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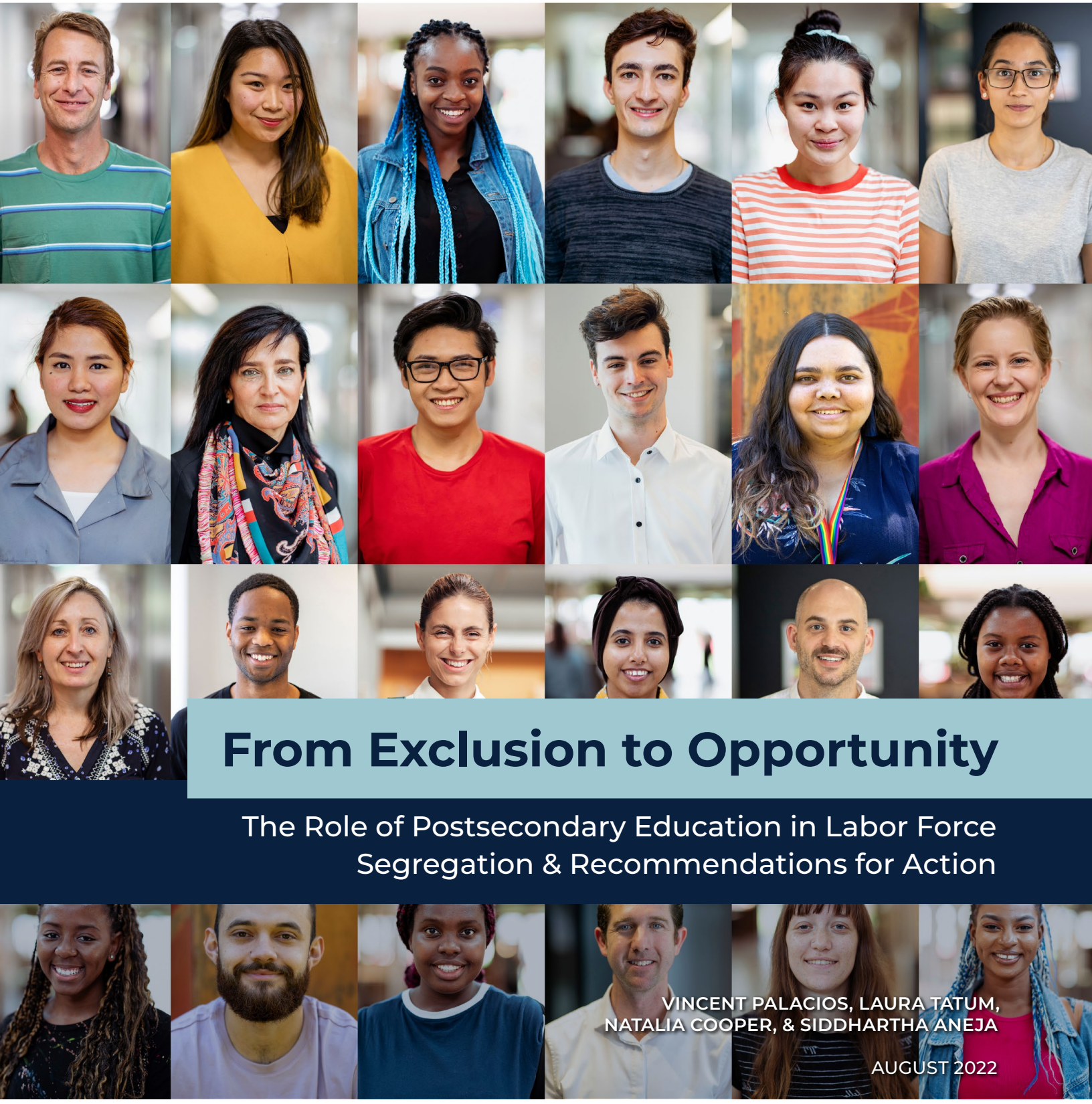

From Exclusion to Opportunity

The Role of Postsecondary Education in Labor Force Segregation & Recommendations for Action

VINCENT PALACIOS, LAURA TATUM,
NATALIA COOPER, & SIDDHARTHA ANEJA

AUGUST 2022

Georgetown Center on Poverty and Inequality

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Contents

Abbreviations, Acronyms, & Initializations

ACS American Community Survey

AIAN American Indian and Alaska Native

BPS Beginning Postsecondary Students Longitudinal Study

CIP Classification of Instructional Programs

CPI-U Consumer Price Index for All Urban Consumers

DSI Duncan Segregation Index

ESOI Economic Security and Opportunity Initiative

FLSA Fair Labor Standards Act

GCPI Georgetown Center on Poverty and Inequality

HBCU Historically Black Colleges and Universities

HEGIS Higher Education General Information Survey

HSI Hispanic-Serving Institution

IPEDS Integrated Postsecondary Education Data System

MSI Minority-Serving Institution

NCES National Center for Education Statistics

NCSG National Survey of College Graduates

NHOPI Native Hawaiian and Other Pacific Islanders

NPSAS National Postsecondary Student Aid Study

PSE Postsecondary Education

PUMS Public Use Microdata Sample

PWI Predominantly White Institution

STEM Science, Technology, Engineering, and Mathematics

UMBC University of Maryland, Baltimore County

I. Introduction & Summary

In 1840, Catherine Brewer Benson was the first woman in the U.S. to obtain a bachelor's degree,[1] nearly two hundred years after Harvard College conferred the first degrees in the U.S. in 1642.[2] It would be more than a century before all higher education institutions began to fully desegregate and admit Black and Brown students.[3] By the early 1980s, women reached parity with men in the number of bachelor's degrees earned and, in 1982, surpassed them.[4] Many students of color continue to face steep barriers to accessing, navigating, and achieving equitable representation in postsecondary education enrollment[5, 6] and degree attainment.[7] Today, postsecondary educational systems continue to amplify inequities in our society through segregation by race and gender within higher education—which contributes to segregation later in the workforce—harming individuals, communities, and our economy.

Obtaining a bachelor's degree can provide individuals the tools to achieve economic security, the freedom to fulfill their full potential, and opportunities to become upwardly mobile. Just as it plays a key role in facilitating workers' economic security and opportunity, higher education—historically inaccessible to people of color and women—also plays a key role in occupational segregation by race and gender. Occupational segregation deepens income,[8] wealth,[9] and labor market inequities;[10] corrodes our nation's potential for innovation[11] and leadership; and reinforces pipeline-level barriers such as racism and sexism in postsecondary institutions.[12, 13] Given that labor market demand for workers with at least a postsecondary credential is expected to grow faster than demand for workers with less education,[14] ensuring that postsecondary education works to reduce rather than reinforce occupational segregation becomes all the more imperative.

Occupational Segregation Is Closely Tied to Postsecondary Education

To achieve a society that values people's labor equitably and provides opportunity inclusively, it is vital to interrupt the role postsecondary education plays in perpetuating occupational segregation. This report focuses on understanding the link between postsecondary field of study and segregation in the labor market. This report begins by sharing a framework for this complex topic which has guided both our data and policy analysis. Our original quantitative analysis of Integrated Postsecondary Education Data System (IPEDS) and Beginning Postsecondary Students (BPS) Longitudinal Study data, as well as data from other sources, finds field of study segregation in degree-seeking undergraduate students by gender and race. Using our findings, the report then presents four principles for ameliorating field of study segregation and increasing degree attainment to improve labor market outcomes and decrease occupational segregation. The report offers recommendations for both postsecondary institutions and federal and state policymakers that would reduce occupational segregation and improve equitable economic outcomes.

Field of Study Segregation Significantly Contributes to Occupational Segregation

A four-year postsecondary degree offers opportunities for a higher income and upward economic mobility, as compared to a high school diploma or an associate degree. However, the sorting of students into specialized fields of study at postsecondary institutions eventually contributes to segregated occupations.[15, 16] This report expands upon this link between higher education institutions and occupational segregation in its framework section (see Section II, "A Framework for Understanding & Disrupting Field of Study Segregation—a Key Link Between Postsecondary Education & Occupational Segregation").

Structurally excluded students[i]—a term defined for this report to include women and students of color—experience barriers to access and success, including discrimination, in the most lucrative fields of study.[17, 18, 19] This report defines structurally excluded students accordingly because research has demonstrated that students of particular races and genders—namely Black and Brown students and women—typically fare worse in various ways when pursuing a four-year degree than students who are white or men. Racism, sexism, discrimination, and unaffordability have posed barriers to their inclusion and achievement at postsecondary education institutions.

i There are additional groups of students who are structurally excluded from postsecondary education, such as those who face barriers due to their income background or first-generation student, sexual orientation, immigration, and/or disability status, whom we do not include in this term as used in this report to contain its scope. Further research is needed analyzing the segregation and exclusion that these groups of students experience in postsecondary education.

Quantitative Analysis Reveals Field of Study Segregation Is Substantial, Particularly by Gender & Race Together

From enrollment through graduation, students sort into different fields of studies by gender,[ii] race and ethnicity,[iii] and other characteristics. The magnitude of this segregation is particularly stark when race and gender are analyzed together. This report's analysis shows how Black and Brown women are especially segregated by field of study, likely due to intersecting and compounding barriers such as racial and gendered bias and discrimination, systemic racism, health, and economic disparities, which research shows as being contributors to occupational segregation.[20, 21] This report uses the best available data—including an administrative dataset that accounts for all bachelor's degrees conferred by year in the U.S.—to assess patterns in field of study segregation. The report analyzes longitudinal data to examine students' first field of study, their resulting rate of attainment, and their final field of study.

Key findings from this quantitative analysis include:

- Students enter postsecondary institutions already segregated across fields of study by gender and race.
- Our postsecondary system does little to interrupt this initial segregation, and graduates remain segregated across fields of study by gender and race, including at public universities.
- Students leaving their first-intended field of study or exiting postsecondary education altogether exacerbates field of study segregation.
- Field of study segregation between women of color and white men has increased over the past three decades.

ii Gender is not binary and is not synonymous with sex assigned at birth. Binary gender categories do not reflect the diversity of students' gender identities and students can self-identify with gender identities that are different from their sex assigned at birth. This report identifies field of study segregation between men (used interchangeably with "male") and women (used interchangeably with "female") because of data availability in IPEDS, NPSAS, and BPS. Additional data and analysis are required to identify field of study segregation for non-binary students and students of other gender identities.

iii Due to how the data are reported, this report treats both race and ethnicity as a single concept and refers to them together as race. That is, people who identify as Latinx or Hispanic in the data sources are included as a separate race category.

Four Principles to Decrease the Field of Study Segregation Experienced by Structurally Excluded Students

Structurally excluded students are sorted into certain fields of study—and ultimately occupations—and away from others. In general, postsecondary institutions fail to seize opportunities to interrupt this segregation in the student body, and sometimes actively facilitate it. However, promising initiatives being implemented in particular institutions featured in this report are increasing racial and gender equity across fields of study.

This report's recommendations are guided and organized by four overarching principles based on unique data analysis and sociological, psychological, and economic research.[iv] These principles can guide policymakers and institutions in their effort to evaluate and address the role of postsecondary education in perpetuating occupational segregation:

1. Affordability for Every Field of Study
2. Inclusive and Supportive Academics in Every Field of Study
3. Career-Connected Learning and Experience in Every Field of Study
4. Data Use and Improvements to Better Understand and Pursue Equitable Outcomes for Students

Each of these principles is tied to key points in students' journeys in their fields of study.[v] The first three principles cover the timeline of a student's journey from postsecondary education enrollment through graduation and employment. The fourth principle—focused on inadequate data and attention to equity in student major and career outcomes—describes the need for postsecondary institutions and policymakers to use data to understand students' journey to completion and early career.

iv These principles are also supported by extensive engagement with academics, workplace leaders, college students, and other stakeholders.

v Many phenomena influencing students' postsecondary experiences and fields of study begin much earlier in students' lives; however, they are outside the scope of this report.

II. A Framework for Understanding & Disrupting Field of Study Segregation — a Key Link Between Postsecondary Education & Occupational Segregation

Postsecondary education should expand opportunities to access pathways for upward economic mobility, secure a well-paying job, and achieve one's full potential, especially for students experiencing significant, structural barriers to economic security and mobility.[22] Yet, in practice, postsecondary education tends to facilitate rather than disrupt occupational segregation in a variety of ways.

Occupational segregation harms workers and the economy. While this report focuses on its links to postsecondary education, occupational segregation is caused and exacerbated by many factors, including: the history and legacy of legal racial- and gender-based exclusion, employers' discriminatory practices, employers' racial and gender biases based on stereotypes tied to occupational "fit," differential exposure to career paths, unequal access to professional networks and career pathways, and inequitable access to quality education and educational attainment[23] across one's lifespan.

This section first outlines the harms of occupational segregation. It then discusses some of the structural factors contributing to postsecondary education's role in occupational segregation and introduces field of study as a way to further examine this intersection.

Occupational Segregation Harms Workers & the Economy

Occupational segregation—the inequitable division of workers across occupations by demographic characteristics such as race and gender—is deeply rooted in systems of racial and gender-based oppression.[24, 25] The history of occupational segregation in the U.S. intertwines both the outright exclusion from many occupations, including those that required advanced education, and the devaluation of work performed by people of color—especially Black people—and women.[26] Exclusion and devaluing have resulted in structural wage and benefit disparities that affect workers to this day.[27, 28] Occupations that employ larger concentrations of people of color—historically and today—typically have lower pay and fewer benefits,[29] less managerial authority,[30] more dangerous working conditions,[31] and fewer opportunities for economic mobility[32] than occupations with higher concentrations of white workers. Many of these societally-devalued yet crucial occupations, including domestic and agricultural work, are vestiges of roles Black people were forced into while enslaved, which were also the most commonly available roles to newly-freed Black people during Reconstruction and through the Jim Crow era.[33] Women of color, particularly Black women, have long engaged in paid employment due to economic necessity and were relegated to a small number of low-paid occupations excluded from federal worker protections, such as domestic service and agricultural work.[34, 35] Despite labor protections gained from unionizing and federal regulation, workers of color are still more likely than white workers to work in an occupation with increased safety risks.[36, 37]

Occupational segregation is an obstacle to racial and gender justice that limits access to resources for structurally excluded workers. Research shows that average wages across an occupation are associated with the share of workers who are white[38] or male.[39] For example, female-dominated professions, such as teaching children or nursing, tend to have lower wages and poorer work conditions, harming all workers in these jobs, regardless of gender.[40] Further, the quality of employer-based benefits also varies by occupation, and workers whose occupational choices are constrained due to segregation miss out on access to better benefits such as subsidized health care, retirement plans, and educational benefits.[41, 42]

Occupational segregation harms everyone, not only workers funneled into low-paid, precarious positions.[43, 44] It harms financial stability and economic opportunities for individuals, economic security for families, and the adaptability of the broader labor force.[45] It lowers productivity and contributes to social and economic inequality,[46] both of which harm the overall economy.[47] For example, men in occupations with higher shares of female workers experience depressed wages.[48] Additionally, the average annual wage of an occupation with a higher share of Black men is lower than the average annual wage of an occupation with a lower share of Black men.[49]

Postsecondary Education Has a Role in Occupational Segregation

Postsecondary education institutions shape the future demographics of the workforce through their recruitment, admissions, enrollment, and financial aid processes, as well as through the academic programs, environment, and supports they offer. Postsecondary institutions and higher education policymakers' decisions influence the composition of the labor force via access, representation, and degree completion. That is, the higher education system impacts occupational segregation in the labor market by influencing which groups of students are admitted, their fields of study, their continuation in that field, and timely degree attainment. Students' pathways and success are affected by the financial support available to them,[50] by structural racism[51] and sexism in postsecondary education, and by the extent to which they gain relevant experience and make essential career connections during college.[52] These elements are all shaped by the history of exclusion in postsecondary education.

POSTSECONDARY EDUCATION'S HISTORY OF EXCLUSION HAS RESULTED IN ONGOING INEQUITIES & CONTRIBUTED TO OCCUPATIONAL SEGREGATION

... the **HIGHER EDUCATION SYSTEM** impacts **OCCUPATIONAL SEGREGATION** in the labor market by influencing which groups of students are **ADMITTED**, their **FIELDS OF STUDY**, their **CONTINUATION** in that field, & timely **DEGREE ATTAINMENT**.

The history of postsecondary education has shaped the race and gender dynamics of the workforce for centuries, with effects that persist today. The higher education system in the US was created as an exclusive space to train the next generation of white men for leadership positions in society; it has slowly expanded access to other groups over the centuries. When the first colleges were founded in colonial North America through the Civil War, access was reserved primarily for white men from upper-income households to study theology, law, medicine, or letters.[53, 54] During the 19th and 20th centuries, access to postsecondary education expanded to include women and students of color, but these groups have faced barriers to equity and inclusion on campus and across fields of study based in part on debunked theories of scientific racism and sexism that are still used to explain who is capable of higher learning.[55] These students, who this report defines as structurally excluded students, often gained access to higher education through the creation of new institutions—such as women's colleges and Historically Black Colleges and Universities (HBCUs)—that separated these students and white, upper-class men. Only in the past several decades has representation of women and students of color increased at predominantly white and more selective public and private colleges and universities.[56]

This history of changing access to higher education shaped career possibilities for women and people of color and contributed to occupational segregation over the years. For example, in 1900, when only 1 percent of people went to college, as many as half of all women in higher education were studying in "normal" schools, institutions that existed primarily to train women as teachers.[57] By 1920, even though women made up more than 45 percent of undergraduate students,[58] due to prevailing sexist attitudes, women were consistently encouraged—and in many cases required[59]—to pursue a very limited set of occupations and therefore study a

different curriculum than men.[60] It would not be until the late 1960s that the most elite private universities on the east coast began admitting women.[61] Students of color have also been historically excluded from predominantly white postsecondary institutions and marginalized in postsecondary education through racism in admissions practices,[62] hostile climates,[63, 64] and discriminatory laws and policies,[65] such as the underfunding of separate, minority-serving institutions (MSIs).[66] Segregation in classrooms, curriculum, and training had lasting consequences for occupational segregation.[67]

Today, higher education is substantially more diverse with respect to gender and race.[68, 69] Still, higher education access and outcomes continue to be inequitable for students seeking a bachelor's degree due to unequal access to resources[70] and racial and gender bias and discrimination,[71] among other reasons. For example, women and students of color still experience the following inequities in higher education:

- Students of color experience lower enrollment rates and lower degree attainment rates than their white counterparts.[72]
- Examining enrollment and degree attainment rates by gender shows greater disparities for women of color.[73, 74]
- Single mothers experience some of the highest barriers to completion among all students.[75]
- Women face barriers in pursuing science, technology, engineering, and mathematics (STEM) bachelor's degrees[76] and are still much less likely to pursue STEM degrees than men.[77]
- Black and Brown students disproportionately attend community colleges, which typically receive the lowest per student funding among postsecondary institutions.[78]
- Costs beyond tuition can intersect with existing financial challenges that create particular barriers for women of color as they borrow for a degree they may never be able to complete.[79]

As discussed in the report recommendations, increasing structurally excluded students' postsecondary degree attainment so that they have the same success as their white and/or male counterparts—both overall and across fields of study—would help mitigate occupational segregation.

COMPLETING A BACHELOR'S DEGREE TYPICALLY LEADS TO GREATER ECONOMIC SECURITY, BUT OCCUPATIONAL SEGREGATION REMAINS HIGH

Earning a bachelor's degree provides important benefits in today's economy. Compared to workers with lower levels of educational attainment, workers with a bachelor's degree are more likely to have increased job stability,[80] health and retirement benefits, and much lower rates of unemployment. A bachelor's degree also functions as a stepping stone for professions that require graduate education.[81]

Indeed, jobs in today's labor force increasingly require a bachelor's degree. From 2007 to 2016, two-thirds of the six million new jobs created were in occupations typically requiring at least a four-year degree, more than twice as many as the next largest category of jobs (no formal educational credential required).[82] In contrast, over the same period, occupations typically requiring a high school diploma lost 1.3 million jobs.[83] Associate degrees and nondegree certificates also increase economic and workforce opportunities for workers, particularly compared to a high school diploma, but to a more limited extent than a bachelor's degree.[84]

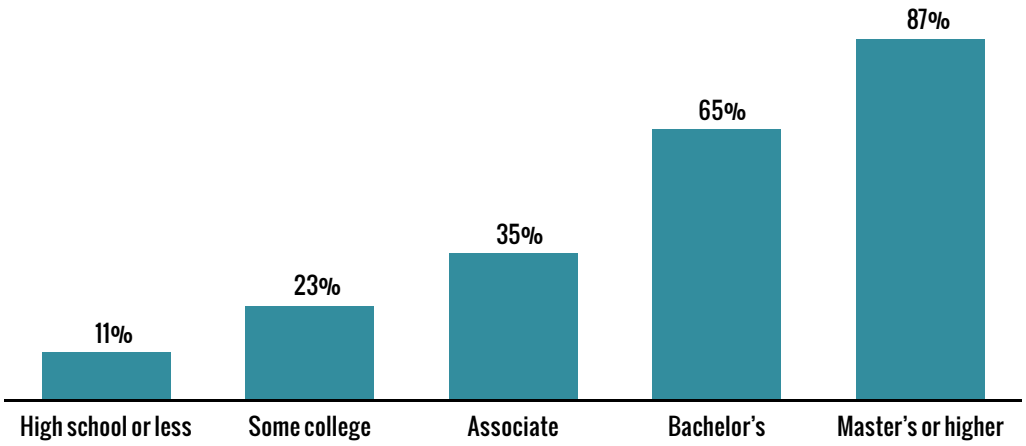
Individuals who hold a bachelor's degree benefit from a significant wage premium.[85] Between 2013 and 2017, the national median earnings for individuals holding a bachelor's degree were significantly higher (about 85 percent for 45- to 49-year-olds) than the national mean earnings for individuals with only a high school diploma.[86] Although attaining a bachelor's degree can lead to much higher compensation, there are still marked disparities in average earnings for graduates by race and gender.[87, 88, 89, 90] While these students benefit from postsecondary education, women who hold bachelor's degrees and bachelor's degree holders of color still suffer a wage penalty, lowering their return on investment for higher education.[91, 92]

Further, the economic returns of formal education vary by each type of degree and by the field of study.[93] Structurally excluded students are often excluded from various fields of study that lead to higher-paying occupations.[94, 95, 96] For example, Black women are structurally excluded from fields of study like business, engineering, and computer sciences.[97] Research demonstrates that students' future labor market outcomes are affected by field of study segregation. A student's future pay is higher if their field of study is dominated by men, and lower if their field of study is dominated by women.[98] Research also indicates that Black students graduate in lower shares from high-paying fields of study at postsecondary institutions where Black students experience the most segregation across majors.[99]

Increased educational attainment reduces occupational segregation—but occupational segregation remains high among workers with postsecondary credentials.[100, 101] Workers with at least a bachelor's degree are much more likely to have management or professional jobs compared to workers with lower levels of educational attainment (see Figure 1), but these groups consist of a wide range of occupations, and substantial occupational segregation remains. In general, research has shown that as educational attainment increases, gender- and race-based occupational segregation declines between workers with the same educational attainment, though overall occupational segregation still remains quite high for even highly educated workers.[102] For example, Black women with a college degree are relatively less segregated from white men with a college degree than Black women without a high school diploma are from white men without a high school diploma.[103] Yet, even accounting for those who have completed a bachelor's degree, nearly half of all Black women would still need to change their specific occupations to diffuse their labor market segregation and match white men's distribution across occupations.[104]

FIGURE 1. Most workers with at least a bachelor's degree are in management & professional occupational groups

Percent of workers ages 25–34 in management & professional occupational groups by educational attainment, 2019



Note: Estimates are for persons ages 25-34 in the civilian labor force to reflect the experiences of early career outcomes more closely for recent college graduates. Management and professional occupations include the major occupation groups from "11-0000" to "27-0000" as categorized by the Bureau of Labor Statistics.

Source: Georgetown Center on Poverty and Inequality analysis of 2019 American Community Survey Public Use Microdata Sample data, 2022. Available at https://www.census.gov/programs-surveys/acs/microdata.html.

Field of Study Segregation Links Postsecondary Education & Occupational Segregation

The links between postsecondary education and occupational segregation can be seen in the role of specialization in fields of study, into which students sort themselves and are sorted by social and institutional factors. Similarities in the patterns of field of study segregation and occupational segregation indicate a relationship between the two—and suggest that postsecondary institutions have an important role to play in the integration of the workforce. Field of study segregation and occupational segregation can fuel each other. This report builds understanding of how field of study segregation bolsters occupational segregation because most students go from college to career rather than going from career to college. This report focuses on factors of postsecondary education that affect students' choice of field of study and their completion of that field of study—all of which significantly impact their employment and earnings—and the ways in which postsecondary policies and institutions can change those factors to interrupt occupational segregation.[105, 106, 107]

WIDENING THE LENS FOR EXAMINING HOW POSTSECONDARY EDUCATION SORTS STRUCTURALLY EXCLUDED STUDENTS INTO OCCUPATIONS

Decisions about majors or fields of study are not just individual decisions. Students' life experiences; social networks; K-12 education; postsecondary faculty, advisors, and systems; and wider societal factors—including sexism and racism—shape these decisions.[108] These decisions greatly impact field of study segregation by gender and race.[109, 110] (For additional discussion of postsecondary institutions' role in students' field of study choices, see Section IV, "Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study.")

Decisions about majors or **FIELDS OF STUDY** are **NOT** just **INDIVIDUAL DECISIONS**. Students' life **EXPERIENCES**; social **NETWORKS**; K–12 **EDUCATION;** postsecondary faculty, **ADVISORS**, & systems; & wider societal factors—including **SEXISM** & **RACISM—SHAPE THESE DECISIONS**

Existing research on postsecondary education and occupational segregation focuses most frequently on the role of gender in choosing a field of study, the connection between race and completion, and racial and gender segregation within STEM fields. Research on field of study segregation by gender[111] has typically investigated how postsecondary institutions help sort women into fields with lower earning potential and subsequently occupations with lower earning potential within their chosen field.[112, 113] Research on racial segregation in postsecondary education has more commonly addressed access to selective institutions[114] or degree completion[115, 116, 117] rather than field of study segregation by race.[118, 119] Existing research on field of study segregation also focuses extensively on segregation in STEM fields.[120, 121] This report builds upon the body of research examining field of study segregation across the complete range of fields,[122] providing an updated and deeper look into the ways in which colleges and universities contribute to the sorting of workers of different races and genders into occupations.

FIELD OF STUDY INFLUENCES STUDENTS' FIRST OCCUPATIONS AFTER COLLEGE

A student's field of study and their first occupation are practically and empirically connected. Many students choose a field of study based in part on their understanding of labor market demands for workers, among other factors.[123, 124] In job postings, employers that prefer or require a degree often search for candidates with degrees in specific majors or fields of study.[vi] In the engineering field, for example, employers of engineers tend to hire workers with particular bachelor's degrees: in 2019, 62 percent of people who worked as engineers had an engineering bachelor's degree.[125] Yet, while field of study correlates with a student's occupation after completing their degree, it does not determine their occupation[126, 127]—e.g., only about a quarter of engineering bachelor's degree holders work as engineers.[128] Other research finds that just over 27 percent of all bachelor's degree holders work in occupations related to their college *major*.[129] As there are many more college majors than fields of study, this estimate potentially represents a lower bound for the connection between fields of study and occupations.

The connections between field of study and occupations also have longer-term economic and employment ripple effects. The first jobs a student holds after graduating—and whether they match their degree level and field of study—impact their future career trajectory, including earnings.[130, 131] Bachelor's degree holders from different majors experience different rates of being

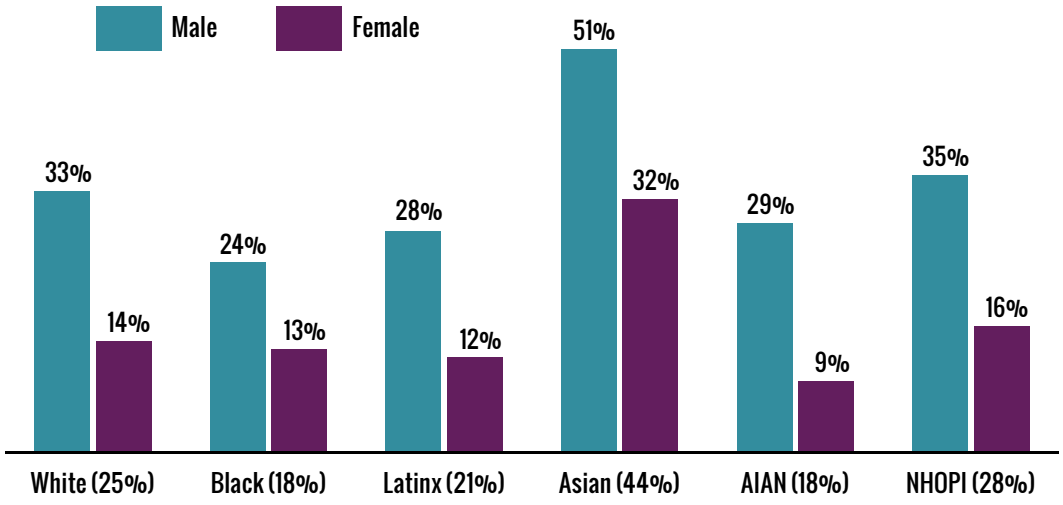
vi A field of study is a collection of related majors. See Appendix A for more information about how these concepts are measured.

employed in their chosen field after graduation.[132] Majors that emphasize technical knowledge (in fields such as engineering, math, and health) are associated with lower odds of unemployment and of working in a job that requires a degree.[133] Over time, however, people who major in fields with low occupational specificity have higher growth in occupational status as compared to those with high occupational specificity.[134]

Bias and discrimination on the basis of race and gender in the labor market interfere with women and workers of color being in well-matched occupations based on their chosen fields of study. For example, Black, Latinx, and Native American women with STEM degrees are much less likely to work in STEM occupations compared to men of various races with STEM degrees, particularly Asian men (see Figure 2).[135] In STEM fields of study, racial bias and discrimination by professors and students based on harmful stereotypes[136, 137] contribute to overrepresentation of Asian degree holders and underrepresentation of Black and Latinx degree holders. At least some part of this overrepresentation can be explained by the fact that Asian students[vii, 138] are more likely to come from households with higher-than-median household income[139] and higher parental education levels,[140] both of which are associated with college success in STEM fields.[141] Research finds, though, that Black men would be the most likely to graduate in physical STEM departments if they came from the socioeconomic background and academic preparation that Asian men have in aggregate.[142]

FIGURE 2. Women with STEM degrees are less likely to work in a STEM job compared to men, across races

Share of workers 25–64 with a STEM undergraduate degree in a STEM occupation, by race & sex, 2019



Note: Estimates are for persons ages 25-64 in the civilian labor force. STEM majors include those that are in the fields of Science, Technology, Engineering, or Mathematics. Occupations are classified as STEM using the classification 2018 STEM code list provided by the U.S. Census Bureau. Percentages in parentheses indicate the share with a STEM degree in a STEM occupation for each racial category. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. This figure omits individuals who selected "other" as their race.

Source: Georgetown Center on Poverty and Inequality analysis of 2019 American Community Survey Public Use Microdata Sample data, 2022. Available at https://www.census.gov/programs-surveys/acs/microdata.html.

vii The aggregation of different subgroups of Asian people masks significant differences. Aggregation frequently occurs to mitigate the data limitations of small sample sizes.

POSTSECONDARY INSTITUTIONS HAVE A ROLE IN INTERRUPTING OCCUPATIONAL SEGREGATION

Racial and gender inequity in both bachelor's degree attainment and representation across fields of study translates into racial and gender inequity in occupational opportunities and choices as students seek employment after graduation. Structurally excluded students face many systemic barriers to college preparedness,[143] college access,[144, 145] and bachelor's degree attainment.[146] Students with dependents (80 percent of whom are women) and students of color who have the same aspiration of completing a bachelor's degree as other students[147] are more likely to begin their postsecondary studies by pursuing an associate degree at a two-year institution[148]—which affects the fields of study students pursue[149] and substantially lowers the likelihood of completing a bachelor's degree within six years.[150] Even at four-year institutions, students of color and women are structurally excluded from various fields of study that lead to higher-paying jobs.[151, 152, 153]

Postsecondary institutions and associated public policies maintain and exacerbate patterns of occupational segregation in our society. Postsecondary institution leaders and personnel, and associated policymakers, must change policies and practices to interrupt these patterns—to remove barriers to bachelor's degree attainment and provide access and support for structurally excluded students across all fields of study. As Dr. Estela Mara Bensimon notes:

> *"Rather than thinking about inequities in graduation rates, in participation in STEM, as having to do with the characteristics of students, [postsecondary institutions should] start asking the question of, for instance, 'Why is it that our institution performs so much better for white students and what is it that we might be doing that is contributing to these racial inequities?'"*[154]

Sections III ("Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study") and IV ("Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study") of this report further discuss these patterns of segregation and related policy recommendations for higher education institutions and policymakers to address them.

III. Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study

Segregation is a persistent problem across the U.S. educational system,[155] including higher education.[156] This section presents original quantitative analysis focused on field of study segregation—the differences in racial and gender makeup by postsecondary field of study. (Section II, "A Framework for Understanding & Disrupting Field of Study Segregation—a Key Link Between Postsecondary Education & Occupational Segregation," discussed how those differences connect to occupational segregation in the labor market.) The results show that degree-seeking undergraduate students experience substantial segregation across fields of study. Female students[viii] and students of color show distinct patterns of specialization compared to male and white students, respectively. This segregation is particularly apparent when race and gender are analyzed together.

This section is organized into four parts that examine the relationship between field of study, gender, and race over the course of a student's enrollment. The first part examines gender and racial segregation across the original, first-declared field of study for degree-seeking students (who, at the time of enrollment, intend to complete a bachelor's degree). The second part analyzes these students' persistence—showing the share of students who go on to complete a bachelor's degree within six years and whether those who complete a degree do so in their original field of study or in a different field. The third part measures field of study segregation by gender and race at the completion of a bachelor's degree. The final part analyzes patterns in field of study segregation over several decades.

viii This report identifies field of study segregation between men and women because of data availability in IPEDS, NPSAS, and BPS—but this strict binary does not reflect the diversity of students' gender identities.

The Duncan Segregation Index (DSI) Provides a Measurement of Segregation Across Fields of Study

To date, relatively few studies exist that rigorously quantify the extent to which students of different racial and gender groups are sorted into different fields of study. This report attempts to fill that gap using the Duncan Segregation Index (DSI) to analyze field of study segregation between various groups of degree-seeking students. Quantifying field of study segregation in this way allows for comparison of the magnitude of field of study segregation across demographic groups over time.

THIS REPORT IS ONE OF FEW TO INCORPORATE BOTH GENDER & RACE TO MEASURE FIELD OF STUDY SEGREGATION USING DSI

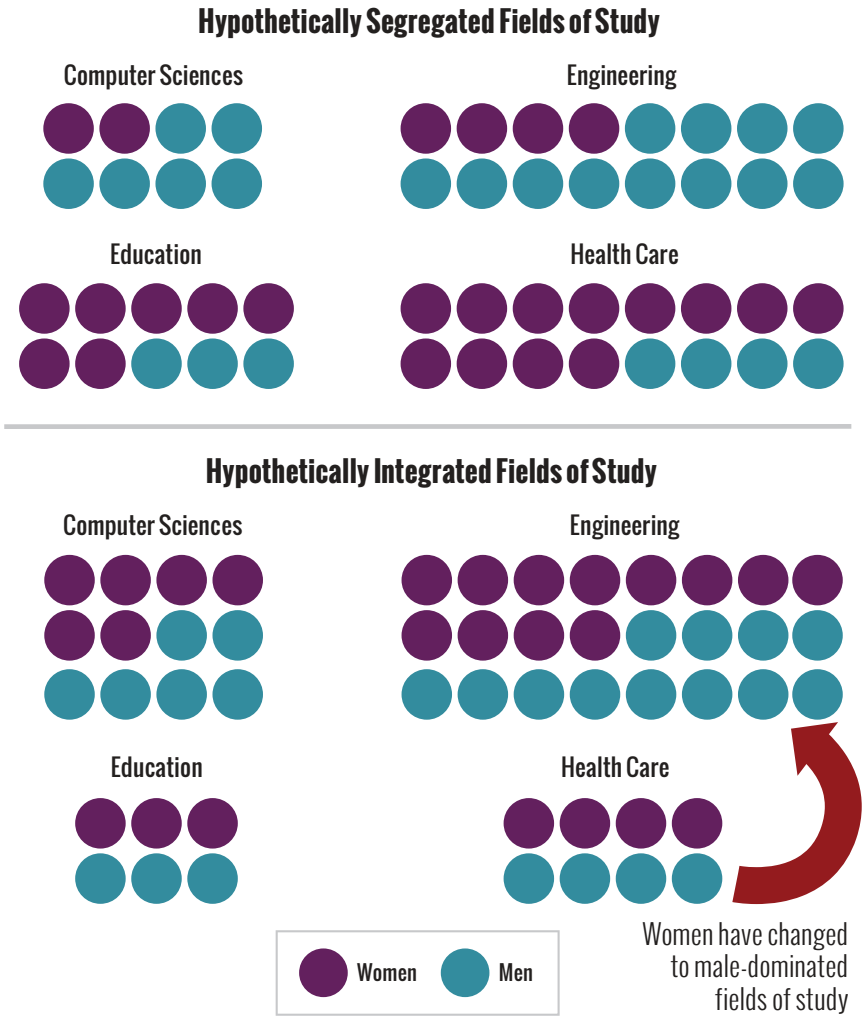
The DSI serves as a versatile measure to compare levels of segregation between any two mutually exclusive student populations at a moment in time. Specifically, DSI expresses the share of individuals in one population who would need to change their field of study to match the field of study distribution of the other population (for a hypothetical illustration of this measure, see Figure 3).

DSI values range from zero to one, and lower values reflect less segregation while higher values reflect more segregation. At one extreme, complete integration yields a DSI value of zero, meaning that students in each of the two population groups enroll in every field of study in the exact same pattern. At the other extreme, complete segregation yields a DSI value of one, meaning that no students in the two population groups share the same field of study. This report finds that DSI values identifying field of study segregation range from 0.07 to 0.33 based on the groups being compared in recent years.[ix]

ix As a measure, DSI is likely most prevalent in the literature about occupational segregation in the workforce. Existing research uses it to measure occupational segregation by gender and race and finds substantial occupational segregation, even when comparing workers with the same level of educational attainment. For example, the DSI value between white men and Black women for workers with a high school degree or less is 0.62, and the DSI value between white men and Black women for workers with an advanced degree is 0.43. DSI values measuring occupational segregation are not directly comparable to the field of study segregation measured in this report because many more categories of occupations (e.g., 529 occupations are measured in American Community Survey data) are typically analyzed. In contrast, this analysis measures field of study segregation across 12 categories, which lowers the amount of segregation that can be detected. For more information, see Matthews, Madison, and Valerie Wilson. "Separate Is Still Unequal: How Patterns of Occupational Segregation Impact Pay for Black Women." Economic Policy Institute, 6 August 2018. Available at https://www.epi.org/blog/separate-is-still-unequal-how-patterns-of-occupational-segregation-impact-pay-for-black-women/.

FIGURE 3. Segregated fields of study produce high DSI values

An illustrated distribution of male & female students across fields of study in segregated & perfectly integrated cases



Note: This figure uses hypothetical data to illustrate the relationship between high field of study segregation and a high a DSI value. Each dot represents one person. For simplicity, only four fields of study are included. The total number of female and male students is the same, but that need not be the case, such as when comparing groups from different racial categories. The distribution of students in the top portion of the figure produces a DSI value of 0.48, meaning 48 percent of women would need to change fields of study to match the male distribution or vice versa. Following this line of reasoning, the DSI value characterizing the bottom portion of the figure would be zero since men and women are similarly distributed across fields of study. In practice, movement between fields of study by gender can occur in both directions simultaneously. We identify field of study segregation between male and female students due to data availability in IPEDS and BPS—but this strict binary does not reflect the diversity of students' gender identities.

Source: Georgetown Center on Poverty and Inequality, 2022.

This report is one of the first analyses applying the DSI to field of study segregation that incorporates both gender and race, a critical intersection to understand to achieve greater equity and inclusion in postsecondary education. One example of earlier research used the DSI to measure field of study segregation by gender from 1948 to 1980. It found that field of study segregation between male bachelor's degree graduates and female bachelor's degree graduates increased from 1948 through 1960 to a high of 0.51 but steadily declined over the next two decades.[157] Although field of study segregation in 1980 was less than it had been at any point in time over the prior 32 years, gender segregation between men and women was still quite substantial—over 35 percent of women would have had to switch fields of study to equalize the distribution.[158]

THIS ANALYSIS USES SEVERAL DATASETS TO MEASURE FIELD OF STUDY SEGREGATION IN DIFFERENT WAYS

This report uses several publicly available datasets to assess segregation at various points in an undergraduate student's experience. As stated above, DSI is always measured between two groups. When analyzing field of study segregation by race using DSI in this report, the default comparison group is white students unless stated otherwise. In other words, the DSI values reported below are between Black and white students, between Latinx and white students, or between Asian and white students. (The analysis showed substantial segregation between Asian students and Black and Latinx students, respectively, but those comparisons are not examined in this report.)

First, this report presents analysis using data from the 2012-2017 Beginning Postsecondary Students Longitudinal Study (BPS) to measure field of study segregation for first-time undergraduates—in their first year of study—who intend to complete a bachelor's degree.[x] This analysis includes students enrolled in associate and bachelor's degree programs as structurally excluded students are more likely to begin their college experience pursuing an associate degree[159] while overwhelmingly expecting to complete a bachelor's degree.[160] Students' original fields of study are grouped into one of ten categories recommended by the National Center for Education Statistics (NCES) for use when analyzing bachelor's degree-seeking students. These same categories are used throughout this report, except that BPS data include "undecided" as an eleventh category for current students.[xi] BPS data are also used to examine six-year completion rates for degree-seeking undergraduates by their original field of study and how these rates vary by gender and race.

This report also uses IPEDS data on degree completion to examine field of study segregation by gender and race for students who completed a bachelor's degree. This analysis sheds light on the extent of field of study segregation as students prepare to enter the workforce. It also provides a useful comparison of the extent to which bachelor's degree holders experience occupational segregation in the labor market,[161] which is outside the scope of this report. Finally, bachelor's degree completers are analyzed intersectionally by gender and race from 1990 to 2020 to examine how field of study segregation has changed over time.[xii]

Data from the 2019 National Survey of College Graduates (NSCG) are used to briefly examine field of study by race for students who start their degrees at community colleges compared to students who begin at four-year institutions. Students with fewer resources typically start their studies at a local community college, and, as shown in this report, this affects which field of study they complete.

Using DSI to measure field of study segregation does have limitations. This report relies on multiple data sources to build a more complete picture of how students are segregated, and there are potential compositional differences between the universes of students. Additionally, DSI measures segregation in the aggregate. DSI values of equal magnitude could represent field of study segregation patterns that are quite different from each other—that is, whether one group

x Estimates from BPS and NSCG are based on survey data, tests for statistically significant differences were conducted when using these data. All comparisons are statistically significant unless otherwise noted. Margins of error are available in an accompanying workbook at: https://www.georgetownpoverty.org/issues/from-exclusion-to-opportunity/. IPEDS data are administrative and therefore do not have margins of error associated with their estimates. Unfortunately, due to sample size limitations in the BPS data, we are unable to examine how race and gender combine in an intersectional way when also examining outcomes over time by field of study.

xi When identifying the share of students in a particular field of study with BPS data, we include undecided students because students of color are more likely to originally declare as undecided and these students have substantially worse completion outcomes.

xii IPEDS completions data has included data on race only since 1990.

is concentrated into a single field of study or if there are small differences in composition across several fields of study. Finally, the DSI analysis in this report does not account for students who leave college before completing a degree. As a result, racialized differences in degree completion due to a variety of structural inequities and inadequate institutional and public support[162] are not apparent in these DSI results. (For further discussion of the methodology and its limitations, see Section VI, "Appendix Methodology.")

Fields of Study Are Segregated by Gender & Race on Day One

Field of study enrollment patterns for beginning undergraduate students vary by race and gender. Women and students of color begin college already concentrated in different fields of study compared to men and white students, respectively. Field of study segregation is most apparent by gender, but racialized differences are evident, nonetheless.

WOMEN ARE LESS LIKELY THAN MEN TO ENROLL IN COMPUTER SCIENCES & ENGINEERING & MORE LIKELY TO ENROLL IN HEALTH CARE & EDUCATION

Starting at enrollment, gender influences the chosen field of study of first-time degree-seeking students, as male and female students tend to declare different original fields of study (see Figure 4). In 2012, 2 percent of female students and 12 percent of male students originally decided to pursue a degree in engineering. Similarly, men are more than five times likelier than women to begin their studies in computer and information science. On the other hand, female students are significantly more likely to focus on health care fields of study than their male counterparts. Roughly 17 percent of beginning women undergraduates studied health care compared to about 6 percent of men.

Using DSI to measure the extent of these differences shows that male and female students are substantially segregated by field of study at the start of their postsecondary education. The DSI value between men and women who enroll in a two-year or four-year program was 0.22 in 2012. More than one in five beginning female students would need to change their field of study to match the fields male students are enrolled in.

FIGURE 4. Computer sciences, engineering, health care, & education fields are heavily segregated by gender as students begin their degrees

Percent of first-year students across original fields of study by gender, 2012

	Undecided	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
Male	19	6	12	10	6	6	6	6	14	3	13
Female	17	1	2	11	5	10	7	17	10	7	13

Note: Includes students originally pursuing a two-year or four-year degree beginning in 2012 who had expectations of completing a bachelor's degree or higher. Field of study categories are those recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality analysis for 2012/17 Beginning Postsecondary Study data and can be accessed using the following table name: "cmjgex." Available at https://nces.ed.gov/surveys/bps/.

UPON ENROLLMENT, STUDENTS OF COLOR ARE ALREADY SEGREGATED IN CERTAIN FIELDS

When students enter postsecondary education, they are already segregated across fields of study by race. Black students, who make up approximately 14 percent of beginning college students,[163] are particularly segregated by field of study when they enter. For example, Black students are underrepresented in STEM fields of study and overrepresented in health care (see Figure 5). Segregation across fields of study is also apparent when making comparisons across students of other races.

In the first year of study, the DSI value between Black and white students is 0.16 and between Latinx and white students is 0.10. Additional DSI values for beginning students by race are shown in Figure 15 in "Appendix III. DSI Values Showing Field of Study Segregation by Race for Beginning and Graduating Students."

FIGURE 5. Racial segregation by field of study is substantial when students begin college

Percent of first-year students across original fields of study by race, 2012

	Undecided	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
White	16	3	6	10	5	8	8	12	12	6	13
Black	24	3	3	6	5	6	4	16	11	4	16
Latinx	21	2	6	7	6	9	7	14	10	4	14
Asian	11	7	11	21	5	8	4	11	11	2	10
AIAN	29	6	8	12	6	3	1	10	12	3	12
NHOPI	12	2	10	-	10	5	6	19	21	5	10

Note: Includes students originally pursuing a two-year or four-year degree beginning in 2012 who had expectations of completing a bachelor's degree or higher. Field of study categories are those recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Estimates by field of study for foreign students and students of more than one race were omitted from this figure. "-" indicates data did not meet NCES reporting standards. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality analysis for 2012/17 Beginning Postsecondary Study data and can be accessed using the following table name: "yfhqpr." Available at https://nces.ed.gov/surveys/bps/.

Field of Study Exit Patterns Exacerbate Racial Segregation & Do Little to Counteract Initial Gender Segregation

This section highlights the variations in bachelor's degree attainment by race and gender across fields of study—trends that are rooted in U.S. educational history.[164, 165, 166, 167] In female-dominated fields of study like health care, women are more likely to graduate in their original field of study than men. In the male-dominated field of computer sciences, women are more likely to exit their field of study. Black and Latinx students are more likely to exit their original field of study than white and Asian students and less likely to complete a bachelor's degree in any field within six years of starting college. These phenomena contribute to occupational segregation—when structurally excluded students exit their first-choice fields of study, the graduates of those fields of study will continue to be disproportionately white and male.

These findings point to a need for colleges and universities to pursue structural solutions and ways to support women, Black, and Brown students persisting in their fields of choice—particularly when those fields are highly segregated fields without equitable representation of structurally excluded students and faculty. Section IV, "Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study," presents recommendations for postsecondary institutions and policymakers to dismantle barriers, mitigate segregation, and support students' persistence to increase equitable access and degree attainment across fields of study.

OVERALL, WOMEN ARE MORE LIKELY TO GRADUATE WITH A BACHELOR'S DEGREE BUT REMAIN UNDERREPRESENTED IN VARIOUS FIELDS OF STUDY

Women are as likely or likelier to attain a bachelor's degree overall and within their original field of study than their male counterparts—but they remain structurally excluded from a variety of fields.[xiii] (Attainment rates by gender and field of study, and overall, are shown in Figure 6 below.) Health care demonstrates a particularly robust difference by gender, as 23 percent of women who initially enroll in the field of study graduate with a degree in health care within six years of enrollment, compared to roughly 9 percent of men (see Figure 6). Furthermore, 53 percent of women who initially enroll in engineering attain a bachelor's degree in engineering within six years of enrollment, compared to 35 percent of men.[xiv] However, due to the high levels of gender segregation at enrollment (see Figure 4, above), female students' higher persistence in engineering is not enough to produce an equivalent number of female engineers. These findings indicate the importance of policy and program interventions (discussed in Section IV, "Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study") to encourage more female participation in male-dominated fields of study starting at enrollment and to reduce female students' exits from certain fields of study.

FIELD OF STUDY EXITS EXACERBATE RACIAL SEGREGATION, ESPECIALLY IN COMPUTER SCIENCES & BUSINESS

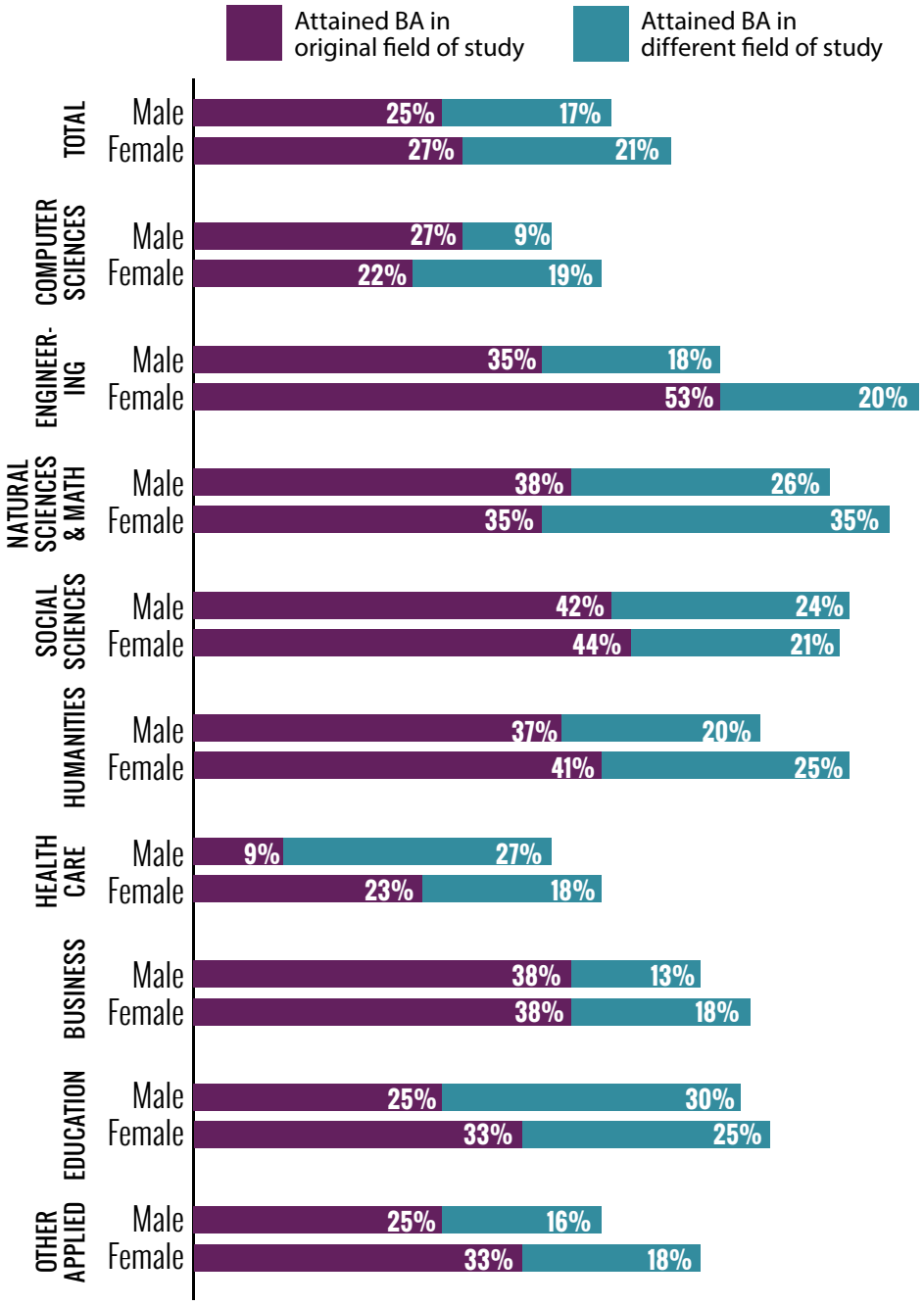
Students of color are segregated by field of study partly because they are more likely than white students to exit certain fields of study. Black and Latinx students' rates of bachelor's degree attainment within six years are lower in nearly every original field of study than for their white and Asian counterparts, particularly in STEM and business fields of study. In 2017, only 10 and 17 percent of Black and Latinx students, respectively, who originally declared a computer sciences field of study graduated with a computer sciences degree (see Figure 7). In contrast, nearly 29 percent of white students and 46 percent of Asian students whose original field of study was computer sciences graduated with a computer sciences degree (the difference between Latinx and white students is not statistically significant). Similarly, 20 percent of Black students whose original field of study was business attained a bachelor's degree in business, compared to more than double that (45 percent) for white students.

xiii The margins of error associated with estimates in Figures 6 and 7 are relatively high and care should be used when interpreting these figures. Recommendations in Section IV, "Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study," discuss the need to collect better data on student outcomes by field of study, gender, and race.

xiv This finding is likely explained by the higher share of male students who originally declare engineering as their field of study who begin at a 2-year institution. Based on GCPI ESOI analysis of Beginning Postsecondary Students Longitudinal Study: 2012/17 (BPS) data.

FIGURE 6. Women are equally or more likely to attain a bachelor's degree in their original field of study than men

Bachelor's degree attainment six years after enrollment by original field of study and gender, 2012-2017

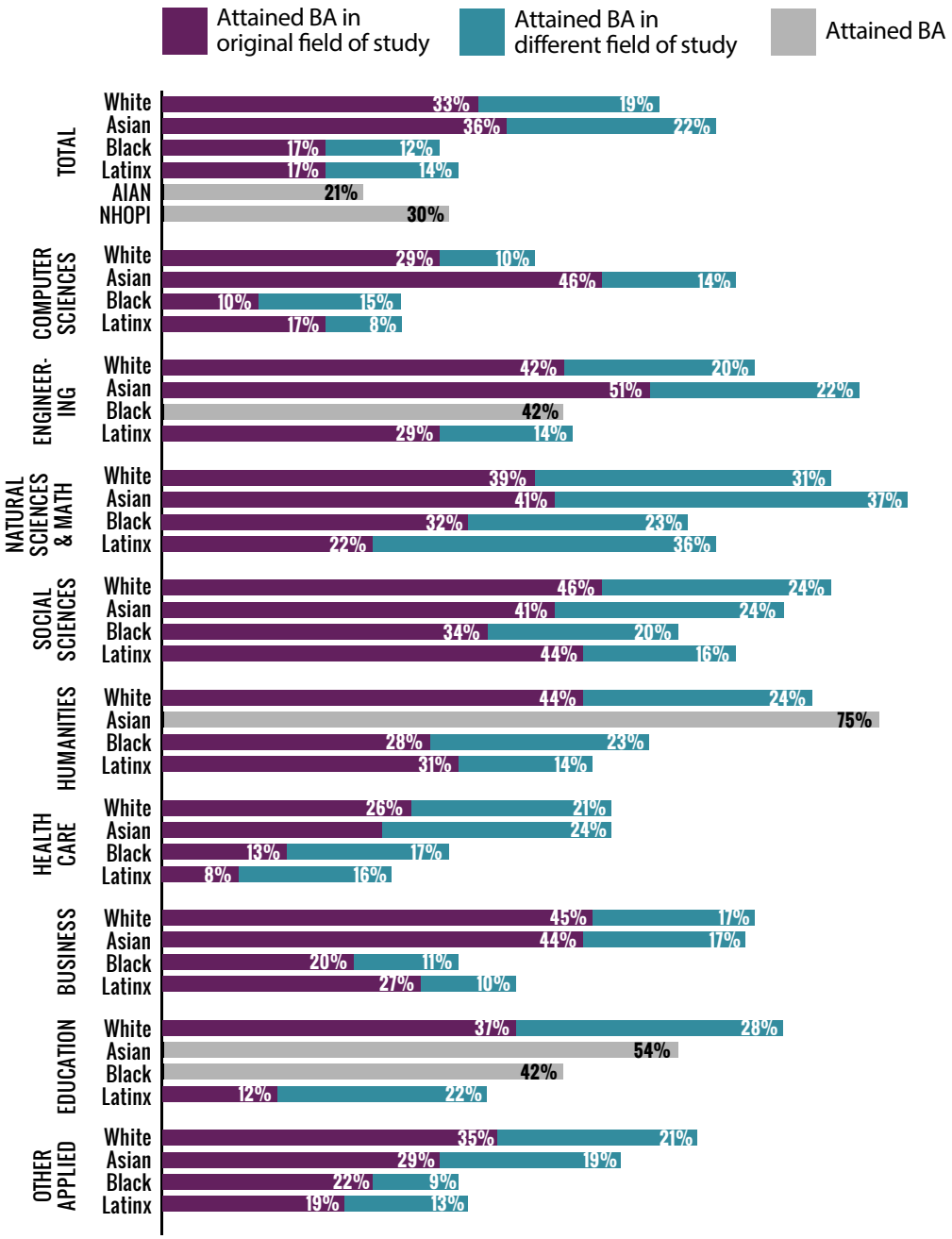


Note: Includes students originally pursuing a two-year or four-year degree beginning in 2012 who had expectations of completing a bachelor's degree or higher. Field of study categories are those recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. Attainment refers to bachelor's degree attainment. "Undecided" and "General studies" have the lowest bachelor's degree completion rates at 13 percent and 25 percent, respectively, and are not included in this figure. Percentage estimates are rounded to the nearest whole number.

Source: Georgetown Center on Poverty and Inequality analysis for 2012/17 Beginning Postsecondary Student Longitudinal Study data and can be accessed using a combination of the following table names: "Inqckr" and "zemfwl." Available at https://nces.ed.gov/surveys/bps/.

FIGURE 7. Black & Latinx students exit nearly every field of study at a higher rate than white & Asian students

Bachelor's degree attainment six years after enrollment by original & final field of study & race, 2012-2017



Note: Includes students originally pursuing a two-year or four-year degree beginning in 2012 who had expectations of completing a bachelor's degree or higher. Field of study categories are those recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. Attainment refers to bachelor's degree attainment. Grey bars indicate the percentage of students who attained a bachelor's degree but due to insufficient sample sizes, are unable to be further segmented into graduates with a degree in one's original or different field of study. "Undecided" or "General studies" have the lowest bachelor's degree completion rates at 13 percent and 25 percent, respectively, and are not included in this figure. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Estimates by field of study for foreign students and students of more than one race were omitted from this figure. Percentage estimates are rounded to the nearest whole number.

Source: Georgetown Center on Poverty and Inequality analysis for 2012/17 Beginning Postsecondary Student Longitudinal Study data and can be accessed using a combination of the following table names: "dmqlpa" and "mwtojh." Available at https://nces.ed.gov/surveys/bps/.

Segregation by Gender & Race Continues Across Fields of Study at Graduation

Field of study segregation continues through degree completion. Women are substantially segregated across field of study compared to men when they receive their diplomas and enter the workforce. Field of study segregation by race also continues through graduation—although it is less severe when compared to the magnitude of field of study segregation by gender—and Black and Brown students are less likely to complete a bachelor's degree within six years than white students.

AT GRADUATION, GENDER SEGREGATION BY FIELD OF STUDY IS SUBSTANTIAL

At graduation, field of study segregation by gender remains substantial. In 2020, the DSI value between men and women who completed a bachelor's degree was 0.29. In other words, assuming all women remained in their same field of study, 29 percent (close to one-third) of men would have to switch their field of study for the field of study enrollment patterns between men and women to be equal.[xv] In essence, the gender segregation of students across fields of study at initial enrollment is preserved rather than disrupted by the higher education system through graduation.

Gender disparities in fields of study at graduation are particularly striking in computer sciences, engineering, business, and health care. Men are significantly more likely than women to graduate with degrees in computer sciences, engineering, or business.[168] About 13 percent of male students graduate with engineering as their field of study compared to less than 3 percent of female students (see Figure 8). Similarly, male students are more than four times likelier than female students to study computer and information science. On the other hand, female students are nearly four times more likely to focus on health care fields of study than their male counterparts. Nearly 19 percent of female students graduating from a bachelor's degree program studied health care compared to about 5 percent of male students.

FIGURE 8. Women graduates are underrepresented in computer sciences, engineering, & business fields of study

Percent of students graduating with a bachelor's degree across fields of study by gender, 2020

	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
Male	9	13	11	4	10	8	5	24	2	13
Female	2	3	11	5	14	10	19	15	6	15

Note: Data represent bachelor's degrees awarded in 2020. Second bachelor's degrees awarded have been removed from the results. Field of study categories are based on two-digit CIP codes that have been collapsed into 10 categories recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality analysis of 2020 Integrated Postsecondary Education Data System Completion component data. Available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions.

xv Conversely, if men remained in the same fields of study, 29 percent of women would need to switch fields of study for an equal distribution between men and women.

FIELD OF STUDY SEGREGATION BY RACE CONTINUES THROUGH GRADUATION

At graduation, field of study segregation by race remains. In 2020, the DSI value between recent Black and white graduates was 0.13,[xvi] and the DSI value between Asian students and students of other races was much higher[xvii] (additional DSI values for graduating students by race are shown in Figure 16 in "Appendix III. DSI Values Showing Field of Study Segregation by Race for Beginning & Graduating Students"). At public doctoral universities, the Black-white DSI value for field of study segregation was even higher at 0.17 (not shown).

STEM fields, particularly engineering, provide a clear example of the field of study segregation between students of different races. For example, Black students are structurally excluded from engineering fields of study. In 2020, only 3 percent of Black graduates had an engineering field of study, while 7 percent of white students graduated with an engineering field of study (see Figure 9).[xviii]

Although field of study segregation by race at graduation is less severe when compared to the magnitude of field of study segregation by gender, it suggests (along with racial differences in completion rates) that postsecondary education can do more to interrupt this segregation that feeds into similar patterns in the workforce.

FIGURE 9. Black, Latinx, AIAN & NHOPI graduates are underrepresented in STEM fields

Percent of students graduating with a bachelor's degree across fields of study by race, 2020

	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
White	4	7	11	4	11	10	13	19	5	14
Black	4	3	7	6	14	7	15	18	3	21
Latinx	3	6	10	5	16	9	12	18	3	17
Asian	11	10	17	4	12	7	12	18	1	8
AIAN	3	5	9	6	12	9	15	19	6	16
NHOPI	4	4	8	5	12	7	17	20	4	17

Note: Data represent bachelor's degrees awarded in 2020. Second bachelor's degrees awarded have been removed from the sample. Field of study categories are based on two-digit CIP codes that have been collapsed into 10 categories recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Students whose race was recorded as foreign, multiracial, or "unknown" were omitted from this figure. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality analysis of 2020 Integrated Postsecondary Education Data System Completion component data. Available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions.

xvi In other words, 13 percent of white students would need to switch fields of study to match the pattern of Black students' field of study.

xvii Field of study segregation for Black, Hispanic, and AIAN students relative to Asian students was 0.23, 0.19, and 0.21, respectively, in 2020 as measured by DSI.

xviii Part of the reason for the disparity among STEM graduates by race is that students of some races are more likely to switch from a STEM field of study to another. In particular, Black students who originally chose a STEM field of study are more likely to graduate with a non-STEM field of study compared to their Asian, Latinx, and white counterparts.

TRANSFERRING TO A FOUR-YEAR INSTITUTION AFFECTS FIELDS OF STUDY OF STRUCTURALLY EXCLUDED STUDENTS

Students at two-year institutions typically have the same goal of completing a bachelor's degree as do students at four-year institutions,[169] but they tend to be in very different fields of study.[170] Two-year institutions provide coursework and certifications for students seeking to enter a career field without a bachelor's degree, as well as academic programs for students intending to transfer to a bachelor's degree program.[171, 172]

Transfer-oriented two-year degrees are often considered a "general" field of study[173]—and once these students transfer from a two-year to a four-year college, a process known as a "vertical transfer," they must choose a final field of study for their bachelor's degree. The large share of community college students enrolled in the general studies field makes it challenging to analyze field of study segregation between students enrolled in two-year versus four-year degrees. However, patterns in the final fields of study of vertical transfer students raise questions about four-year institutions' transfer receptivity. Bachelor's degree holders who made a vertical transfer are segregated across fields of study with respect to students who did not transfer into their four-year institution. The DSI value between bachelor's degree holders who never attended community college and those who started at community college is 0.13, indicating that starting college at a community college affects a student's choice of field of study.

DIFFERENCES IN FIELD OF STUDY between bachelor's graduates who **TRANSFERRED** vertically & those who did not are even **LARGER BY RACE**.

Differences in field of study between bachelor's graduates who transferred vertically and those who did not are even larger by race. As shown in Figure 10, white bachelor's graduates who never studied at a community college are much more likely to have a STEM field of study and less likely to have an applied education or health field of study than their Black counterparts who transferred vertically. Approximately 14 percent of Black bachelor's degree graduates who started at a community college have health care as their field of study, but only 7 percent of white bachelor's degree holders who started at a four-year institution have health care as their field of study. White graduates who started at a four-year institution are more than twice as likely as Black graduates who started at community college to have natural sciences and math as their field of study. The DSI value measuring field of study segregation between white bachelor's degree holders who started at a four-year institution and Black bachelor's holders who started at community college is 0.24, suggesting that the impact of starting at community college on a student's field of study is racialized. The connections between vertical transfer, field of study segregation, and race are important for policymakers to consider because an increased reliance on community colleges to improve bachelor's degree attainment could also inadvertently increase field of study segregation and occupational segregation.

FIGURE 10. Students who transfer from 2-year to 4-year institutions experience substantial field of study segregation

Percent of students across fields of study by type of starting institution, 2019

	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
White, 4-year	3	8	13	2	17	14	7	17	9	12
White, 2-year	3	5	10	3	14	10	11	19	12	12
Black, 4-year	5	5	11	1	20	5	8	23	3	18
Black, 2-year	5	5	5	1	15	7	14	24	4	20
Latinx, 4-year	4	11	10	2	18	11	6	20	6	13
Latinx, 2-year	3	5	8	8	18	10	10	20	5	13
Asian, 4-year	12	24	17	1	11	6	9	15	1	5
Asian, 2-year	10	8	13	0	11	7	13	24	4	9

Note: Includes persons ages 25-44 who earned at least a bachelor's degree. Field of study categories are based on the most detailed categorization available and have been collapsed into 10 categories recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. Students who started at a community college and earned a bachelor's degree are assumed to have transferred to a four-year institution, although this is a simplification as some community colleges award bachelor's degrees. People who identify as Latinx or Hispanic are included as a separate race category. People whose race was recorded as "mixed race" or "other race" were omitted from this figure. Estimates by field of study for Native Hawaiian/other Pacific Islander or American Indian Alaska Native students are not available due to insufficient sample size. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality analysis of 2019 National Survey of College Graduates data. Available at https://www.census.gov/programs-surveys/nscg.html

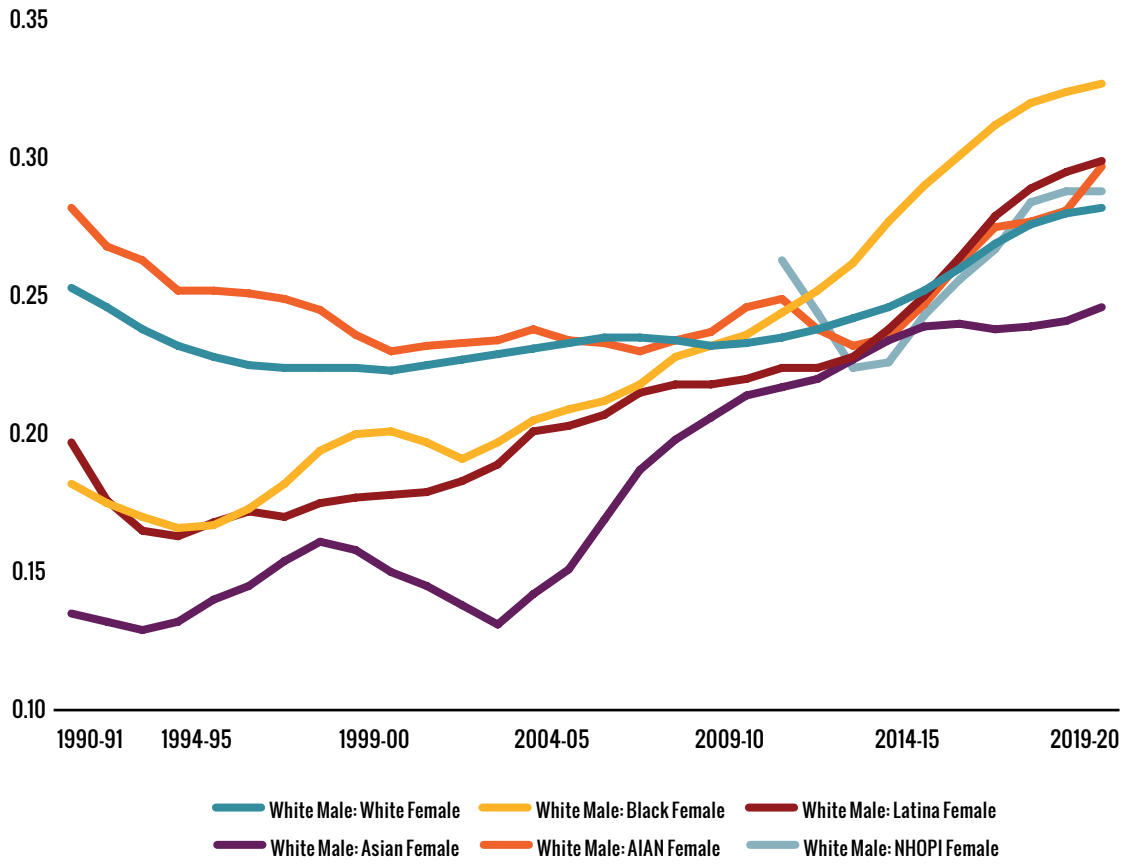
Racial & Gender Segregation Across Fields of Study Has Defined Postsecondary Education for Decades

The most current data available show that male and female students are significantly segregated across fields of study,[174] a pattern that dates back to the early days of U.S. higher education.[175, 176] Even though women have earned a majority of bachelor's degrees since 1982,[177] field of study segregation by gender continues. Fields of study are also segregated by race.

An intersectional analysis of graduating students by race *and* gender reveals patterns in field of study segregation over time. Since the early 2000s (and in some cases earlier), field of study segregation between women of color and white men has been on the rise. While the DSI values between Black students and white students changed relatively little from 1990 to 2020, the DSI values between Black female students and white male students rose from 0.18 in 1990-91 to 0.33 in 2019-20, almost doubling (see Figure 11). Field of study segregation has also increased since the early 2000s between female Hispanic and Asian students, respectively, in comparison to white male students. Field of study segregation between Black men and white men also rose during that time, to a lesser extent. Overall, field of study segregation has *generally* held steady or increased to varying degrees over the last 30 years when considering DSI values analyzing the distribution of white men and their peers of color.

FIGURE 11. Segregation across fields of study between white men & women of color is rising

DSI values for field of study segregation among bachelor's graduates, by race & gender, 1990-2020



Note: Data represent bachelor's degrees awarded from 1990 to 2020. Estimates are calculated using two-years of data. Second bachelor's degrees awarded have been removed from the sample for the year 2002 and later. Field of study categories are based on two-digit CIP codes that have been collapsed into 10 categories recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Asian and NHOPI students are combined in years prior to 2010. Students whose race was recorded as foreign, multiracial, or "unknown" were omitted from this figure. Comparisons shown illustrate important trends in field of study segregation between several groups of structurally excluded students but are not necessarily indicative of other comparisons.

Source: Georgetown Center on Poverty and Inequality analysis of 1990-2020 Integrated Postsecondary Education Data System Completion component data. Available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions.

IV. Policymakers & Postsecondary Institutions Should Address Segregation & Promote Student Success in Every Field of Study

Addressing segregation across fields of study can help ensure that structurally excluded students have access to all occupations. This section proposes policy and programmatic recommendations, arranged under four principles[xix] outlined below, to mitigate postsecondary education's contributions to occupational segregation. While the recommendations primarily focus on postsecondary institutions (including two- and four-year institutions) and state and federal policymakers, a wider range of stakeholders will find these recommendations useful and applicable. Many of the policy recommendations help address the wide variety of challenges and constraints that postsecondary institutions face.

The recommendations, which are not intended to be comprehensive, include a mix of universal approaches and targeted approaches that are necessary to overcome group-specific obstacles. Many of the recommendations would work best when implemented together with other recommendations, as no single solution is sufficient.

- **PRINCIPLE 1.** **Affordability for Every Field of Study**
- **PRINCIPLE 2.** **Inclusive and Supportive Climates in Every Field of Study**
- **PRINCIPLE 3.** **Career-Connected Learning and Experience in Every Field of Study**
- **PRINCIPLE 4.** **Data Use and Improvements to Better Understand and Pursue Equitable Outcomes for Students**

xix The principles were developed following interviews with experts and advocates with relevant lived experience, internal learning and discussion, and extensive literature review.

Principle 1: Affordability for Every Field of Study

The prohibitive cost of higher education in the U.S. is a key contributing factor to occupational segregation by race and gender. Too-high costs are a barrier to degree completion[178, 179] and saddle large swaths of people—regardless of whether they complete their degrees or exit postsecondary education before completion—with student debt.[180] Moreover, federal Pell grants and scholarships often inadequately cover full tuition and fees, let alone costs beyond tuition.[181, 182] Differential tuition and course loads exacerbate cost-related barriers to higher education overall and restrict access to certain fields of study—thus contributing to occupational segregation.[183, 184] For example, tuition for business and engineering fields tends to be more expensive than tuition for social work or humanities fields.[185, 186] Students of color and students with caregiving responsibilities—the vast majority of whom are women—are more likely than their white, male counterparts to have lower incomes and to have their education interrupted or derailed by cost considerations.[187, 188] Postsecondary institutions and federal and state policymakers should address the prohibitive cost of higher education and affordability-related barriers to fields of study.

CHALLENGE: DIFFERENTIAL COSTS & FINANCIAL BARRIERS INCREASE OCCUPATIONAL & FIELD OF STUDY SEGREGATION

Certain fields of study can be costlier to students due to differential tuition or a higher course load requirement, on top of the high overall costs of postsecondary education.[189, 190] Differential tuition is an increasingly common pricing model for public institutions to charge students different prices depending on their field of study.[xx] Colleges typically receive a fixed per-student amount from the federal government, regardless of the variability in operational costs of the fields of study.[191] Even though more expensive fields are typically those which result in higher wages for graduates,[192] the federal policy on per-student funding disincentivizes institutions from increasing the numbers of students in fields of study that are more costly to operate.

Institutions have justified the use of differential pricing as a counterbalance to state underfunding of public higher education—but differential pricing is harmful to equity.[193, 194] In Iowa, for example, the Iowa Board of Regents approved tuition increases in 2016 in the fields of study that already used differential pricing to offset state cuts to postsecondary education funding.[195] At least one governor has justified the selective price increases based on the relatively higher value of those degrees.[196] Differential costs deter students of color more than their white counterparts from more expensive fields of study like engineering, which deepens field of study segregation.[197]

Students also face different *time* costs depending on their field of study. Fields of study with a higher load of credits are particularly burdensome—in terms of the time cost—for students with caregiving responsibilities and structurally excluded students. Structurally excluded students are both more likely to have caregiving responsibilities and are more likely to work while enrolled due to significant financial barriers.[198, 199] In fact, students from households with lower incomes are more likely to engage in formal employment during college semesters and to work more hours at their jobs than students from households with higher incomes.[200] When structurally excluded students consider a career in a field that requires graduate education or further

xx In 2016, 86 of 165 public four-year research universities, which altogether enroll about half of bachelor's degree students at public institutions, employed some form of differential tuition. For more information see Wolniak, Gregory C., Casey E. George, and Glen R. Nelson. "12. The Emerging Differential Tuition Era Among U.S. Public Universities." Under Pressure: Higher Education Institutions Coping with Multiple Challenges, edited by Teixeira, Pedro N., et al., Koninklijke Brill NV, pp. 191-214, 2019. Available at https://louisville.edu/education/centers/economic-ed/files/eair-chapter-12-published-v.pdf.

training after undergraduate studies, they must factor in these additional financial and time costs. Medicine, law, academia, engineering, and other highly segregated—and/or high-paying—careers often require a longer educational time horizon.[201]

Many equity-focused postsecondary education leaders and policy analysts have noted how such opportunity costs can hinder the success of structurally excluded students in fields of study with disproportionate time costs.[202, 203, 204] For example, Dr. Freeman Hrabowski of the University of Maryland, Baltimore County, co-founder of the renowned Meyerhoff Scholars Program (see Box 2 for more information), said, "It is impossible for a student to do well in biochemistry while working 25 hours on the outside."[205] If STEM majors facing financial challenges find it hard to finish their program in four years, they may be more likely to change out of STEM to a field of study that allows them to complete their degree in four years.[206]

RECOMMENDATIONS: ADDRESS COST & TIME BARRIERS THAT SEGREGATE FIELDS OF STUDY & EXCLUDE STUDENTS BY RACE & GENDER

Postsecondary institutions and federal and state policymakers should pursue solutions to the affordability crisis in higher education and field of study-specific affordability barriers.

Postsecondary Institutions Should Take Steps to Standardize Costs & Requirements Across Majors & Invest in the Transfer Process

Explore alternatives to differential tuition, such as charging uniform tuition and fees across all fields of study. Students of color are more likely to leave a field of study due to differential costs than their white counterparts.[207] Institutions should eliminate the use of differential tuition to a) ensure that students' choices when considering a field of study are not influenced by varying costs, and b) mitigate entry barriers to segregated fields of study.

Explore ways to make course load requirements more equitable across majors to mitigate barriers to access, especially for students with outside responsibilities. Majors that require more than a full course load of credits to graduate on time can deter structurally excluded students, who are more likely to hold jobs or have caregiving responsibilities, from pursuing them.[208] Institutions should explore potential offsets—such as adjustments to non-major requirements or course sequencing for those majors—in pursuit of more equitable outcomes for structurally excluded students.

Invest in and improve the transfer process to reduce financial and time costs for structurally excluded students and better facilitate their success at four-year institutions in their chosen fields of study. Transfer students often lose credits when they transfer to a four-year university from a community college. While much of the work to prepare community college students for transfer to a four-year institution occurs at the community college level,[xxi] four-year institutions should commit to equity and inclusion for transfer students and to improving outcomes for transfer students.[209] Through robust collaboration with two-year institutions on transfer agreements, four-year institutions can reduce the cost of transferring[210, 211] as well as improve access and degree completion.[212, 213] Receiving institutions should implement orientation programs that acclimate transfer students to their new departments specifically as well as to the school community.[214] Community colleges also should provide strong advisory programs with personalized support for transfer students[215] to ensure that they have a clear path to completing field of study requirements and avoiding lost

xxi Community colleges should have formal goal- and course-of-study-planning discussions with students from day one—including any discussion of transfer. Unlike four-year institutions where declaring a major upon enrollment is the norm, community college students often may not have a clear field of study path when they enroll.

credits, money, and time,[216] particularly in the transition from lower-level courses to upper-level courses within a field of study.[217] Community colleges can begin these advisory programs when their students enroll to ensure students understand their options for fields of study and the connections to future career paths.

State & Federal Policymakers Should Adequately Fund Postsecondary Education & Invest in the Transfer Process

Provide adequate funding for higher education institutions, in general, to eliminate a need for charging differential tuition. Inadequate state funding for higher education[218] is one reason why some institutions have implemented differential tuition in recent decades.[219] Policymakers should ensure funding that is adequate for all fields of study. State policymakers should use an equity lens in setting education funding levels, increasing funding to all types of public institutions.[220] Federal policymakers should also explore avenues for increasing funding—with a focus on equity—for higher education institutions.[221]

Ensure continuity and affordability of studies—in all fields of study—for students who transfer from community colleges to four-year institutions. When students transfer into a four-year field of study, they often face lost credits, which equate to lost time and money. To help ensure seamless continuity and affordability of all fields of study for transfer students from two-year into four-year institutions, state policymakers should promote credit transfer agreements between public institutions as well as guided pathways that connect community college courses to fields of study at public four-year institutions.[222, 223] Also, state policymakers should build a unified course catalog for use in the public postsecondary system to make it easier for transfer students to maintain their credits as they transfer vertically. To allow for greater career and coursework portability, administrators should also explore opportunities for terminal community college programs (such as medical assistance) to fulfill corresponding field of study requirements at a four-year institution. Virginia provides a strong model[224], including the use of equity-oriented principles to guide robust policy[225] and an informational website for transfer students to ease transfer and promote success.[226] State policymakers can further ensure continuity and affordability of studies by allowing transfer students to maintain their in-state tuition status regardless of the number of credits they have already earned from their previous institution.

Principle 2: Inclusive & Supportive Climate in Every Field of Study

Structurally excluded students often experience a "chilly climate"[xxii] in more segregated fields of study, where curriculum and course structure, pedagogy, policies, culture, faculty, other students, and advising can all contribute to an unwelcoming, discouraging, and even hostile environment. Chilly climates reproduce racial hierarchy, which can limit access and derail success for students of color.[227] Fields of study with chilly climates do not serve as *inclusive* pathways for structurally excluded students to enter more segregated professions. Postsecondary institutions should invest in removing these barriers through systematic, culturally relevant improvements to their programming, curriculum,

xxii We apply the term "chilly climate" throughout this report to describe the experience of structurally excluded students in fields of study that are highly segregated, which can be discouraging or hostile. It is an academic term scholars Roberta Hall and Bernice Sandler coined in 1982, defined as when microinequities, microaggressions, a lack of representation, and unconscious bias in non-diverse fields of study create a space that is hostile and discouraging for women. Subsequent scholarship has broadened the use of "chilliness" and "climate" to describe similar dynamics for students of color and other structurally excluded and marginalized groups. While we focus on chilly climates at the level of field of study, institutions as a whole can have chilly climates as well. Hall, Roberta M., and Bernice R. Sandler. "The Classroom Climate: A Chilly One for Women?" Association of American Colleges, February 1982. Available at https://files.eric.ed.gov/fulltext/ED215628.pdf.

organizational structures, pedagogy, and support structures and promote equity for structurally excluded students—including transfer students. Federal and state policymakers should increase investments in HBCUs, use funding and accreditation processes to improve diversity objectives, and invest in building faculties with gender and racial diversity across fields of study.

CHALLENGE: SOME FIELDS OF STUDY CAN BE PARTICULARLY CHILLY & DISCOURAGING TO STRUCTURALLY EXCLUDED STUDENTS

For structurally excluded students, certain fields of study—such as STEM fields—are particularly chilly. Structurally excluded students frequently experience stereotype threat and microaggressions in postsecondary institutions,[228, 229] particularly in more segregated fields of study.[230, 231, 232] Researchers have found that STEM departments are "purposively constructed as exclusionary spaces where students must essentially prove that they deserve to stay," in addition to experiencing stereotype threat ("presumed inferior cognitive and mathematical ability").[233] Scholars have also described a phenomenon where the in-group maintains its advantages by perpetuating stereotyped assumptions and beliefs about the out-group (structurally excluded students) and uses those stereotypes to justify the exclusion.[234] Black students are particularly likely to experience racial microaggressions in STEM fields of study, which contributes to racial segregation in STEM professions.[235] While most extensively documented in research about STEM[236] departments, structurally excluded students experience similar chilliness in social sciences[237] and business fields of study.[238]

A dearth of representation, inclusion, and support from a department's faculty and exclusionary pedagogy[239] also fuels chilly climates. Tenured faculty, who may be a student's first exposure to a field of study, can perpetuate exclusion through their teaching, mentoring, and advising practices.[240] Even if not overtly discouraged by faculty, students are more likely to report a sense of not belonging when their field of study—including the faculty—does not appear to welcome their presence.[241] Notably, college students are more than twice as likely as faculty to be Black and four times as likely to be Latinx.[242] Moreover, women and people of color are underrepresented in full professorships and tend to be more represented among the most junior positions,[243] such as adjuncts and contingent work positions which tend to be precarious and frequently come with very low pay and no health benefits. This racially and gender-stratified hierarchy sends a message to students about who belongs in which fields of study and who does not. Additionally, if a field of study's pedagogy is Western- and white-dominated, that also contributes to a chilly climate for structurally excluded students.[244]

Black and Latinx students are more likely to be discouraged by faculty, administrators, or advisors during their pursuit of a STEM career than white students.[245] For example, in a survey of chemists and chemical engineers of all races about their pursuit of a STEM career, respondents identified that professors were the most common source of discouragement (compared to colleagues, family members, or advisors), with African-American women experiencing such discouragement more than respondents of other races and genders.[246] The same survey found African-American men and Hispanic women reported being discouraged from pursuing STEM careers most often by a guidance counselor or advisor.[247]

Discouragement from faculty and administrators can be passive or active and can occur at any stage of a student's academic career. Passive discouragement can include structurally excluded students facing an absence of support or resources from faculty when struggling with a field of study or not seeing representation of their race or gender in other students and faculty. Active discouragement can include gatekeeping of a field of study via introductory or "weed-out" courses. Weed-out courses are often the first in a sequence of study for a major or discipline and are intentionally designed to discourage some students from further study based on the erroneous assumption that only a few students are capable of succeeding.[248, 249] Experts point to the gatekeeping function of weed-out classes as a key issue and contributor to field of study segregation (and eventual occupational segregation).[250, 251] When students struggle with "weed-out" classes, they are more likely to be encouraged to switch out of the major than receive support to stay and improve.[252] STEM fields of study provide a stark illustration of this issue: despite declaring STEM fields of study at the same rate as their white peers,[253] Black and Brown students have disproportionately higher exit rates, with wider gaps in persistence than in other majors.[254] For Black and Brown students, the consequences are even starker: failing or withdrawing from these introductory classes is correlated with withdrawing from college altogether.[255]

For the past **25 YEARS**, the **GAP** in **EARNINGS** between **BLACK** & **BROWN** students & **WHITE** students has been steadily **INCREASING**.

Policies excluding students with low early-stage grade point averages from lucrative majors—such as in STEM—disproportionately impact Black and Brown students due to systemic inequities, with significant consequences for their future earnings. For the past 25 years, the gap in earnings between Black and Brown students and white students has been steadily increasing.[256] This steady increase can be partly attributed to policies—especially at some of the largest public research universities—that exclude students with low early-stage grade point averages from the most popular and lucrative majors.[257] This policy disproportionately impacts students of color since they are less likely to have received equally rigorous preparation for college as white students[258] and, therefore, may be more likely to earn lower initial grades in early postsecondary coursework.[259]

RECOMMENDATIONS: FOSTER INCLUSIVE, WARM, & REPRESENTATIVE ENVIRONMENTS IN ALL FIELDS OF STUDY

To address chilly climates in certain fields, postsecondary institutions should implement culturally relevant, systematic improvements to their programming, curriculum, pedagogy, and support structures. Federal and state policymakers should increase investments and create incentives for institutions that improve accessibility for structurally excluded students in highly segregated fields of study.

Postsecondary Institutions Should Prioritize Inclusion Through Support Networks, Mentorship, Advising, & Curriculum Structure

Invest in holistic, culturally relevant community-building efforts to boost structurally excluded students' sense of belonging and to facilitate the creation of vital support networks—both across campus and within fields of study. Institutions should mitigate the impact of chilly climates by investing in peer-to-peer supports as well as other opportunities that connect students with faculty and staff, particularly at the field of study or department level. Facilitating connections and collaboration helps forge the types of inclusive support networks and sense of belonging that are integral to the success of structurally excluded students.

Institutions can look to existing programs for proven, scalable models that build community and facilitate increased degree completion by structurally excluded students within their chosen fields of study. Leading models include the University of Maryland, Baltimore County (UMBC) Meyerhoff Scholars Program (see Box 2);[260, 261] various community-building models for Black male[262] and Latinx students;[263] and HBCUs[264] (such as Xavier University; see Box 1 for additional details).

Within particularly segregated fields of study, such as STEM, structurally excluded students benefit from stronger connections with their peers in the field and with faculty members. Departments should create a sense of community by investing in spaces for students to deeply engage in their fields of study and build a strong support network. Structurally excluded students are more likely to persist in STEM fields when they can build these connections through science clubs, study groups, undergraduate research opportunities, and cohorts.[265] Students also have a greater sense of belonging when their departments affirm and celebrate their culture.[266, 267]

Implement evaluation measures for ongoing institutional efforts to improve department climates for structurally excluded students. By regularly surveying all students on classroom climate—department by department—institutions can learn about the student experience of chilliness in each field of study, measure the effectiveness of community-building efforts, and assess where investments in community-building efforts are most needed. Students should have input in the design of these evaluation measures. The evaluation measures and implementation of feedback should be designed so that students feel safe sharing openly and have confidence that their feedback will be applied to improve department climates for structurally excluded students.

Establish multiple types of mentorship programs for structurally excluded students navigating segregated fields of study. Institutions should cultivate or refresh formal mentorship programs and other supportive services and resources for structurally excluded students, especially in fields of study in which they are particularly underrepresented. Mentorship is associated with long-term success and persistence for these students.[268, 269] Mentorship programs[270] that connect professors, professionals in desired career fields, and peer mentors to structurally excluded students can mitigate feelings of exclusion and foster their success in highly segregated majors. The Meyerhoff Scholars Program, for example, pairs scholars with both a mentor who is a professional in the local STEM community as well as with a research mentor (either inside the university or outside in a community laboratory).[271] Spelman College is nationally recognized for its STEM education which includes an emphasis on mentorship for students, both with faculty and with peers.[272] Research shows that the most effective and inclusive mentorship programs include training and support for the mentors, as mentors can better address their mentees' needs when they have training and support to increase their self-efficacy and skills as mentors.[273, 274]

BOX 1

HBCU XAVIER UNIVERSITY OF LOUISIANA MODELS BEST PRACTICES FOR INCLUSIVE & SUPPORTIVE FIELDS OF STUDY

Xavier University of Louisiana's concerted STEM persistence and success strategy highlights the importance of multi-level, multi-targeted, and sustained programming to increase the number of students graduating with degrees in the STEM fields. Xavier consistently ranks at the top of schools graduating Black STEM degree holders, particularly in the biomedical sciences.[275] The historically Black college invests heavily in developing STEM talent, regardless of a student's level of preparation or economic hardship, characteristics that are known to impede STEM persistence and success.[276]

Xavier's empirically-validated interventions to support students in STEM include: multiple opportunities to engage in hands-on research of their own, with faculty, and with partner organizations; peer-led discussions and peer-shadowing experiences to boost interest and familiarity with student research; STEM-related seminars and skill-building workshops from the first year of study; supportive faculty mentorship and strong advising; multiple academic supports (tutoring, extra instruction, and academic-skills workshops) throughout all introductory-level STEM classes and now through many higher level classes, as well.[277, 278] Each year, student cohorts receive intensive nurturing in various STEM fields with opportunities ranging from mentored research positions to outside-funded financial supports through the school's specialty initiatives.[279] Xavier has also increased its availability of and funding for on-campus jobs to address the need of the majority of their students to work, with an emphasis on providing opportunities in STEM roles, such as lab technicians, teaching assistants, and even administrative assistants.[280] Xavier also assists recent degree-holders in obtaining research positions and applying to graduate schools.[281]

Xavier has also made investments to improve the mentoring and advising skills of STEM faculty and staff.[282] Xavier trains faculty in the use of an "early warning" academic risk model and data collection so that faculty are well-prepared to address student concerns promptly to support their persistence.[283, 284] Moreover, STEM departments now coordinate to improve curricular offerings and cross-fertilization through a program called Innovation Through Institutional Integration.[285] Lastly, the university has strengthened partnerships with outside organizations to increase students' and graduates' opportunities for paid research during the summer and after graduation.[286]

These efforts make Xavier's students feel supported and capable,[287] with students touting the "sense of togetherness"[288] and the powerful feeling of being part of a community of current and future Black professionals in STEM.[289] If these interventions are the building blocks of Xavier's success educating Black STEM majors, then the commitment to community, support, and student success is the foundation.[290, 291, 292]

Invest in quality, equity-focused academic advising regarding field of study choice, coursework selection, and persistence in chosen field of study. Institutions should have strong, equity-focused academic advising programs to help students select courses and majors with an eye toward persistence and successful navigation of their chosen field of study. Equity-focused advising may help facilitate structurally excluded students' persistence within their fields of study. Black, Brown, and female students are more likely than their white and male counterparts to have limited knowledge of the range of opportunities for fields of study and eventual careers, but proactive and inclusive academic advising can facilitate informed decision-making and help mitigate chilliness in segregated fields of study.[293] Incorporating technology, such as course tracking apps, can improve advising and prevent wasted credits[294] that extend time and cost for students. Because of their influence on students, faculty advisors must be equipped

by institutions to mitigate explicit and implicit bias (both their own and their students'),[295] potentially through regular bias training for faculty and staff and other efforts affirming a campus focus on gender[296] and racial equity.

Foster inclusive teaching and pedagogy in every field of study. Institutions should incorporate critical pedagogy[xxiii] into every curriculum and field of study[297] and require equity-focused interventions in the classroom. Faculty across disciplines—including traditionally white-male-dominated subjects like STEM and economics—can teach with an anti-racist, feminist approach to course materials, readings, discussion topics, and guest speakers to make their courses as inclusive of structurally excluded students as possible.[298, 299] Moreover, institutional leaders should make clear to faculty and administrators that every student deserves to be in any field of study of their choosing. There should be anti-racist training for faculty, with accountability for implementation. Within STEM fields, examples of many institutional interventions, including equity-focused professional development programs for faculty, are funded by Inclusive Excellence,[300] a grant program to create a community of faculty and administrators increasing their institutions' capacity for inclusion of all STEM students.

In every field of study, design curriculum structure, academic supports, and policies for inclusion and student success. Institutions should design curriculum structure, academic supports, and policies for students' inclusion and success—and address barriers to structurally excluded students' success. For example, summer experience or "bridge" programs support structurally excluded students in increasing mastery and persistence in STEM fields.[301] Subject-specific tutoring for structurally excluded students supports student success, exemplified by the model of the Academic Resource Center at the School of General Studies at Columbia University.[302] Additionally, institutions should reverse the trend at the top public research universities to restrict majors based on low grade point averages, a practice which—due to systemic inequities—disproportionately prevents structurally excluded students from majoring in the most lucrative fields.[303]

Departments should monitor the outcomes of courses that function as "weed-outs"[xxiv] to track how many and which students are dropping a major after taking a certain class, or how many and which students fail a particular class.[304] Institutions should reform such classes to mitigate these harmful student outcomes. For example, instead of large, lecture-style introductory courses (that help institutions with budget considerations), institutions—with the help of additional funding as proposed in principle 1—could move toward smaller class sizes and incorporate teaching methods proven to be effective in retaining structurally excluded students.[305, 306, 307] Team-based problem-solving sessions such as those hosted by UMBC Chemistry Discovery Center[308] can be the pedagogical opposite of "weed-out" classes, providing students ample opportunity to lean in and grow in mastery of the subject.

Prioritize representative faculty and administrative staff in every field of study. Institutions should prioritize diversifying their faculty[309] and administrative staff[310] across fields of study and at leadership levels to achieve racial and gender parity in service of improving chilly climates and student experience.[311, 312] Improving outcomes for structurally excluded students in segregated

xxiii Based primarily on the work of educator and theorist Paolo Freire, critical pedagogy holds that "education [is] a form of countersocialization to promote democracy and social justice. Countersocialization is a necessary response to mainstream education, which functions to legitimate a social order defined by extreme disparities of wealth, income, political power, and oppression based on class, gender, ethnicity, and cultural status." Stanley, William B. "Critical Pedagogy: Democratic Realism, Neoliberalism, Conservatism, and a Tragic Sense of Education." Counterpoints: Critical Pedagogy: Where Are We Now? 299(371-389), 2007, p.371. Available at https://www.jstor.org/stable/42979416.

xxiv As an example of a "weed-out" course, introductory biology (biology 101) is commonly taught in large lecture halls, in which it is easier for students to fall through the cracks.

fields of study is an important upstream measure in addressing faculty pipeline issues, as it ensures more of these students have the opportunity to attend graduate school and become faculty. Further, institutions should also invest in inclusive strategies for faculty recruitment, retention, and advancement. Departments should train their administrators and faculty members to be knowledgeable about the role of implicit bias[313] in the subtle but powerful shaping of hiring and retention dynamics. Many schools, including UMBC, have implemented the University of Michigan's STRIDE program[314] to improve faculty diversity and shift departmental cultures.[315] STRIDE uses concepts from other inclusion work (including a commitment to diversity, awareness of unconscious bias, and strategies for fair evaluations) to improve hiring of diverse faculty and to create a community environment that promotes retention for students and faculty of structurally excluded backgrounds.[316] The related University of Michigan's ADVANCE Program, targeting diversity within STEM fields, gives specific and frank attention to what departments need to do to retain women and Black and Brown faculty members.[317]

State & Federal Policymakers Should Invest in HBCUs, Diverse Faculty, & Equity in Fields of Study Beyond STEM

Invest more dollars in HBCUs, including reparations for decades-long disparities in funding for public HBCUs. HBCUs are remarkably efficient at educating structurally excluded students in competitive fields with high occupational segregation,[318, 319] such as STEM fields,[320, 321, 322] despite having significantly fewer resources than predominantly white institutions (PWIs). Moreover, policymakers should institute reparations to HBCUs to repair the harm[323] of disparities in funding compared to funding for PWIs. Potential blueprints include successful efforts by the Coalition for Equity and Excellence in Maryland Higher Education[324] and elected officials in Tennessee,[325] as well as proposals for reparations.[xxv, 326, 327]

Use funding and accreditation processes to advance equity by requiring transparency, such as transparency of faculty diversity by department. The U.S. Department of Education distributes approximately $112 *billion* annually in federal student aid[328] yet generally lacks metrics to determine if the funding is improving equity outcomes.[329] The triad of oversight for higher education (regional postsecondary accrediting organizations, the states, and the U.S. Department of Education) has the untapped power to leverage this funding and its oversight role to improve equitable outcomes for students.[330, 331] For example, policymakers should use this oversight to require that institutions report the gender and racial composition of faculty by department—which is currently not available in IPEDS data—as part of funding and accreditation processes.

Invest in racial and gender equity for faculty beyond STEM fields of study. Policymakers should invest in interventions to improve representation of women and people of color among faculty at all public postsecondary institutions, beyond the typical focus on STEM fields of study.[332, 333] This would support institutional-level initiatives to improve faculty representation. As an adaptable example, the National Science Foundation's ADVANCE program is a federally-funded initiative to address the dearth of women in STEM, with well over 150 institutions receiving awards[334] and many documented positive results.[335] The model works to increase women's representation and success as STEM faculty members with a focus on evidence-based systemic change strategies; many of these strategies could be adopted to improve gender and racial equity in other segregated fields.[336]

xxv As just a small share of all postsecondary students (and thus a small share of all students of color) attends HBCUs, HBCUs are not drivers of the phenomena discussed in this report.

Principle 3: Career-Connected Learning & Experience in Every Field of Study

Postsecondary education is a critical time for career-connected learning and experience. However, postsecondary institutions often do not provide their students with adequate information on careers and connections to the professional world.[337, 338, 339] Because structurally excluded students face additional challenges in obtaining full-time employment within their field, postsecondary education institutions' lack of programming to connect students to their future careers is a missed opportunity to interrupt occupational segregation.[340] Postsecondary institutions should facilitate students' participation in meaningful work-based opportunities—including internships—and seek out opportunities to embed connections to careers in coursework in every field of study. Federal and state policymakers should leverage their power to improve access to paid internships and ensure worker protections for interns.

CHALLENGE: INADEQUATE & INEQUITABLE CAREER-CONNECTED LEARNING & EXPERIENCE

The bridge to employment, or the experience of students as they seek full-time employment for post-graduation, is not equitable.[341, 342] For example, structurally excluded students have less exposure to and awareness of the range of potential fields of study and related career fields than more privileged students.[343, 344] Uneven access to employment-related social networks can compound inequities.[345, 346]

Postsecondary institutions can help interrupt this inequity by integrating career-connected learning—including opportunities to apply and advance classroom learning in work-related and work-based settings—within fields of study, but four-year postsecondary institutions often provide limited or no opportunities for career-connected learning within fields of study.[347, 348] Historically, four-year postsecondary education has been largely academic, with an emphasis on lectures and textbook learning, while career-connected learning opportunities are less widely available.[xxvi, 349] Career-connected learning helps students gain exposure to career possibilities while developing their skills.[350] It can help build career and employment networks that are very important to early career success.[351, 352] It also fosters students' career-focused engagement with faculty and departments; research shows that students using faculty and department connections and traditional career services earn higher salaries overall than those who do not.[353]

Student work and internship experiences in their field of study are critical, as they tend to improve post-graduation employment outcomes.[354] Internships are generally recognized as a crucial step postsecondary students should take to strengthen their resumés before seeking entry-level employment.[355] However, access to internships and paid internships during postsecondary education is highly unequal[356, 357] and at least half of all students miss out on these essential opportunities.[358] The kinds of jobs and internships students work in during postsecondary education are also inequitable.[359, 360, 361] Compared to students from low-income backgrounds, students from higher-income backgrounds are more likely to secure employment related to their

xxvi While the concept of "career-connected learning" is most commonly associated with secondary education, it also has relevant applications within the postsecondary education context.

field of study.[362] These disparities worsen inequitable outcomes for students from low-income backgrounds , who are more likely to be female, Black, or Latinx.[xxvii, 363]

Internship access and pay are marked by gender and racial inequities as well.[364] A 2021 survey of students in college internships found about 76 percent of men were paid and 24 percent were not paid for their internships, compared to about 54 percent of women being paid and 46 percent not being paid for their internship work across different fields of study and non-profit and for-profit sectors.[365] The literature on racial differences in internships, paid or unpaid, is empirically limited and understudied.[366] A study of paid congressional internships—a highly regarded opportunity for students interested in careers in law, policy, advocacy, and social sciences—finds that paid internships go disproportionately to students in highly competitive, private colleges and universities, who are much more likely to be white and affluent than students from public institutions.[367]

RECOMMENDATIONS: ENSURE EQUITABLE & MEANINGFUL WORK-BASED OPPORTUNITIES RELEVANT TO STUDENTS' FIELD OF STUDY

Postsecondary institutions should strengthen opportunities for structurally excluded students to engage in meaningful work-based learning and experiences that connect their fields of study to relevant career paths. Federal and state policymakers should continue to work towards improving access and worker protections for students engaging in paid internships.

Postsecondary Institutions Should Embed Work-Based Learning & Career Connections in All Fields of Study

Early and often in their degree programs, provide students with information on the range of fields of study and advising on potential careers. From the first year of enrollment, institutions should provide students with quality, up-to-date information, via advising and guidance, on available fields of study—and how those fields connect with potential careers—to help students make informed decisions.[368] This field of study engagement should begin early, with information provided during admissions and throughout the postsecondary journey by advisors and faculty. These measures will help ensure that students choose a field of study or major with a greater awareness of career opportunities and likely economic outcomes such as projected earnings.[369]

Ensure career-connected learning and experiences—including field of study-relevant career awareness, exploration, preparation, and training, and access to internships. Well-designed career-connected learning can expand opportunities for structurally excluded students.[370, 371] Institutions should foster accessible classroom-based connections between postsecondary education and the workforce,[372] such as: classroom projects with business and non-profit partnerships,[373] guest lectures,[374] student mentorship programs with professionals in the field,[375] and department or class presentations by alumni who work in the field.[376] Institutions should implement and expand work-based learning opportunities for all so that structurally excluded students can build knowledge of careers in their field of study, a network of potential mentors and contacts in their desired field,[377] and essential skills that employers desire.[378, 379] Work-based learning opportunities offered by academic departments help to establish a more inclusive bridge

xxvii Researchers found that 14 percent of higher-income students gain job experience in STEM, business, or health care, compared to six percent of their fellow students from low-income backgrounds. By contrast, low-income students are more likely to work in food service, sales, and administrative support fields. "Racial Disproportionalities Exist in Terms of Intern Representation." National Association of Colleges and Employers, 24 July 2020. Available at https://www.naceweb.org/diversity-equity-and-inclusion/trends-and-predictions/racial-disproportionalities-exist-in-terms-of-intern-representation/.

from postsecondary education to career[380, 381] compared to the inequitable status quo of students often pursuing career connections and job opportunities through their own individual, family, and community networks. For students with limited access to professional and social networks, such programming provides real workplace experience and skills, offers the chance to try out personal interests, and builds potential job connections for post-graduation.[382, 383]

Offer equity-focused and robust career services and advising, including a focus on helping students obtain quality, paid career experiences before graduation. Institutions should provide equitable and comprehensive career services and advising to students. [384] Institutions should establish anti-racist and feminist values and standards to guide decisions about activities of career services and advising departments, to include standards upholding equity[385] and inclusion for employers who seek to recruit on campus.[386] Institutions should also seek out partnerships with employers and professional associations like the National Society of Black Engineers, whose attention to equity is central to their work.[387] Postsecondary institutions should ensure that their career services and institutional fundraising efforts include a focus on removing barriers that structurally excluded students face when seeking internships, such as by offering scholarships or award programs to make internships financially feasible.[388] Institutions should collaborate with employers to help students access a range of quality, paid internship experiences.[389] Lastly, career services should share information about the job search and job market by fields of study to faculty and staff, to whom students often turn first as trusted information sources.[390, 391]

Encourage more employers to pay students who are completing an internship for college credit, as both can happen together. The Fair Labor Standards Act (FLSA) allows an internship to be unpaid in instances where the intern earns academic credit,[392] and some employers use these criteria to justify not paying interns.[393] However, some credit-bearing internships require more time from students than a comparable class—undermining some students' ability to engage in needed paid employment—and some employers use credit-bearing internships as a substitute for paid labor. Institutions should make clear to employers that the FLSA does not prohibit student interns who earn college credit from being paid for their labor.[394]

BOX 2

THE MEYERHOFF SCHOLARS PROGRAM AT THE UNIVERSITY OF MARYLAND, BALTIMORE COUNTY, DEMONSTRATES PROVEN, HIGH-QUALITY PRACTICES FOR CAREER-CONNECTED LEARNING & EXPERIENCES IN STEM

The Meyerhoff Scholars Program at the University of Maryland, Baltimore County (Meyerhoff UMBC) is designed to achieve greater equity in STEM fields. With over 1400 alumni participants, the program is considered by many to be "the most successful program in the United States for preparing minority students for careers in academic research."[395] Meyerhoff UMBC exemplifies many of the practices recommended in this report for career-connected learning and experiences in STEM fields of study.

UMBC President Freeman Hrabowski III explains that Meyerhoff UMBC focuses on four pillars for achieving its mission of diversifying STEM fields:[396]

1. Maintaining high expectations of students, faculty, and staff;
2. Building a community where people work to help each other;
3. Involving working professionals in the program ("It takes researchers to produce researchers or scientists to produce scientists"[397]); and
4. Rigorous evaluation.

Meyerhoff UMBC focuses on 13 key components:[398]

1. Recruitment;
2. Financial aid;
3. Summer bridge;
4. Program values;
5. Study groups;
6. Program community;
7. Personal advising and counseling;
8. Tutoring;
9. Summer research internships;
10. Mentors (mentoring both by professionals in the local STEM community and by faculty mentors in research laboratories);
11. Faculty involvement;
12. Administrative involvement and public support; and
13. Family involvement.

Students report the shared senses of belonging and identity, professional development, scholarships, and academic support as particularly beneficial elements of the Meyerhoff experience.[399]

The achievements of Meyerhoff UMBC's students and alumni in STEM fields are evidence of the program's efficacy. An evaluation of Black students accepted into the Meyerhoff program at UMBC found that students who chose to attend UMBC were 4.8 times more likely to complete STEM PhDs than Meyerhoff-accepted students who chose to study elsewhere.[400]

State & Federal Policymakers Should Improve Internships Through Wages, Worker Protections & Federal Financial Aid

Raise the wage floor for all government internships. All levels of government should take the lead in paying interns fair wages to disrupt the harmful culture of unpaid internships,[401, 402] demonstrate a commitment to equitable staffing,[403] ensure that government internships are accessible to people who cannot afford to work without pay, and increase pressure on employers to pay interns.

Allow federal financial aid to fund internships to help level the playing field. Policymakers should consider a mechanism for students to seek grant-based financial aid specifically to fund internship opportunities.[404] Policymakers could also expand a Federal Work-Study experiment that facilitates off-campus student employment or reform it to link the program to internships.[405] Financial aid for internships would help students from lower-income households overcome barriers to internship success that associated costs—such as temporary relocation, short-term rental housing,[406] and professional attire—can present.

Ensure paid internships and robust worker protections. Policymakers should address the racial, gender, and class disparities in paid and unpaid internships by requiring that all interns be paid[xxviii]—which would improve structurally excluded students' access to internships.[407, 408, 409] Until all internships are paid, however, federal and state lawmakers should consider ways to significantly increase the number of paid internships available to students. For example, lawmakers could offer a tax credit to small businesses hiring enrolled, degree-seeking students as paid interns.[410] Furthermore, interns are vulnerable to discrimination, sexual harassment, and other forms of exploitation.[411] Federal, state, and local lawmakers should ensure strong labor protections for interns, whether paid or unpaid.[412, 413]

Principle 4: Data Use & Improvements to Better Understand & Pursue Equitable Outcomes for Students

Postsecondary institutions point to student career outcomes as evidence of program efficacy, but limits to the data, if left unaddressed, will undercut efforts to track and address disparate outcomes for structurally excluded students. Postsecondary education as a field—including institutions themselves, state and federal education systems, and relevant policymakers and advocates—lacks adequate data on student career outcomes nationwide.[414, 415] State and federal data collection systems hinder institutions' ability to measure and track student career outcomes over time. Changes to data collection policies and practices will help postsecondary stakeholders understand the link between career outcomes and students' postsecondary education experiences (including field of study), especially along the lines of race and gender, which is critical for decreasing postsecondary education's role in occupational segregation.[416] This principle explores how postsecondary education institutions and policymakers can facilitate improved collection and disaggregation of data to understand and pursue equitable outcomes for structurally excluded students.

xxviii Student intern pay could come from the employer, a sponsor, or a grant fund, among other possibilities. For more information see Hora, Matthew T. "Unpaid Internships & Inequality: A Review of the Data and Recommendations for Research, Policy and Practice." Center for Research on College-Workforce Transitions, University of Wisconsin-Madison, March 2022. Available at https://ccwt.wceruw.org/wp-content/uploads/2022/03/CCWT_Policy-Brief-2_Unpaid-Internships-and-Inequality-1.pdf.

CHALLENGE: INSUFFICIENT DATA COLLECTION CONTRIBUTES TO A POOR UNDERSTANDING OF STUDENTS' FIELD OF STUDY & CAREER OUTCOMES

Federal and state policy strictly limits what kind of data can be collected and shared between governmental agencies on student educational attainment and career outcomes.[417, xxix] Without addressing this structural limitation in data collection, any efforts to improve postsecondary education's role in mitigating occupational segregation are limited by inadequate information on structurally excluded students and their postsecondary experiences. The data that are currently collected do not provide an accurate picture of student experiences from entry into postsecondary education up through their bridge to employment.[418, 419] Furthermore, students obtaining a bachelor's degree in some fields of study, such as computer sciences and health care fields, take longer than six years, on average, from first enrollment to complete their degree[420]—meaning that the experiences of many students are not currently captured in federally mandated six-year completion statistics.[421]

Data limitations create additional roadblocks for stakeholders working to analyze and address equity in postsecondary education and early career.[422] The existing data systems for tracking student educational attainment and career outcomes, particularly when accounting for a student's field of study, rarely contain sufficiently-sized samples of structurally excluded students. This limits researchers, policymakers, and other stakeholders in their examination of patterns in field of study for small populations of students, particularly disaggregating further by race or gender (e.g., analyzing the experiences of American Indians and Alaska Natives and Native Hawaiian and other Pacific Islander students). Such data limitations contribute to a statistical erasure of these students from government reports that examine student outcomes by race.[423]

The small sample size for racial groups with small populations, when compounded with limited or missing information on gender, impedes analysis of and accountability for students' experiences and outcomes. In particular, the lack of institutional-level tracking of students by program of study, race, gender, and performance and completion outcomes does not allow for external oversight and accountability in improving the experiences of structurally excluded students.[424] Postsecondary institutions, students and their families, policymakers, and other stakeholders have no way to understand the experiences of students who enter, exit, or complete their degree programs or to evaluate different fields of study across universities for their commitment to structurally excluded students' success.[xxx, 425]

RECOMMENDATIONS: STRENGTHEN DATA COLLECTION TO BETTER UNDERSTAND & IMPROVE STRUCTURALLY EXCLUDED STUDENT OUTCOMES

Postsecondary institutions and federal, state, and local policymakers should work to achieve a federal student-level data system that allows for institutions and policymakers to meaningfully set and track goals related to the inclusion of structurally excluded students in segregated fields of study and their achievement in postsecondary education and early career.

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xxix In the early 2000s, the Department of Education requested Congress consider legislation to allow for student unit records to provide greater transparency about student outcomes. Lobbyists for private, nonprofit colleges (which depend on federal aid dollars for tuition, as they receive no state funding) successfully shut down the movement toward increased outcome accountability by introducing the specter of privacy concerns about student unit records. McCann, Clare, and Amy Laitinen. "College Blackout: How the Higher Education Lobby Fought to Keep Students in the Dark." New America, March 2014. Available at https://www.luminafoundation.org/files/resources/collegeblackoutfinal.pdf.

xxx Current data do not allow for analysis of field of study or of faculty by race and gender.

Postsecondary Institutions Should Track Early Career Outcomes

Track and use data on student educational and early career outcomes by field of study, race, and gender to improve student outcomes. Institutions should track students by field of study, race, and gender throughout their journey in postsecondary education and into their early careers.[426, 427] Concrete information about student educational attainment and early career outcomes by field of study, race, and gender will enable institutions to identify and address issues of inequity that harm structurally excluded students.[428, 429] The robust data set that will develop over time from consistent data collection will enable institutions to analyze areas of progress, promising ideas, and areas for improvement within and across fields of study.[430] It is imperative that institutions meaningfully engage students in the design of data collection mechanisms for student outcomes, as student input will make the data more valuable.

State & Federal Policymakers Should Track Student Outcomes & Hold Institutions Accountable for Outcomes

Rescind the student unit records ban and create a federal student-level data system that incorporates state-level data to track student outcomes by race and gender. Policymakers can help reduce postsecondary and occupational segregation by rescinding the federal student unit records ban and creating a federal student-level information system for all postsecondary institutions.[431, 432] Standards for data collection should include documenting incoming students' intended field of study and their fields of study upon graduation or exit. These data should also include a student's race and gender, among other demographic characteristics.[433, 434] As it stands, postsecondary institutions are not required to know the racial and gender identities of those students entering, dropping, or completing their degree program by field of study.[435] A federal student-level data system will help establish standards for data collection and reporting and facilitate a shared body of knowledge that institutions and other stakeholders across the country can use to evaluate the experiences of structurally excluded students.[436] States can support movement toward this goal of a federal student-level data system by implementing improvements to their student record systems.

V. Conclusion

The steep economic and social costs of occupational segregation require action. Mitigating segregation across fields of study, including by removing barriers to degree access and completion, is crucial for disrupting existing labor market segregation by race and gender. It is also essential for increasing earnings and upward career mobility for millions of workers, especially Black and Brown workers, women workers, and other structurally excluded workers.[437] As this report outlines with recommendations organized under four guiding principles, integrating occupations will require a sustained, comprehensive, and multi-pronged commitment to address the postsecondary roots of occupational segregation by key stakeholders such as policymakers and postsecondary education institutions.

VI. Appendices

Appendix I. Qualitative Methodology

A literature review and engagement with experts in the field provided us with a strong foundation from which to investigate field of study segregation in postsecondary education.

LITERATURE REVIEW

We began with a wide-ranging literature review on postsecondary educational equity, representation, and success for structurally excluded students and field of study segregation as it relates to career outcomes. We examined scholarly papers, news articles, opinion pieces, white papers, histories, and podcast interviews. Our review inspired our application of the DSI measure to investigate field of study.

EXPERT ENGAGEMENT

We also conducted interviews with 26 experts about postsecondary education's role in occupational segregation. These individuals, the majority of whom were women and people of color, came from an array of backgrounds: academia, university administration, students/recent graduates, research and policy experts, and advocates.

Appendix II. Quantitative Methodology

This section describes the quantitative methods we use in this report to examine the relationship between postsecondary education and occupational segregation through the key link of field of study segregation, which is described in Section III, "Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study." The definitions, data, and methods we use to measure field of study segregation for students, as well as several limitations, are detailed below.

DEFINING GENDER & RACE

This report analyzes field of study segregation across two key dimensions: gender and race. Gender is not binary and is not synonymous with sex assigned at birth.[438] Binary gender categories do not reflect the diversity of students' gender identities. Students can have gender identities that are different from their sex assigned at birth. This report identifies field of study segregation between men (used interchangeably with "male") and women (used interchangeably with "female") because of data availability in IPEDS and BPS. Additional data and analysis are required to identify field of study segregation for non-binary students or students of other gender identities.

Race and the related concept of ethnicity are socially created constructs that vary by society and over time.[439] Due to how the data are reported, this report treats both concepts as one and refers to them together as "race." That is, people who identify as Latinx or Hispanic in the data sources are included as a separate race category. BPS and IPEDS data also treat foreign students as a separate racial category. People whose race was unknown/other or are multiracial are not reported in our figures, nor are foreign students.

DEFINING "FIELD OF STUDY" CONCEPT

The National Center for Education Statistics (NCES) defines field of study as "the primary field of concentration in postsecondary certificates and degrees."[xxxi] In essence, it is a grouping of related majors that share common theories, methods, practices, and/or applications. Majors are more narrowly defined than fields of study and are typically a single academic discipline. For example, the majors of psychology, sociology, and economics are all considered part of the field of study called social sciences in this report.

NCES categorizes fields of study by Classification of Instructional Programs (CIP) codes. This is a taxonomy of postsecondary disciplines, which helps formalize the organization of academic fields of study for precise reporting. CIP codes are cataloged as a two-digit, four-digit, and six-digit series; with the former representing broad groupings of related academic fields into fields of study (e.g., Computer and Information Sciences and Support Services), the middle group representing what are commonly thought of as majors (e.g., Computer Programming), and the latter representing the actual names of degree programs at postsecondary institutions (e.g., Computer Game Programming).[440]

IDENTIFYING FIELD OF STUDY ACROSS DATASETS

With particular attention to race, gender, and institutional type, we investigate how degree-seeking students and recent bachelor's degree earners are distributed across fields of study. The following three publicly available datasets are used to examine field of study: The Beginning Postsecondary Students Longitudinal Study (BPS); The Integrated Postsecondary Education Data System (IPEDS); and the National Survey of College Graduates (NSCG). More information about each resource is provided in Figure 12.

FIGURE 12. Different data sources provide unique insights into postsecondary students' characteristics & experiences

Description of publicly available data sources used in this report that measure a student's field of study

Data source	Description
Beginning Postsecondary Students Longitudinal Study (BPS)	Provides longitudinal data evaluating student progress through the postsecondary education system.
The Integrated Postsecondary Education Data System (IPEDS)	Provides the following data about postsecondary institutions: admission, enrollment, financial aid, fields of study provided, various outcome measures (graduation and retention rates, as well as degrees and certificates conferred), and various resources required by such institutions.
National Survey of College Graduates (NSCG)	Provides data on the characteristics of college graduates and their career paths with a particular focus on STEM and STEM-related occupations.

Note: BPS data are available at https://nces.ed.gov/surveys/bps/. IPEDS Completions data are available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions. NSCG data are available at https://www.census.gov/programs-surveys/nscg.html.

Source: Georgetown Center on Poverty and Inequality, 2022.

xxxi The NCES formalizes relevant terms in their glossary: https://nces.ed.gov/programs/raceindicators/glossary.asp#f

Each dataset measures field of study at a different level of detail, with IPEDS offering the most detail (486 majors) and BPS offering the least detail (45 fields of study). To investigate segregation across fields of study using different datasets in a consistent manner, we mapped the available data to a single set of 10 broad field of study categories that NCES recommends for analyzing students who are enrolled in a bachelor's degree program (details discussed further below). Figure 13 lists the category labels we use and how they correspond to the labels that appear in BPS data and related publications.

FIGURE 13. Field of study categories used in this report are designed to analyze baccalaureate students

Correspondence between field of study category labels used in this report & BPS data

Label Used in This Report	BPS Value Labels
Computer sciences	Computer and information sciences
Engineering	Engineering and engineering technology
Natural sciences & math	Biological & physiological sciences, science technology, math, agriculture
General studies	General studies and other
Social sciences	Social sciences
Humanities	Humanities
Health care	Health care fields
Business	Business
Education	Education
Other applied	Other applied
Undeclared	Undecided or Undeclared

Note: The BPS variable "MAJORS4Y" aggregates 23 undergraduate fields of study, classified according to the U.S. Department of Education's Classification of Instructional Programs 2010 edition, into 10 categories recommended by the National Center of Education Statistics for analyzing bachelor's degree students. Labels used in this report shorten those categories to simplify in-text references and figure labels.

Source: Georgetown Center on Poverty and Inequality, 2022.

Figure 14 shows the distribution of students across fields of study for the three datasets we use across the same 10 categories for field of study. We find a roughly similar distribution of students/graduates across fields of study despite the different underlying samples and the different years these data represent.

FIGURE 14. Overall pattern of field of study distribution is relatively consistent among data sources

Percent of students across fields of study by data source

	Computer Sciences	Engineering	Natural Sciences & Math	General Studies	Social Sciences	Humanities	Health Care	Business	Education	Other Applied
BPS (2012)	3	7	12	5	15	11	9	16	6	17
IPEDS (2020)	3	6	11	5	13	10	12	19	5	16
NSCG (2019)	5	8	13	3	14	11	12	16	5	13

Note: BPS sample includes students who originally pursued a two-year or four-year degree beginning in 2012, expected to complete a bachelor's degree or higher at enrollment, and completed a bachelor's degree by 2017 and omits undeclared students. IPEDS data represent bachelor's degrees awarded in 2020 (second bachelor's degrees awarded have been removed from the results). NSCG data include persons ages 25-44 who earned at least a bachelor's degree. Field of study categories are those recommended by the National Center for Education Statistics when analyzing four-year degree-seeking students. Percentage estimates are rounded to the nearest whole number and may not add to 100.

Source: Georgetown Center on Poverty and Inequality, 2022 analysis of 2012/17 Beginning Postsecondary Study data (available at https://nces.ed.gov/surveys/bps/), 2020 Integrated Postsecondary Education Data System Completion component data (available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions), and 2019 National Survey of College Graduates data (available at https://www.census.gov/programs-surveys/nscg.html).

MEASURING FIELD OF STUDY SEGREGATION WITH THE DUNCAN SEGREGATION INDEX

The Duncan Segregation Index (DSI)—also known as the Index of Dissimilarity—is conventionally used to measure occupational segregation across several fields between two populations (e.g., the distribution across detailed occupations by sex). Although these two groups must be mutually *exclusive*, they aren't always mutually *exhaustive* (e.g., Black and white workers may be of different racial groups but are not the only two groups who can be considered). The DSI measure yields a value ranging from zero to one, indicating the proportion of a given group (e.g., men) that would need to change their occupation to achieve an even distribution with a second group (e.g., women) across fields. For example, a DSI value of 0.35 indicates that 35 percent of men in the workforce would need to change to different occupations to achieve the same distribution of women across all occupations assuming no women changed occupation and a constant population (i.e., no men or women entered or left the workforce). Furthermore, the interpretation of DSI values is symmetrical. Using the same example, one could equally have said that 35 percent of women in the workforce would need to change their occupations to achieve the same distribution as men.

The DSI measure, as it is most frequently applied, sums the difference in distributions between men and women across occupations (e.g., general manager, lawyer, nurse, social worker, etc.) and halves the absolute value of the total. The process of calculating the DSI value across occupations by gender can be expressed in a formula, as shown below:

$$\text{DSI Value} = \frac{\sum |w_i - m_i|}{2}$$

Where w_i indicates the fraction of women in a given *i* occupation (e.g., social work) relative to all employed women, and m_i indicates the fraction of men in that same *i* occupation relative to all employed men. The difference between these two values is summed across all *i* occupations and then halved. Taken to its extremes, values of zero and one indicate complete integration or exclusion, respectively, across the labor force.

We apply the DSI to measure postsecondary field of study segregation among students by gender between male and female students and by race between pairs of racial groups using the 10 fields of study categories listed in Figure 13. For example, extending the DSI to measure field of study segregation between Black and white students would change the above formula as follows:

$$\text{DSI Value} = \frac{\sum |B_i - w_i|}{2}$$

Where B_i indicates the fraction of Black students in a given *i* field of study (e.g., health care) relative to all Black students. w_i indicates the fraction of white students in that same *i* field of study relative to all white students. The difference between these two values is summed across all *i* fields of study and then halved. A DSI value of 0.16 indicates that 16 percent of Black students would need to change to different fields of study to achieve the same distribution of white students across all fields of study or vice versa.

In a similar fashion, we extend this approach to measure postsecondary field of study segregation across combined demographic characteristics—such as gender *and* race or race *and* starting institution—always comparing two separate groups of students at a time.

Notably, we use DSI to measure the extent to which field of study segregation occurs in postsecondary education at the national level. This can be compared to recent research that examines field of study segregation at the institutional level, which finds important consequences on earnings where racial segregation is high.[441] By using DSI to identify field of study segregation, we apply methods similar to those first found in "The Sex-Segregation of Fields of Study,"[442] published in 1986. That study analyzes field of study segregation by gender from the 1940s to the 1980s. Our analysis provides a much-needed update and explores field of study segregation from 1990 to 2020. Similar research has looked at "preoccupational segregation" by gender within race for select fields of study of first-year students,[443] by gender within race for STEM fields of study,[444] and between Black and white students across all fields of study.[445]

USING BPS TO MEASURE FIELD OF STUDY SEGREGATION OF BEGINNING STUDENTS BY STUDENT & INSTITUTIONAL CHARACTERISTICS

The Beginning Postsecondary Longitudinal Study (BPS) dataset is ideal for measuring field of study segregation of students at the start of their undergraduate studies. The BPS is a longitudinal survey that is designed to follow first-time undergraduate students for a period of six years and captures a wealth of information on their characteristics, experiences, and the institutions they attend. In particular, BPS data on the original (i.e., first-declared) field of study for first-year students is more accurate than similar data from the National Postsecondary Student Aid Study (NPSAS). While the BPS is based on the NPSAS sample frame, data on field of study are superior because they include revisions based on student follow-up to reflect students' original fields of study more accurately. Neither IPEDS nor NSCG measures a student's original field of study.

Our analysis uses BPS data from 2012–2017 and includes only students enrolled in a two-year or four-year degree program who said they aimed to earn a bachelor's degree or higher based on the question "What is the highest level of education you ever expect to complete at any school?" The data allow us to quantify the relationship between the institutional characteristics and the degree of segregation by field of study for attending students based on the student's gender and race. The dataset aggregates fields of study from the U.S. Department of Education's Classification of Instructional Programs (CIP 2010) to the 10 categories shown in Figure 13, making it a suitable dataset to investigate the effect on those seeking a bachelor's degree. This analysis with BPS data helps to shed light on the extent to which colleges may be addressing and/or exacerbating field of study segregation.

USING IPEDS TO MEASURE FIELD OF STUDY SEGREGATION BY RACE & GENDER

The Integrated Postsecondary Education Data System (IPEDS) provides data reported at the institution level on a variety of topics, including admission, enrollment, financial aid, institution characteristics, and various postsecondary education outcome measures (e.g., graduation and retention rates). We used the completion component dataset, which contains information on degrees conferred during a given year along with some basic information about the students who earned those degrees. These data were used to examine field of study segregation by race and gender from 1990 to 2020 for students obtaining a bachelor's degree (note: dual degree students were removed from the dataset for years after 2002). Since the dataset is administrative in nature, it is not subject to sampling error, which allows us to apply an intersectional lens across race and gender without the concern of statistically unreliable estimates.

Field of study was collapsed into the aforementioned 10 categories in the following manner: First, CIP codes were collapsed to their broader two-digit format. To compare these fields to the BPS two-digit CIP codes, data from 2012 to 2020 used the CIP 2010 classification, while data from years prior to 2012 used historic crosswalks provided by the National Center for Education Statistics (NCES). Once aligned with BPS two-digit CIP codes, the fields were further mapped onto the 10-category grouping consistent with the BPS codes. Prior to 2010, Asian and Pacific Islander are measured as a single race category, and students of more than one race are not identified. Students identifying as Latinx as well as foreign students are treated as a separate race group. Thus, precision in identifying differences between these racial groups is strongest in our analyses using data after 2010.

Finally, to test the sensitivity of our analysis of field of study segregation based on IPEDS data, we repeated our analysis controlling for institutional characteristics. Specifically, the extent of field of study segregation by race was measured in 2020 while excluding private universities and HBCUs separately. Additionally, we ran a third test examining field of study segregation by race for students graduating from public doctoral universities. In each case, overall patterns of field of study segregation were consistent, suggesting that field of study segregation is pervasive throughout postsecondary educational settings.

USING NSCG TO MEASURE FIELD OF STUDY SEGREGATION BY STUDENT & INSTITUTIONAL CHARACTERISTICS

The National Survey of College Graduates (NSCG) allows us to compare field of study segregation between those who began their postsecondary education at a two-year institution with those who began at a four-year institution—and further evaluate those differences across race or gender. More than a third of first-year degree-seeking undergraduate students who expect to earn a bachelor's degree start at two-year colleges,[446] and about one-quarter of bachelor's degree holders under age 45 started at a community college.[447] It is important to measure how these students' fields of study compared to those of students who begin bachelor's degrees at four-year institutions. We used 2019 NSCG data for bachelor's degree holders who were 25-44 years of age and manually cross-walked the 136 fields of study onto the aforementioned 10 broader categories used in BPS data.

LIMITATIONS OF FIELD OF STUDY DEFINITIONS

The level of aggregation in fields of study is important in determining how much segregation is measured, and aggregation choices might obscure deeper patterns of segregation. Some fields of study appear to be well integrated along racial lines but contain specific majors that are substantially segregated. For instance, the computer sciences field of study is relatively integrated overall compared to other STEM fields of study, but there are significant racialized differences in the enrollment patterns of computer science majors and information sciences majors. Similarly, the other applied field includes majors such as "construction trades" and "communications, journalism, and related programs," which range from being generally male-dominated to more gender-ambiguous, respectively. These underlying patterns are not captured by the DSI measure when aggregating fields of study to the 10 categories used in this report, which suggests that there may be more segregation across majors than across the fields of study discussed in this report.

In addition, our DSI analysis in Section III, "Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study," measures field of study segregation at the national level, but it does not necessarily represent what is happening within a particular institution. The levels of segregation for any specific university will be influenced by its unique history, geography, and institutional missions. Other research, however, does examine racial field of study segregation within colleges and universities and finds that Asian students are the most isolated from their university peers, followed by Black and Latinx students.[448] Black students, in particular, are less likely to graduate in majors associated with high-paying careers, and this segregation is worse in highly selective institutions.[449] White students, on the other hand, appear to be more likely to be evenly distributed across majors compared to students from other race categories.[450]

LIMITATIONS OF MEASURING FIELD OF STUDY SEGREGATION WITH DSI

DSI is a useful measure to understand racial and gender segregation across fields of study, but it does have certain limitations. DSI is a point-in-time measure, and the categories we use do not account for students who leave college after their initial enrollment. Thus, students are not captured by this measure if they decide to leave the institution without earning a degree, whether from experiences related to structural exclusion or otherwise. Relatedly, our measure does not account for changes in the gender or racial composition of the incoming first-year class.[451]

Additionally, the DSI measure compresses large amounts of information into a single value, which can result in incomplete or even misleading conclusions. For example, DSI values of the same magnitude do not capture how that segregation manifests across the groups who are being analyzed. Thus, DSI values are best interpreted as higher-level representations of a phenomenon rather than conclusive measures that describe comparable situations across groups.

Finally, as a single DSI value is a pair-wise comparison of two subpopulations, it omits information on other populations not included. When DSI is used to analyze segregation for demographic characteristics where there are more than two categories, such as race, a single DSI value cannot capture and does not represent the total extent of segregation among all groups. Interpreting DSI values is always limited to the two groups directly involved.

USING BPS TO MEASURE STUDENT OUTCOMES BY ORIGINAL FIELD OF STUDY

To account for how postsecondary institutions produce different outcomes for students based on gender or race once enrolled, we used BPS data to calculate the share of students who go on to earn a bachelor's degree in their original field of study for each field of study. Calculating these estimates using publicly available data through PowerStats required combining results from two separate tables. The first table looks at the distribution of students by original field of study who completed a bachelor's degree within six years of enrollment. The second table includes only students who earned a bachelor's degree within the six-year study period and whether their last reported field of study was the same as their original field of study for each field of study. The last reported field of study variable was used as opposed to the field of study based on transcript data because the sample sizes are larger, and the overall patterns remain the same.

Appendix III. DSI Values Showing Field of Study Segregation by Race for Beginning & Graduating Students

This report presents figures showing the distribution of students across fields of study by gender and by race. The share of students in a field of study is easy to interpret and useful for examining how students' pursuit of specific fields of study differ based on such characteristics, such as in Figure 5 (See Section III, "Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study.")

We also identify segregation using the Duncan Segregation Index (DSI). The DSI is a value between zero and one that allows us to compare differences across fields of study that students pursue between two separate groups. For each figure in Section III, "Students in Postsecondary Education Experience Substantial Segregation Across Fields of Study," that presents the distribution of students across fields of study by their individual or institutional characteristic, we also calculate DSI values between the relevant groups and present those results below. This section presents all pair-wise DSI values for Figures 5 and 9, which show the distribution of students across fields of study by race for first-year degree-seeking undergraduate students in 2012 and students graduating with a bachelor's degree in 2020, respectively.

INTERPRETING PAIR-WISE DSI VALUES IN FIGURES

Before presenting accompanying figures with DSI values, we walk through how to interpret these figures using Figure 15 as an example, which has been reproduced below. DSI values always represent the degree of segregation between two mutually exclusive populations, identified as categories of a characteristic we are interested in examining. We present these DSI values in a table where each category of a given characteristic is listed in both the rows and columns of the table. Example Figure 15 below shows the DSI values that correspond to the disparate enrollment patterns across race categories in their first year for students in a two- or four-year degree program. To find the DSI value between Black and white students, for example, we need to find the cell where the two categories intersect. That value here is 0.16. Again, this value (multiplied by 100) represents the percentage of Black students (16 percent) who would need to switch their fields of study so that they have the same field of study distribution as white students or vice versa. The tables are symmetrical in that every pair-wise combination in the lower-left portion of the table has a corresponding match in the upper-right hand portion of the table. Repeated values in the upper-right-hand portion of the table are darkened to simplify interpretation.

PAIR-WISE DSI VALUES

Below are figures that present pair-wise DSI values for field of study segregation by race for students beginning a two- or four-year program in 2012 (BPS) and students who earned a bachelor's degree in 2020 (IPEDS).

FIGURE 15. Students experience substantial field of study segregation by race when they begin college

Duncan Segregation Indices (DSIs) across original fields of study by race for first-year students, 2012

	White	Black	Latinx	Asian	AIAN	NHOPI
White	0.00	0.16	0.10	0.19	0.18	0.25
Black	0.16	0.00	0.11	0.28	0.19	0.27
Latinx	0.10	0.11	0.00	0.25	0.20	0.25
Asian	0.19	0.28	0.25	0.00	0.22	0.30
AIAN	0.18	0.19	0.20	0.22	0.00	0.33
NHOPI	0.25	0.27	0.25	0.30	0.33	0.00

Note: Includes students originally pursuing a two-year or four-year degree beginning in 2012. Field of study categories are those recommended by the National Center for Education Statistics to use when analyzing four-year degree-seeking students. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Estimates by field of study for foreign students and students of more than one race were omitted from this figure.

Source: Georgetown Center on Poverty and Inequality analysis of 2012/17 Beginning Postsecondary Study data. Available at https://nces.ed.gov/surveys/bps/.

FIGURE 16. Students earning a bachelor's degree are substantially segregated across fields of study by race

Duncan Segregation Indices (DSIs) across fields of study by race for students graduating with a bachelor's degree, 2020

	White	Black	Latinx	Asian	AIAN	NHOPI
White	0.00	0.13	0.08	0.16	0.07	0.10
Black	0.13	0.00	0.09	0.23	0.08	0.08
Latinx	0.08	0.09	0.00	0.19	0.07	0.10
Asian	0.16	0.23	0.19	0.00	0.21	0.21
AIAN	0.07	0.08	0.07	0.21	0.00	0.06
NHOPI	0.10	0.08	0.10	0.21	0.06	0.00

Note: Universe consists of undergraduates earning a bachelor's degree in 2020 using Integrated Postsecondary Education Data System (IPEDS) datasets. People who identify as Latinx or Hispanic are included as a separate race category. AIAN refers to American Indian and Alaska Natives; NHOPI refers to Native Hawaiian and Other Pacific Islanders. Students whose race was recorded as foreign, multiracial, or "unknown" were omitted from this figure.

Source: Georgetown Center on Poverty and Inequality analysis of 2020 Integrated Postsecondary Education Data System Completion component data. Available at https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions.

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