courses, (2) providing STEM and non-STEM faculty professional development to enhance student literacy skills with a dedicated focus on STEM, and (3) establishing a reading center for students and their peer tutors to work through reading assignments. This plan was undergirded by a teaching and learning model that incorporates cross-disciplinary perspectives, which emphasized reading comprehension and critical thinking skills directly related to courses in STEM majors.



## WHAT WE LEARNED

When considering the forces that predict educational attainment, researchers tend to forget or have a difficult time accounting for the influence exerted by a student's institutional structure and culture. In this study, we had the honor of visiting 10 four-year HBCUs from across the country to understand how their daily practices of teaching, mentoring, and programming contributed to the achievement of Black students in STEM gateway courses. Although we identified many tangible lessons (which are highlighted in the institutional descriptions), we were in awe of the much broader lessons that underscored the importance of these institutions in the face of increasing educational and racial inequality in the United States. These broader lessons highlight the inherent intelligence and achievement of all students and demonstrate how these 10 HBCUs have widened aspiration, opportunity, and success for their students.

### Promoting a Legacy of Achievement

HBCUs have an extensive history of graduating successful Black leaders, educators, and innovators and this legacy should be celebrated. Capitalizing on past successes provides a high degree of momentum for students, especially for students coming from environments where success is rarely or hardly recognized. Being embraced by an institutional or departmental culture with a history of achievement can help students hold onto and translate their own aspirations into earning a STEM degree. Take for instance, Prairie View A&M University (PVAMU) and their several hundred STEM graduates who have gone onto medical school or other graduate and professional education programs. When asked what contributes to their current success in the university's gateway courses, PVAMU students often drew inspiration from the institution's legacy of achievement in STEM. In contrast to the national narrative on Black students, success is considered a norm at PVAMU, not the exception.

### Expanding the Notion of Family among Students and Faculty

For many students, college marks the first time they leave their families. Although college can be a time of great excitement and adventure, knowing that one's family network may not be readily accessible can also fuel fear, uncertainty, or anxiety among students. During the time we spent across the 10 HBCUs, we noticed a consistent pattern of how faculty and students expressed their relationships with each other: the notions of family and close kinship were commonly used to explain faculty commitment to student success as well as students' unwavering drive to meet faculty expectations. When faculty members spoke of their students as their "children," it became clear why they were willing to exert so much time and energy—both in and outside the classroom—to remove any roadblocks that would inhibit their students' ability to achieve. Similar to parents who possess a deep willingness to ensure their children succeed in life, the faculty and staff in our study remain committed to seeing their students through to graduation.

“The best thing about the Chemistry Department at Xavier is becoming part of a department that feels like family. The faculty members have an open door policy and there are numerous resources on campus to aid students in being successful—everything from the free organic tutoring center to the faculty and student mentors. Xavier’s chemistry department offers a rigorous program that will prepare any student for the next stage.”

—DOMINIQUE R. BENSON,  
Student at Xavier University,  
New Orleans, LA

### Culture of Institutional Responsibility

The culture of STEM can be characterized as individual, cutthroat, and competitive—a culture in which only a few students are expected to achieve a narrow set of standards that demonstrates their mastery of the content. According to data shared above, many students enter college intent on pursuing a degree in STEM, but few actually do so. The attrition of Black students can be partially explained by disciplinary practices and norms that assume few individuals have the inherent intelligence, capacity, or ambition to pursue the sciences—we know this cannot be further from the truth. Often, institutions expect minority students to achieve these standards without real regard for their academic and personal backgrounds. These students are also expected to learn with and from fellow students and faculty who rarely reflect their own racial and ethnic identities or understand the challenges of systemic racial and class inequalities that shape their pathways differently. Stereotyped as inferior and isolated by classmates for this reason, Black students’ sense of belonging and, ultimately, their achievement are discouraged.

During our visits, we discovered that the 10 HBCUs enacted institutional responsibility by acknowledging the unique needs and challenges of their students and worked with them to meet the rigorous standards of STEM. This included challenging common assumptions about college readiness, cultivating community among students to promote a “we over me” mentality, and encouraging faculty to proactively reach out to students who might need additional support and monitoring. It’s not that students do not have the talent to succeed, it’s that institutions need to take greater responsibility for the varied needs of their STEM students.

### Student Learning Over Faculty Needs

Often, faculty members put their need for convenience over students’ need and desire to learn. However, at the 10 HBCUs we visited, we noticed that faculty in the STEM fields worked together to craft STEM curricula that were designed to amplify the learning of students. Often this approach meant hiring new people with a team-based outlook or spending countless hours ensuring that all of the classes spoke to one another. Despite a respect for academic freedom in the classroom, faculty members were compelled to learn what others were doing in their classes and build on the contributions of their colleagues.



“Everyone really helped us a lot because we got to go over math skills we normally forget in the summer. We got to meet new people at Morgan State University who helped us to achieve our goals by being able to get better test grades on our placement tests.”

—CORA BUCK, Student at Morgan State University, Baltimore, MD

“I was part of the PASS and research program, which polished my research skills and gave me the edge to be involved in graduate research. It gave me what I needed to be a successful graduate student at Cal State Long Beach.”

– SIMEON WILSON, Dillard University, New Orleans, LA

### Peers Mentoring Peers

Peer support is another characteristic that may promote degree attainment in the STEM fields. At many HBCUs, there is a climate in which students support one another rather than work against one another—there is an ethos of “your success is my success and vice versa.” Study groups and peer tutoring are the main ways that peer support takes place and this mechanism promotes academic achievement and hard work among students. Although a sense of immense competition does not permeate the culture of HBCUs in this study, students still set high goals for themselves and feel challenged by the curriculum. Rather than feeling jealous of their peers, they hold each other accountable and often feel inspired by peers who are presenting at conferences, doing research, or working in prominent internships. Institutions such as Xavier University of Louisiana promote peer interaction among students and make mutual support a part of the ethos of the institution.

### Same-Gender and Same-Race Faculty Role Models

One of the greatest advantages that HBCUs have over their majority counterparts is diversity among the STEM faculty members. In particular, there are higher numbers of African American professors. Most colleges and universities nationwide have faculties that are predominantly White; the lack of Black faculty and faculty of color is particularly evident in the STEM fields. A lack of racial, ethnic, or gender diversity among faculty and students in STEM programs may be problematic for African American students, as it likely contributes to a culture discouraging African American students’ sense of belonging in STEM. Research on HBCUs and the STEM fields suggests that having a same-race, and often same-gender, faculty mentor, combined with the predominantly Black setting, can serve as a counter-narrative to Black students in STEM (Perna et al., 2009). Mentors may provide Black students with many advantages including strategies for coping with racism and sexism in the STEM pipeline and ultimately bolster student confidence (Hurtado et al., 2008).

“Xavier has an incredibly dedicated faculty who have sought out to work here because they are committed to Xavier’s mission. I have incredible colleagues in the Chemistry department. Whenever we plan new curriculum or design new resources we always frame it from the viewpoint of “What would be best for the students?” Our classes are designed to give them the resources they need as well as the challenges they deserve. We treat them the way we want them to treat each other—that is, to be resources for each other and always open to help their fellow student.”

– STASSI DiMAGGIO, Associate Professor of Chemistry, Xavier University of Louisiana, New Orleans, LA







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Located at the University of Pennsylvania under the direction of Professor Marybeth Gasman, the Penn Center for Minority Serving Institutions' mission is to:

ELEVATE the educational contributions of MSIs, ensuring their participation in national conversations;

.....

INCREASE rigorous scholarship on MSIs;

.....

CONNECT MSI academic and administrative leadership to leading reform initiatives in the United States;

.....

INFORM administrative, instructional and philanthropic practices at MSIs;

.....

ADVANCE effective policies that have a positive impact on strengthening MSIs, the development and support of their students and faculty, and the quality of the elementary and secondary schools within their communities;

.....

BRING TOGETHER MSIs around their common interests, strengths, and challenges to increase efficiency and optimize resources;

.....

ENHANCE the efforts of MSIs to close educational achievement gaps and assessment performance of disadvantaged communities.



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