HBCU Contributions to Black Bachelor's Degree Attainment in Selected STEM Fields from 2014 to 2023

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Abstract

Historically Black colleges and universities (HBCUs) play an important role in Black students' attainment of degrees in science, technology, engineering, and mathematics (STEM). This study examines HBCU contributions to bachelor's degree awards to Black or African American students in six selected STEM fields from 2014 to 2023. Using Integrated Postsecondary Education Data System data, the descriptive analysis compares annual degree counts, cumulative awards, and HBCU shares across eligible four-year institutions. During the study period, institutions awarded 248,409 degrees in the selected fields, including 47,405 at HBCUs (19.1%). Annual awards increased by 52.2% across all institutions and by 9.2% at HBCUs. Despite this increase in HBCU output, their share declined from 23.8% in 2014 to 17.1% in 2023 as awards grew more rapidly at non-HBCU institutions. Biological and biomedical sciences accounted for the largest cumulative number of awards, whereas computer and information sciences experienced the greatest percentage growth. HBCUs conferred 23.8% of biological and biomedical sciences awards, 23.4% of engineering technologies awards, and 23.9% of physical sciences awards. These findings demonstrate the importance of examining absolute output alongside proportional contributions and distinguishing trends across disciplines. The results provide a descriptive basis for institutional planning and further research on Black STEM degree attainment; they do not establish causal differences in institutional effectiveness.

Keywords: historically Black colleges and universities, Black students, STEM degrees, bachelor's degree attainment, IPEDS

Introduction

Historically Black colleges and universities (HBCUs) warrant sustained attention in research on Black participation in science, technology, engineering, and mathematics (STEM). Their contribution can be evaluated through the number of degrees they confer and through their share of degrees awarded to Black students. These measures answer different questions. An institution sector may increase its degree output while accounting for a smaller proportion of national awards if other institutions expand more rapidly. Examining both measures is necessary to interpret HBCU trends accurately.

National reporting situates this question within broader changes in science and engineering education. The National Science Board (2023) documented increases between 2012 and 2021 in the combined share of science and engineering awards earned by American Indian or Alaska Native, Black or African American, and Hispanic students. Such aggregate patterns provide context, but they do not isolate Black students, distinguish HBCU contributions within each field, or resolve how absolute and relative contributions change together. The present study addresses those descriptive questions for six selected fields over the period 2014–2023.

Institutional Context and Prior Research

Research on HBCUs provides a basis for studying institutional contributions without treating degree counts as direct measures of institutional quality. Perna et al. (2009) examined how Spelman College supported African American women's attainment in STEM. Their case study highlighted the potential importance of institutional characteristics, policies, and practices in addressing barriers to attainment. Because the study concerned one institution, its findings should inform questions about institutional processes rather than be generalized to every HBCU.

Hurtado et al. (2011) combined a five-campus qualitative study with longitudinal data from students at 117 institutions to examine interactions between aspiring scientists and faculty. They found that institutional context shaped access to faculty support; Black students at HBCUs reported more frequent and supportive interactions. This evidence supports attention to educational environments, although the present analysis does not measure those interactions or test whether they explain degree trends.

Federal support also recognizes the role of HBCUs in undergraduate STEM education. The National Science Foundation's (2023) HBCU Undergraduate Program supports improvements in STEM education and research at these institutions. Its rationale includes their contribution to the baccalaureate preparation of Black science and engineering doctorate recipients. That broader pathway provides a reason to examine undergraduate degree production, but doctoral attainment and workforce entry are outside the outcomes measured here.

Purpose and Research Questions

The purpose of this study is to describe the contribution of HBCUs to bachelor's degree awards to Black students in selected STEM fields from 2014 to 2023. The analysis addresses three questions: How did annual degree awards change across eligible institutions and HBCUs? How did HBCUs' share of those awards change? How did cumulative awards and trends differ across the

selected fields? The contribution is a field-specific description of degree production, rather than an estimate of the causal effect of attending an HBCU.

Method

Design and Data Source

The study uses a descriptive, repeated cross-sectional design based on annual institutional completion counts attributed to the Integrated Postsecondary Education Data System (IPEDS). IPEDS distinguishes awards conferred from the number of people completing programs and collects completion information by field, award level, race and ethnicity, and sex (National Center for Education Statistics [NCES], n.d.). Accordingly, the outcome in this manuscript is degree awards, not a deduplicated count of individuals. Annual counts do not follow a cohort of students through college.

The observation years are labeled 2014 through 2023 in the supplied tabulations. IPEDS Completions reporting covers the 12-month period ending June 30 of the collection year; for example, the 2023 collection covers July 1, 2022, through June 30, 2023 (NCES, 2023). The original extraction documentation is needed to confirm that the manuscript's year labels follow that convention. The tabulations alone do not document file versions, the download date, or the treatment of first and second majors.

Institutional Coverage and Population

The reported institutional universe comprises 2,726 four-year degree-granting institutions: 733 public, 1,536 private nonprofit, and 457 private for-profit institutions. Of these, 90 were identified as HBCUs. Institutions classified as two-year or less-than-two-year were excluded. These counts are retained from the original manuscript; their reference year and whether they represent a fixed panel or the union of institutions observed across years require confirmation.

The target population is bachelor's degree awards reported for the IPEDS Black or African American category. This category should be interpreted according to the survey's reporting rules rather than as a count of all people who may identify as Black. The final analytic documentation must specify the race and ethnicity variables, aggregation across sex, bachelor's award-level filter, and treatment of missing or imputed values.

Definition of Selected STEM Fields

Six two-digit Classification of Instructional Programs (CIP) families define the study's scope: computer and information sciences and support services (11); engineering (14); engineering technologies and engineering-related fields (15); biological and biomedical sciences (26); mathematics and statistics (27); and physical sciences (40). These labels follow NCES (2020). The scope is a selected set of STEM fields and should not be interpreted as an exhaustive federal STEM definition. Science technologies (41) and all other CIP families fall outside this operational definition.

The selected fields include mathematics and statistics (CIP 27). The operational definition is held constant at the two-digit family level; comparability across the 2010 and 2020 CIP classifications remains subject to confirmation from the extraction documentation.

Analytic Strategy

Annual counts are summarized for all eligible institutions and for the HBCU subset. The annual HBCU share equals HBCU awards divided by awards at all eligible institutions, multiplied by 100. Non-HBCU counts are obtained by subtracting HBCU awards from the corresponding all-institution totals. HBCUs are therefore included in the all-institution denominator; the two series are not independent comparison groups.

Cumulative shares use the sum of HBCU awards divided by the sum of all-institution awards across the ten years. They are not averages of rounded annual percentages. Percentage change is calculated as the difference between 2023 and 2014 counts divided by the 2014 count, multiplied by 100. Changes in shares are reported in percentage points. Results are descriptive; no statistical significance tests or causal models were applied.

Annual entries were checked against reported subtotals and percentages. Cumulative values were recalculated from the annual series. The all-institution mathematics series uses the field-specific count of 881 for 2023. HBCU mathematics counts and shares are withheld because conflicting entries could not be reconciled. These data-quality limitations are considered when interpreting the findings.

Results

Overall Degree Awards and HBCU Share

Across the supplied annual series, eligible institutions awarded 248,409 bachelor's degrees to Black students in the selected fields during 2014–2023, including 47,405 at HBCUs (19.1%; Table 1). All-institution annual awards increased from 19,193 in 2014 to 29,207 in 2023, a gain of 10,014 awards (52.2%). HBCU awards increased from 4,564 to 4,985, a gain of 421 awards (9.2%).

The HBCU share declined from 23.8% to 17.1%, or 6.7 percentage points. HBCU output ranged from 4,482 awards in 2016 to 5,239 in 2021 and declined during the final two years of the series. Thus, HBCU output grew over the full period but did not increase continuously. Non-HBCU awards rose from 14,629 to 24,222 (65.6%). This larger increase explains the falling HBCU share mathematically, without identifying the institutional or student-level processes responsible.

Table 1

Bachelor's degree awards to Black students in selected STEM fields by year and institution group

Year	All institutions	HBCUs	Non-HBCUs	HBCU share %
2014	19,193	4,564	14,629	23.8
2015	20,508	4,516	15,992	22.0
2016	21,686	4,482	17,204	20.7
2017	23,118	4,551	18,567	19.7
2018	24,211	4,557	19,654	18.8
2019	25,795	4,636	21,159	18.0
2020	26,873	4,799	22,074	17.9
2021	28,873	5,239	23,634	18.1
2022	28,945	5,076	23,869	17.5
2023	29,207	4,985	24,222	17.1
Total	248,409	47,405	201,004	19.1

Note. Source: IPEDS tabulations reported in the source manuscript (NCES, 2024). All institutions includes HBCUs; non-HBCU counts are the difference between the two series. HBCU share is the percentage of all-institution awards conferred by HBCUs. Selected CIP families are 11, 14, 15, 26, 27, and 40. Counts remain provisional pending source-data reconciliation.

Distribution Across Fields

Biological and biomedical sciences accounted for the largest number of awards: 93,671, or 37.7% of the selected-field total (Table 2). Computer and information sciences followed with 69,636 awards (28.0%), and engineering accounted for 46,053 (18.5%). Physical sciences contributed 14,822 awards (6.0%), engineering technologies 14,485 (5.8%), and mathematics and statistics 9,742 (3.9%). Percentages may not sum to 100 because of rounding.

Table 2

Cumulative bachelor's degree awards to Black students by selected field from 2014 to 2023

Field	All institutions	Share of selected fields %	HBCUs	HBCU share within field %
Computer and information sciences	69,636	28.0	8,005	11.5
Engineering	46,053	18.5	7,890	17.1
Engineering technologies	14,485	5.8	3,392	23.4
Biological and biomedical sciences	93,671	37.7	22,289	23.8
Mathematics and statistics	9,742	3.9	—	—
Physical sciences	14,822	6.0	3,539	23.9

Note. Cumulative counts and shares are calculated from annual entries. An em dash indicates an unresolved value, not zero. Engineering HBCU annual counts sum to 7,890 rather than the originally reported 7,905. The mathematics series uses 881 for 2023; source confirmation is required. HBCU mathematics counts and shares are withheld. Source: NCES (2024), as tabulated in the source manuscript.

The field trajectories differed substantially (Table 3). Computer and information sciences increased from 4,552 to 9,844 awards (116.3%), engineering from 3,499 to 5,112 (46.1%), and biological and biomedical sciences from 7,341 to 10,604 (44.4%). Engineering technologies changed little, decreasing from 1,394 to 1,388 (0.4%). Physical sciences declined from 1,449 to 1,378 (4.9%). Using the field-specific mathematics series, awards declined from 958 to 881 (8.0%). The increase in the combined total therefore should not be interpreted as growth in every field.

Table 3

Annual bachelor's degree awards to Black students at all eligible institutions by selected field

Year	CIS	ENG	ET	BIO	MATH	PS
2014	4,552	3,499	1,394	7,341	958	1,449
2015	5,010	3,792	1,366	7,957	963	1,420
2016	5,338	4,122	1,447	8,450	948	1,381
2017	5,793	4,353	1,456	9,016	974	1,526
2018	6,392	4,694	1,486	9,041	1,020	1,578
2019	7,276	4,884	1,540	9,564	982	1,549
2020	7,635	5,076	1,493	10,101	1,050	1,518
2021	8,643	5,179	1,495	10,936	1,050	1,570
2022	9,153	5,342	1,420	10,661	916	1,453
2023	9,844	5,112	1,388	10,604	881	1,378
Total	69,636	46,053	14,485	93,671	9,742	14,822

Note. CIS = computer and information sciences; ENG = engineering; ET = engineering technologies; BIO = biological and biomedical sciences; MATH = mathematics and statistics; PS = physical sciences. The 2023 mathematics count of 881 follows the field-specific series and requires source confirmation. Annual field sums equal Table 1 totals. Source: NCES (2024), as tabulated in the source manuscript.

HBCU Contributions Within Fields

Based on the annual field counts, HBCUs awarded 22,289 biological and biomedical sciences degrees, or 23.8% of awards in that field. They also conferred 3,539 physical sciences degrees (23.9%) and 3,392 engineering technologies degrees (23.4%). Computer and information sciences accounted for 8,005 HBCU awards (11.5% of the field total). Annual engineering entries sum to 7,890 HBCU awards (17.1%). The engineering subtotal remains subject to reconciliation with the source extract.

HBCU trends also varied by field (Table 4). Computer and information sciences awards increased from 702 to 957 (36.3%), biological and biomedical sciences from 2,035 to 2,367 (16.3%), and engineering from 691 to 869 (25.8%). Engineering technologies declined from 415 to 307 (26.0%), and physical sciences declined from 440 to 314 (28.6%). HBCU shares declined between the endpoints in each of these five fields. No HBCU mathematics trend is asserted because the conflicting counts cannot be resolved from the manuscript alone.

Table 4

Annual bachelor's degree awards to Black students at HBCUs by selected field

Year	CIS	ENG	ET	BIO	MATH	PS
2014	702	691	415	2,035	—	440
2015	726	750	378	1,991	—	390
2016	682	722	346	2,136	—	346
2017	674	722	352	2,199	—	323
2018	733	753	318	2,127	—	382
2019	802	738	360	2,206	—	335
2020	797	829	311	2,317	—	339
2021	964	895	311	2,505	—	354
2022	968	921	294	2,406	—	316
2023	957	869	307	2,367	—	314
Total	8,005	7,890	3,392	22,289	—	3,539

Note. Abbreviations follow Table 3. An em dash indicates withheld data. The HBCU mathematics series could not be reconciled. The five displayed fields sum to 45,115 awards; the residual of 2,290 relative to Table 1 is not treated as a verified mathematics count. Source: NCES (2024), as tabulated in the source manuscript.

Institutional Award Counts

The institutional tabulations identify programs with substantial reported award counts (Table 5). North Carolina A&T State University has the largest listed counts in computer and information sciences, engineering, and engineering technologies. Howard University leads the listed biological and biomedical sciences counts, Spelman College the mathematics and statistics counts, and Xavier University of Louisiana the physical sciences counts. Because the observation period and ranking universe are not documented, these entries are presented as provisional institutional counts and are not interpreted as verified national rankings for 2014–2023.

Table 5

Reported institutional award counts by selected STEM field

Field	Institution	Reported count
Computer and information sciences	North Carolina A&T State University	605
Computer and information sciences	Bowie State University	475
Computer and information sciences	Morgan State University	414
Computer and information sciences	Florida A&M University	390
Computer and information sciences	Alabama State University	301
Engineering	North Carolina A&T State University	1,644
Engineering	Prairie View A&M University	1,072
Engineering	Morgan State University	796
Engineering	Tuskegee University	684
Engineering	Alabama A&M University	521
Engineering technologies	North Carolina A&T State University	533
Engineering technologies	Savannah State University	303
Engineering technologies	Virginia State University	283
Engineering technologies	University of Arkansas at Pine Bluff	249
Engineering technologies	Jackson State University	221
Biological and biomedical sciences	Howard University	1,097
Biological and biomedical sciences	Xavier University of Louisiana	1,057
Biological and biomedical sciences	Jackson State University	1,018
Biological and biomedical sciences	Alcorn State University	855

Field	Institution	Reported count
Biological and biomedical sciences	Florida A&M University	728
Mathematics and statistics	Spelman College	150
Mathematics and statistics	North Carolina A&T State University	98
Mathematics and statistics	Virginia State University	89
Mathematics and statistics	Morehouse College	84
Mathematics and statistics	Alabama State University	79
Physical sciences	Xavier University of Louisiana	362
Physical sciences	Jackson State University	218
Physical sciences	Howard University	183
Physical sciences	Morehouse College	143
Physical sciences	North Carolina A&T State University	132

Note. These are unverified counts transcribed from original Table IV. They must not be described as 2014–2023 totals or national rankings until their provenance is confirmed.

Discussion

The supplied data indicate that HBCUs remained substantial contributors to Black bachelor's degree awards in the selected STEM fields while the distribution of awards across institution types changed. The coexistence of rising HBCU output and a declining HBCU share is the central descriptive finding. Interpreting the share alone would obscure the additional 421 awards conferred annually at HBCUs by the end of the period. Interpreting only the endpoint increase would overlook the decline after the 2021 peak.

Field composition matters to this interpretation. The fastest-growing field, computer and information sciences, had a smaller cumulative HBCU share than biological and biomedical sciences, engineering technologies, and physical sciences. Expansion in fields with lower HBCU representation can influence the combined share. However, the analysis does not decompose the relative contributions of changing field composition and within-field changes, so their separate effects cannot be quantified from these summaries.

The results describe where degrees were awarded, not why students completed them. Earlier research provides plausible questions about institutional support, including the role of policies and educational practices at Spelman College (Perna et al., 2009) and differences in faculty interaction across institutional contexts (Hurtado et al., 2011). The present tables contain no direct measures of

mentoring, financial support, instructional quality, or research participation. Those mechanisms require additional data and should not be presented as explanations established by this study.

Likewise, comparing HBCUs' share of degrees with their share of institutions does not measure productivity or effectiveness. Institutions differ in enrollment, program offerings, size, resources, and student composition. Enrollment-based denominators and student-level progression data would be needed to investigate differences in completion probabilities or the contribution of specific institutional practices. The non-HBCU category also contains diverse institutions and should not be equated with predominantly White institutions.

Implications for Policy and Practice

Institutions and policymakers should monitor counts and shares together when assessing changes in Black STEM degree production. Field-specific reporting is especially useful because the combined increase masks declines in some areas. For HBCU leaders, these descriptive patterns can help identify programs for closer review using admissions, enrollment, persistence, staffing, and resource data. The counts do not determine which intervention is appropriate or how much funding an institution requires.

Partnerships and investments should be designed around documented local needs. The HBCU Undergraduate Program offers one established context for strengthening STEM education and research (National Science Foundation, 2023). Evaluations of such efforts should link resources and implementation to student outcomes and examine variation across programs. Institutions with large award counts may be useful sites for further study, but a volume ranking alone does not establish a transferable model of effectiveness.

Limitations and Future Research

Source-data inconsistencies limit the interpretation of the findings. The HBCU mathematics series could not be reconciled, and the engineering subtotal calculated from annual entries differed from the reported subtotal. The 2023 all-institution mathematics count also differed across source tables. The institutional counts in Table 5 lack a confirmed observation period. Consequently, the reported counts remain provisional until the underlying IPEDS extract is reproduced. No HBCU mathematics trend or verified institutional ranking is inferred.

The descriptive design imposes additional limits. Degree counts cannot establish graduation rates, persistence, learning, or institutional effects. They may include multiple awards to the same person and can be affected by major-counting rules. The selected CIP families omit fields included in other definitions of STEM, limiting comparisons with broader national statistics. Institutional reclassification, changes in reporting, and the CIP revision may also affect comparability over time.

The period ends in 2023 and does not describe subsequent changes. The analysis aggregates across sex, institution control, region, and program characteristics and does not measure graduate education or employment. Future work could disaggregate these dimensions, connect degree counts to enrollment and progression measures, and examine how changes in program availability and institutional resources correspond to award trends. A formal decomposition could separate field-composition changes from changes in HBCU shares within fields.

Conclusion

The provisional annual series attributes 19.1% of Black bachelor's degree awards in six selected STEM fields during 2014–2023 to HBCUs. Their annual output increased over the period while their share declined, reflecting more rapid growth at other institutions. Contributions and trajectories varied across fields, making discipline-specific analysis essential. After reconciliation with the original IPEDS extract, these findings can provide a descriptive basis for investigating how institutions sustain and expand Black participation in STEM degree attainment.

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