Nos. 20-1199 & 21-707

IN THE

Supreme Court of the United States

STUDENTS FOR FAIR ADMISSION, INC.,
Petitioner,

vs.

PRESIDENT AND FELLOWS OF HARVARD COLLEGE,
Respondent.

STUDENTS FOR FAIR ADMISSION, INC.,
Petitioner,

vs.

UNIVERSITY OF NORTH CAROLINA, *ET AL.*,
Respondents.

On Writs of Certiorari to the
United States Courts of Appeals
for the First and Fourth Circuits

BRIEF OF *AMICI CURIAE* INDIVIDUAL SCIENTISTS IN SUPPORT OF RESPONDENTS

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TABLE OF CONTENTS

TABLE OF AUTHORITIES

Page(s)

IDENTITY AND INTEREST OF *AMICI CURIAE*[1]

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[1] *Amici Curiae* certify that no counsel for any party authored this brief in whole or in part, no party or its counsel made any monetary contribution intended to fund the preparation or submission of this brief and that no person or entity other than the *Amici* or their counsel made such a contribution. All parties have consented to the filing of this brief.

(AIP); Jami Valentine Miller, PhD Physics & Astronomy, Founder of African American Women in Physics, Inc. (AA WIP); and Jesus Pando, PhD Physics, Chair and Associate Professor of Physics and Astrophysics, DePaul University.

Each individual is interested in ensuring that the respective fields of study and the institutions they serve today and may serve in the future benefit from a diverse population of students and faculty because diverse groups empirically achieve more success than homogenous groups in endeavors requiring innovation, collaboration and creativity, particularly in science, technology, engineering and mathematics. Accordingly, each believes that academic institutions, including Harvard College and the University of North Carolina, should consider race, gender, and ethnicity as a positive factor in favor of individuals who are members of underrepresented minorities in undergraduate and graduate admissions decisions. Indeed, the *Amici* are deeply concerned that prohibiting such considerations will inevitably reverse the progress that has been made in improving the diversity of teams engaged in scientific exploration and that such a reversal will impair scientific inquiry and discovery at a time of dire need.

The *Amici* note that they file this brief and make the statements in it in their personal capacities and not as representatives of their employers or groups with which they are affiliated.

SUMMARY OF ARGUMENT

The STEM education *amici* address three topics: (1) diversity in the STEM community is crucial to arriving at innovative solutions; (2) mismatch theory is not supported by credible, comprehensive evidence and is debunked when incomplete and biased assumptions are examined; and (3) race-conscious admissions policies catalyze positive change in STEM culture.

1. The STEM community seeks innovation. A diverse scientific community propels innovation that is more rigorous because diverse teams are better at

solving research problems. Of the five types of diversity studied, ethnic diversity best correlated with scientific innovation. Indeed, "demographically underrepresented students innovate at higher rates than majority students."[2] Gaps in scientific research emerge from a lack of diverse perspectives, especially on women's health, including less research on increasing maternal mortality rates among Black women. A diverse scientific community fills these gaps. By working in diverse environments, the scientific community uses its full range of knowledge to produce the best research.

Yet, Hispanic and Black Americans are significantly underrepresented in the STEM community. Adult Hispanic individuals account for 15% of the U.S. population, and adult Black individuals account for 12% of the U.S. population. Yet, in 2015, Hispanic and Black individuals made up only 6% and 5%, respectively, of the STEM industry workforce, and an even smaller percentage in academia.[3] Race-conscious decisions expanding STEM educational opportunities promote diversity in STEM academia and industry and lead to rigorous scientific progress on which our economy and society relies.

2. Mismatch theory—which counsels against expanding STEM-based educational opportunities to promote diversity—lacks evidentiary support and is debunked when its incomplete and biased as-

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[2] Bas Hofstra, *et al.*, *The Diversity-Innovation Paradox in Science*, PNAS, April 28, 2020 at 9284, https://www.pnas.org/doi/pdf/10.1073/pnas.1915378117

[3] According to the NSF Survey of Earned Doctorates from 2020, Table 22 (https://ncses.nsf.gov/pubs/nsf22300/data-tables). From STEM disciplines (life sciences, physical sciences, math, engineering, and psychology), Hispanic Americans earned 4.7%, Indigenous earned 0.1%, Asian Americans earned 6.2%, and Black Americans earned 3.3% of the 42,622 STEM PhDs awarded in the US in 2020.

sumptions are scrutinized. Among these faulty assumptions is that faculty members lecture to the median student so that a student with less prior academic preparation in STEM disciplines will be unable to "keep up" in those fields. This is unsupported by persuasive empirical data and fails to account for other factors that can remediate, compensate for, or neutralize adverse effects of prior inadequate academic preparation. Data indicates that Black students fare better when attending "more selective" institutions. Data shows that at highly ranked institutions, all groups succeed in roughly equal proportions. To rely on mismatch theory to shut the door on minority-student attendance at highly ranked institutions breaks the pipelines for future minority students to enter the STEM community.

Further, the premise that members of advantaged groups lose opportunities because of affirmative action suffers from a causation fallacy. The data establishes that affirmative action is not inherently the cause for any one candidate's lack of admission, qualification, or consideration. Attacking affirmative action on this basis scapegoats a policy intended to counteract vast inequalities existing from before the inception of our nation, a policy that is vital to innovation in STEM fields.

3. Race-conscious admissions policies catalyze change in STEM culture and advance innovation. The culture in educational environments underlies the experiences of educators and students, and forms the foundation for teaching and learning. The culture that permeates STEM education is pivotal to attracting and engaging students. Research shows that the culture that students encounter in STEM education profound effects their interest, self-concept, sense of connectedness, and persistence in these disciplines. For historically underrepresented students, how race, ethnicity, and gender function in their college environment are vital to their social and academic adjustment. Underrepresented students who experience a hostile or

unwelcoming college racial culture risk social and academic withdrawal. Conversely, underrepresented students who encounter a welcoming racial environment are more likely to persist and succeed. Further, a diverse student body will promote a more diverse workforce which leads to better scientific solutions. Moreover, policies seeking to bring the numbers of minority students to more proportional levels are vital to ongoing work to combat bias in scientific research.

For these reasons, race-conscious admissions policies promote diversity, equity, and inclusion in STEM education. A diverse STEM academic community in turn is vital to producing the diverse workforce necessary to perform better scientific work critical to our country and its global competitiveness.

ARGUMENT

I. Diversity is invaluable to ensuring the success of the STEM community.

Diversity is vital to the success of the STEM community. The STEM community is critical to human progress and the ability of the United States to compete globally.

Science and technology underpin the success of the U.S. economy, Americans' quality of life and health, and U.S. national security. Diversity can be key to the strength of the nation's society, economy, and postsecondary institutions.[4] As Dr. Shirley Malcom of the American Association for the Advancement of Science said, "[t]he abundance and safety of the food we eat, the quality of the water we drink, the adequacy of our public health structures and our ability to combat diseases, the ability to protect our nation's security at

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[4] National Academy of Sciences, *et al*., *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*, THE NATIONAL ACADEMIES PRESS (Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, *et al.* eds., 2011).

home and abroad, and the safety and robustness of our infrastructure are—at the most fundamental level—products of the investments that the country has made in science, technology, engineering, mathematics, and biomedical research and education."[5] Researchers and policymakers note the importance of STEM capabilities in the U.S., recognizing the STEM community's major role in American society.[6] STEM research leads to technological and medical advances vital to human life and society. The bedrock of scientific progress is innovation. Innovation expands humanity's knowledge, and propels scientists to explore unchartered territories. Diversity in the STEM community drives innovation.

Hispanic and Black members of the STEM industry are underrepresented when compared to the U.S. population. Adult Hispanic people account for 15% of the U.S. population, and adult Black people account for 12% of the U.S. population.[7] Yet, in 2015, Hispanic and Black people made up only 6% and 5%, respectively, of the STEM industry workforce.[8] Minority populations are also significantly underrepresented in STEM academia. Black people comprise only 1% of the

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[5] *Achieving the Promise of a Diverse Stem Workforce*; *Hearing before the Committee on Science, Space, and Technology*, 116th Cong. (2019) (Written Testimony of Dr. Shirley Malcom, American Association for the Advancement of Science, *HHRG-116-SY00-Wstate-MalcomS-20190509.pdf (congress.gov).

[6] *Id.*

[7] *Id.*

[8] National Science Board, *Science and Engineering Indicators 2018*, 409–17, (Jan. 15, 2018), https://www.nsf.gov/statistics/indicators/ (In 2015, the U.S. STEM industry employed 6.4 million workers. Of those, 67% were White, 21% were Asian, 6% were Hispanic, and 5% were Black.).

country's astronomy faculty and Hispanic people comprise only 3%,[9] eight times below these groups' joint representation in the U.S. population.[10] As of 2016, there was only one astronomy department with both Black and Hispanic faculty members.[11] About two-thirds of the astronomy departments had neither.[12] Not having access to minority mentors working in academia reduces the underrepresented student populations that choose to pursue STEM degrees.

Another significant obstacle to increasing diversity in STEM education is a lack of exposure of members of underrepresented populations to the sciences.[13] For many members of underrepresented populations, college may be the first exposure to STEM work, especially for first generation college students. Demographic trends reveal that universities are failing to attract and advance diverse talent. About 2.5% of all White first-year students intend to major in the physical sciences rather than the 1.5% of Black, Hispanic and American Indian/Alaska Native first-year students who intend to do so.[14] Further, 11% of White students intending to major in the physical sciences will earn a degree in physics or astronomy.[15] Only 4% of

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[9] THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE, PATHWAYS TO DISCOVERY IN ASTRONOMY AND ASTROPHYSICS FOR THE 2020S, app. N-8 (The National Academic Press 2021).

[10] *Id.*

[11] *Id.*

[12] *Id.*

[13] Selby Frame, *National Conference Shows Underrepresented Researchers Making Strides*, AMERICAN ASS'N FOR THE ADVANCEMENT OF SCIENCE, (2014), https://www.aaas.org/news/national-conference-shows-underrepresented-researchers-making-strides.

[14] *Supra* note 9 at app. N-6.

[15] *Id.*

students from underrepresented populations with the same intent will earn a physics or astronomy degree.[16] The growing diversity of the U.S. population increases the importance of having a scientific community representative of the society it serves.

Universities' failure to attract and advance diverse talent has long-term consequences for the diversity of the STEM workforce. For example, the 2020 NASA Science Plan states, "As research has shown, diversity is a key driver of innovation and more diverse organizations are more innovative. … NASA believes in the importance of diverse and inclusive teams to tackle strategic problems and maximize scientific return."[17] Like NASA, the NIH, NSF, and DOE all have strategic plans to further diversity in the STEM profession.[18] To supply the pool of diverse talent the STEM profession needs, universities must be able to garner a diverse student population.

A. Cultural diversity and cooperation are critical to successful innovation.

Diversity in the STEM community increases the pursuit and attainment of innovative solutions.[19] Scientists from underrepresented groups have concerns, perspectives, and experiences that differ from tradi-

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[16] *Id.*

[17] *Id.* at N-8.

[18] *Id.* at N-18.

[19] Sylvia Ann Hewlett, *et al.*, *How Diversity Can Drive Innovation*, HARVARD BUSINESS REVIEW (2013), https://hbr.org/2013/12/how-diversity-can-drive-innovation; Massachusetts Institute of Technology, *Workplace diversity can help bottom line, study shows*, Science Daily, (Oct. 6, 2014), https://www.sciencedaily.com/releases/2014/10/141006114053.ht; Bedoor K. Alshebli, *et al.*, *The preeminence of ethnic diversity in scientific collaboration*, NATURE, (2018),https://www.nature.com/articles/s41467-018-07634-8#Sec7.

tionally-represented groups in STEM. Including diverse members in the STEM community helps solve historically overlooked problems and leads to better solutions to problems generally.[20]

All scientific disciplines are knowledge communities that pursue questions based on experience and cultural knowledge.[21] A scientist must first recognize a problem before developing an innovative solution. Unsurprisingly, underrepresented scientists seek out under-researched topics, exposing gaps in prior research and re-examine prior results. A diverse scientific community creates more robust innovation because diverse individuals pursue under-researched topics and reconsider unchallenged premises.[22] The STEM community requires greater diversity of perspectives to arrive at the innovative solutions required for our society to thrive.

Diverse groups are collectively smarter and more innovative than homogeneous groups.[23] Achieving greater diversity in STEM education improves innovation by increasing the perspectives and range of knowledge represented, and improves the culture in STEM education for underrepresented populations by acknowledging that their contributions are an essential component of collaborative innovation. Moreover, diversity in STEM education also benefits our economy

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[20] Bas Hofstra *et al*., *The Diversity-Innovation Paradox in Science*, PNAS, (2020), https://www.pnas.org/doi/pdf/10.1073/pnas.1915378117.

[21] *Supra,* note 19.

[22] *Supra,* note 5.

[23] Scott E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*. Princeton, NJ: Princeton University Press (2007).

because diversity drives the innovation critical to economic growth.[24]

Innovation requires creativity and the courage to ask new questions and seek out potential answers. Homogeneous groups likely ask similar questions,[25] while heterogeneous groups ask different questions because members bring unique perspectives and experiences.[26] Thus, diverse groups find better solutions.[27]

Encouraging myriad approaches and skill sets promotes innovation.[28] Yet, the historical discounting of minorities' innovations and novel contributions may help explain their current under-representation in STEM education.[29] For instance, NASA mathematician Katherine Johnson provided the mathematical basis for America's first human spaceflight in 1961 and first orbital mission in 1962. After a long process ultimately acknowledged her contributions, she became the first woman at NASA to receive credit and recognition for her superior work.[30] A diverse team of scientists and mathematicians from the United States bested the more homogeneous team from the Soviet Union, landing a man on the Moon. Consider as well

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[24] Bill Snyder, *How Innovation Drives Economic Growth*, Stanford Business, (June 24, 2019), https://www.gsb.stanford.edu/insights/how-innovation-drives-economic-growth.

[25] Christin Wiedemann, *Why Diversity is Crucial to Success in STEM*, CERIC, (Feb. 6, 2019), https://ceric.ca/2019/02/why-diversity-is-crucial-to-success-in-stem/.

[26] *Id*.

[27] *How STEM Education Drives Business Innovation*, Geotab, (Nov. 1, 2021), https://www.geotab.com/blog/stem-education/.

[28] *Id*.

[29] *Supra,* note 20.

[30] Margaret Lee Shetterly, *Katherine Johnson Biography,* NASA, (Feb. 24, 2020), https://www.nasa.gov/content/katherine-johnson-biography.

the James Webb Telescope program, directed by NASA engineer Gregory Robinson.[31] Our diversity drives that innovation and provides us with a competitive advantage that our global competitors lack.

Studies suggest that reducing diversity in STEM education would slow innovation.[32] "Demographic groups with lower rates of S&E [(science and engineering)] participation represent an underutilized source of human capital for S&E work," and their exclusion "negatively impact[s] productivity and innovation."[33] In addition to expanding scientific innovation, diverse STEM populations enhance the quality of research by allowing the group to explore a broader range of unexplored methodologies.[34] Evidence establishes that a diversity of backgrounds fosters greater collective innovation than individual ability alone.[35] Scientific accuracy is improved when a group's bias and errors cancel one another, a phenomenon promoted by a diversity of backgrounds.[36] Chemist, inventor and innovator Joseph DeSimone is attributed with recognizing that "[a] successful scientific endeavor is one that attracts a diversity of experience, and cultivates those differences, acknowledging the creativity they spark."[37] A 2018 study found that ethnic diversity

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[31] *See* James Webb Space Telescope, *Meet the Team – Team Biographies*, https://webb.nasa.gov/content/meetTheTeam/people/index.html (last visited Jul. 28, 2022, 4:56 PM).

[32] *Supra,* note 25.

[33] *Supra,* note 8.

[34] *Supra,* note 20.

[35] *Supra,* note 23.

[36] Douglas L. Medin & Carol D. Lee, *Diversity Makes Better Science*, ASSOCIATION FOR PSYCHOLOGICAL SCIENCE, (April 27, 2012), https://www.psychologicalscience.org/observer/diversity-makes-better-science.

[37] *Achieving the Promise of a Diverse STEM Workforce*: *Hearing before the Committee on Science, Space, and Technology*, 116th

alone resulted in a scientific impact gain of 10% for papers and of 48% for scientists themselves.[38] This study analyzed five types of diversity: ethnicity, discipline, gender, affiliation, and academic age.[39] Of these, ethnic diversity had the strongest correlation with positive scientific impact.[40] Diversity leads to better scientific work and more innovative solutions.

B. Underrepresented minorities' perspectives are important for developing scientific solutions for societal issues.

Scientific practices are cultural, and dynamic diverse relationships within these practices are essential to their adaptability and growth.[41] Social-science researchers often choose to study populations that mirror their own, leading to "convenience samples."[42] If the social-science researchers lack diversity, then the populations they choose to study will also lack diversity. Reliance on "convenience samples" hurts scientific research, limiting results to a narrow slice of humanity.[43]

Cong. (2019) (Written Testimony of Dr. Shirley Malcom, American Association for the Advancement of Science), *HHRG-116-SY00-Wstate-MalcomS-20190509.pdf (congress.gov).

[38] Bedoor K. Alshebli, *et al.*, *supra* note 19.

[39] *Id.*

[40] *Id.*

[41] *Supra,* note 36.

[42] *Id.*

[43] *Id.*

These results should not be generalized to other populations, but often are.[44] Gaps in scientific research resulting from the lack of diverse perspectives are pervasive, including a lack of research on women's health generally and particularly on the increasing maternal mortality rates among Black women. Research is also lacking regarding artificial intelligence and facial recognition on minority populations.[45]

As with all human endeavors, scientific discovery benefits from its participants not being disproportionately from a particular race, ethnicity, or gender.[46] Diversity results in better science.[47] As professional scientists, the success of whose professional endeavors are reliant on the critical principle of objectivity, A*mici* are vitally aware that racial, ethnic, and gender bias exists within the domain of science.[48] Diverse perspectives, values, and cultural practices are critical to ensuring objectivity in all fields of science. Teams engaged in scientific pursuits "work smarter" and more successfully when their members are diverse.[49] "People from diverse backgrounds may alter the behavior of a

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[44] Joseph Henrich, *et al*., *The weirdest people in the world?* BEHAVIORAL AND BRAIN SCIENCES 33, 61-135 (2010), https://henrich.fas.harvard.edu/files/henrich/files/henrich_heine_norenzayan_2010-2.pdf.

[45] Alex Najibi, *Racial Discrimination in Face Recognition Technology*, Social Policy and Social Justice BLOG (Oct. 24, 2020), https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-technology/

[46] *Cf*. Brief for Lt. Gen. Julius W. Becton, Jr., *et al*. as Amici Curiae Supporting Respondents, Fisher v. Univ. of Tex. at Austin, 579 U.S. 365 (2016) (No. 11-345).

[47] *Supra,* note 36.

[48] *See id*.

[49] David Rock & Heidi Grant, *Why Diverse Teams are Smarter*, Harvard Business Review, (Nov. 4, 2016), https://hbr.org/2016/11/why-diverse-teams-are-smarter.

group's social majority leading to improved and more accurate group thinking."[50] The value of improved and more accurate collaboration among scientists is inestimable, and our country and humankind depend upon it to survive.

II. Minority students attending highly ranked institutions fare better than their peers in less selective programs.

Mismatch theory would have us believe that students attending institutions where their academic competencies are ranked lower than those typically admitted leads to the mismatched student's loss of academic performance and diminished success later in life because of that underperformance.[51] The mismatch theory, however, is not supported by credible evidence and is debunked through critical examination and actual evidence.

A. Mismatch theory rests on faulty assumptions.

The faulty assumptions upon which mismatch theory rests include that professors, in their respective institutions, "pitch their lectures to the level [of academic competency] of the median student, and…that students with academic credentials much below the school's median student will be unable to keep up."[52]

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[50] *Id*.

[51] *See generally*, Rick Sander, *An Emerging Scholarly Consensus on Mismatch and Affirmative Action (Ideologues Not Welcome),* Wash. Post, Dec. 10, 2015, https://www.washingtonpost.com/news/volokh-conspiracy/wp/2015/12/10/an-emerging-scholarly-consensus-on-mismatch-and-affirmative-action-ideologues-not-welcome/.

[52] Richard Lempert, *Mismatch and Science Desistance: Failed Arguments Against Affirmative Action*, UCLA L. REV. (June 12, 2016), https://www.uclalawreview.org/mismatch-science-desistance-failed-arguments-affirmative-action/.

Yet there is no empirical data supporting the assumption about the level at which professors deliver instructions, assignments, and lectures. Additionally, alternative methods to enhance student outcomes readily exist. The mismatch theory does not account for the benefits provided by office-hour conversations and subsidized and peer tutoring, methods that assist students process and learn course materials.[53]

Further, mismatch theory fails to account for external, non-academic factors that remediate, compensate for, or neutralize adverse effects of prior inadequate academic preparation. Factors such as work ethic, degree prestige, personality, emotional intelligence, and enhanced networking opportunities in elite institutions have compounding, and potentially greater determinative effects, in an individual's life trajectory.[54] Mismatch theory rests on the flawed assumption that mismatched students will conclusively fail to succeed academically and beyond. Mismatch theory offers conjecture while the real world demonstrates a different story.

B. Mismatch theory is debunked by data.

One study in particular provides specific data that serve to refute mismatch theory. In *The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions*,[55] William Bowen and Derek Bok used the College and Beyond database collected by the Andrew W. Mellon Foundation. The data included more than 80,000 undergraduate students that matriculated at 28 of the nation's highly

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[53] *See id.*

[54] *See id.*

[55] WILLIAM G. BOWEN & DEREK BOK, THE SHAPE OF THE RIVER: LONG-TERM CONSEQUENCES OF CONSIDERING RACE IN COLLEGE AND UNIVERSITY ADMISSIONS (1998).

ranked colleges and universities.[56] For this study, students were categorized into five SAT score intervals, separating Black and White students within each interval. Bowen and Bok found that "[w]ithin each SAT interval, black students in the most selective schools had higher graduation rates than blacks in less selective schools, and within four of the five intervals, blacks in the medium selectivity schools had higher graduation rates than blacks in the least selective tier."[57] These numbers indicate that Black students fare better when attending those "more selective" institutions.

Following Bowen and Bok's research, other scholars have found that minorities benefit from attending schools at which, mismatch theorists would have us believe, they are overmatched.[58] A study by Mary Fischer and Douglas Massey considered college grade point averages and the likelihood of dropping out, controlling for background characteristics. They found that "minority students who benefited from affirmative action earned higher grades and left school at lower rates than others, and they expressed neither greater nor less satisfaction with college life in general."[59] They found that "[f]or each 10 point increase in the gap between the individual's SAT score and the

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[56] Lempert, *supra,* note 52.

[57] *Id*.

[58] *See Id*. (quoting Mary J. Fischer & Douglas S. Massey, *The Effects of Affirmative Action in Higher Education*, 36 SOC. SCI. RES. 531, 544 (2007)); *see also* Douglas S. Massey & Margarita Mooney, *The Effects of America's Three Affirmative Action Programs on Academic Performance*, 54 SOC. PROBS. 99, 114 (2007), https://academic.oup.com/socpro/article/54/1/99/1607538.

[59] Fischer & Massey, *supra,* note 58, at 544.

institutional average, there was an 8.5 percent *decrease* in the likelihood of leaving college."[60] These studies, among others,[61] demonstrate that

> [b]eyond measures like college grades and class rank, which are normed within institutions, researchers find either no evidence of mismatch effects or that the evidence suggests reverse mismatch effects. When outcomes for undergraduates are examined, researchers are particularly likely to find that minorities who attend more selective schools tend to do better than similar students at less selective institutions.[62]

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[60] *Id*. at 541 (emphasis added).

[61] *See* Sigal Alon & Marta Tienda, *Assessing the "Mismatch" Hypothesis: Differences in College Graduation Rates by Institutional Selectivity*, 78 SOCIO. OF EDUC. 294, 297 (2005); *see also* Eleanor Wiske Dillon & Jeffrey Andrew Smith, *The Consequences of Academic Match Between Students and Colleges,* IZA Discussion Paper Series, Paper No. 9080 (May 2015), http://ftp.iza.org/dp9080.pdf (the article abstract summarizes the results: "We find little evidence to support the 'mismatch' hypothesis . . . . All students benefit from attending higher quality colleges."); *See* Tatiana Melguizo, *Quality Matters: Assessing the Impact of Attending More Selective Institutions on College Completion Rates of Minorities*, 49 RES. IN HIGHER EDUC. 214, 232 (2008); *see generally* Tatiana Melguizo, *Are Students of Color More Likely to Graduate From College If They Attend More Selective Institutions?: Evidence From a Cohort of Recipients and Nonrecipients of the Gates Millennium Scholarship Program*, 32 EDUC. EVALUATION & POL'Y ANALYSIS 230 (2010); *see generally* Kalena E. Cortes, *Do Bans on Affirmative Action Hurt Minority Students? Evidence From the Texas Top 10% Plan*, 29 ECON. OF EDUC. REV. 1110 (2010).

[62] Lempert, *supra,* note 51.

Direct comparisons of students of similar academic credentials and proficiencies attending differing colleges establish that students are generally more likely to graduate from institutions that are "more selective."[63] "Going to a selective institution increases the likelihood of success for all able students, not just those whose test scores are near or above the median of top schools."[64] These studies show there is a particular opportunity for success for minority students attending highly ranked institutions. Lower scoring minorities, including Black and Hispanic students from low income backgrounds, "do in fact fare much better when placed in academically challenging environments, even when other students are predominantly white (75%), and well off (56% of students come from the nation's wealthiest families)."[65] At highly ranked institutions, all groups succeed in roughly equal proportions. The mismatch theory is not supported by the data; using that theory to shut the door of highly ranked institutions to minority students rings of *Plessy*, not *Brown,* inevitably reducing minority student attendance at highly ranked institutions and blocking the pipelines from which future minority scientists will come.

The poignant words of Professor Richard Tapia of Rice University refute mismatch theory concisely:

> If the goal is *just* to produce larger numbers of underrepresented minority scientists, then the Mismatch Theory is a great idea, but numbers of degrees alone are not

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[63] *See* WILLIAM G. BOWEN, *et al.*, CROSSING THE FINISH LINE: COMPLETING COLLEGE AT AMERICA'S PUBLIC UNIVERSITIES (2011).

[64] Anthony P. Carnevale, *et al.*, *The Concept of "Mismatch" at Play in the Supreme Court Fisher Decision is Empirically Unsound*, GEO. UNIV. CTR. ON EDUC. & THE WORKFORCE (2016), https://cew.georgetown.edu/wp-content/uploads/Mismatch-Paper_62016.pdf.

[65] *Id.*

> a good measure of success. Underrepresented minorities must be competitive with the overall population; how else can we break the stereotype? The distribution cannot be skewed toward weaker schools. Steering minorities to lesser schools reminds us of the separate but equal mantra. It turns out that separate but equal is always separate, but never equal. But this is worse. This assumes from the start separate and *weaker*. This would take us back to the pre-to-mid '60s where only the very rare minority student who has been prepared well and tests well under traditional admissions criteria would be admitted to the nation's research institutions. Race and ethnicity should not dictate educational destiny. Steering capable students to lesser schools puts a cap on their potential achievements.[66]

To ignore the inherent inequalities in these separate and unequal "less selective" universities and institutions is to subscribe to a theory of color-blindness, which does nothing to remove the pernicious vestiges of racism and White supremacy. Rather, it denies us the future diverse scientists that scientific teams require to achieve better scientific results. Dr. Ebony McGee discusses the adverse effects of the ideology of color-blindness in compelling candor.[67] She describes how "[c]olor-blind ideology presents an unrealistic demand to pretend that racism does not exist or is not

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[66] *The Flaws in the Mismatch Theory*, U.S. Commission on Civil Rights Briefing on Encouraging Minorities to Pursue Careers in Science, Technology, Engineering, and Mathematics, (Sept. 12, 2008) (testimony of Richard Tapia), https://www.caam.rice.edu/~rat/cv/minority/mismatch_theory_statement_2008-09-12.htm.

[67] Ebony O. McGee, *Black, Brown, Bruised: How Racialized STEM Education Stifles Innovation* (Harvard Education Press 2020)

important," and works hand in hand with structural racism.[68] "Color-blind beliefs urge disadvantaged people to become resilient, while social, political, and educational systems continue to abuse and neglect them. "These ideologies enable racism to go unchallenged in situations where social inequalities are easily justified and calls for racial justice are seen as distasteful and unnecessary."[69] *Amici* have a direct interest in working alongside the brightest, most diverse colleagues, challenged throughout their academic endeavors to create, inspire and contribute to the collective consciousness in what we call the "construction of knowledge."

Finally, affirmative action is one among many actions needed to achieve social justice within STEM. Opponents of affirmative action rely upon schools of thought that, when examined, are based on misperceptions or misunderstandings of data. One faulty perception argues that affirmative action dilutes accomplishments, resulting in the denial of admission to members of advantaged groups in favor of underrepresented candidates, or that those underrepresented candidates are considered without regard to merit.[70] These assumptions are not supported. The premise that members of advantaged groups are not admitted or hired because of affirmative action suffers from a causation fallacy[71]––affirmative action is not inherently the cause for any one candidate's lack of admission, qualification, or consideration.[72] Institutions across the nation accord spe-

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[68] *Id*. at 40.

[69] *Id*. at 42.

[70] Jennifer Lee, *Affirmative Action and Anti-Asian Racism,* Science (Feb. 3, 2022), https://www.science.org/content/blog-post/affirmative-action-and-anti-asian-racism.

[71] *Id*.

[72] *Id*.

cial advantages for recruited athletes, legacy applicants, those on the dean's interest list, and children of faculty and staff (known as ALDCs). Indeed,

> [m]ore than 43% of white admissions [to Harvard] are ALDCs, whereas the share for African American, Asian American, and Hispanics is less than 16%. Moreover, about three-quarters of White ALDC admissions at Harvard would have been rejected absent their ALDC status. The paradox is glaring: Although race-conscious affirmative action policies have been on trial time and again, categorical preferences that are deemed race-neutral yet disproportionately benefit White applicants go unchallenged.[73]

To attack affirmative action on the basis of merit would be to distort a fundamental institutional tradition while scapegoating a policy intended to counteract vast inequalities that predate the formation of our nation.

In their *amicus* brief filed in the First Circuit, Heriot and Kirsanow argue that affirmative action causes fewer minority students to enter technical fields because their completion rates are low.[74] The empirical data demonstrate the opposite, namely that admitting minority students to elite universities improves their completion rates. Unlike Heriot and Kirsanow, *Amici* are scientists. *Amici* are aware that merely adding students to a pipeline is not enough to correct for every societal imbalance. Indeed, the experience of a minority student in STEM is often much different from that

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[73] *Id.*

[74] Brief for Gail Heriot & Peter N. Kirsanow as Amici Curiae Supporting the Petitioner, *Students for Fair Admissions, Inc. v. President and Fellows of Harvard College,* 980 F.3d 157 (CA1 2020) (No. 20-1199).

of a White student in STEM.[75] The benefits of inclusivity and equity are the same for science as they are for every other aspect of our world.

III. Race-conscious admissions policies in STEM education can serve as a catalyst to improve institutional culture.

Many academic institutions have focused on increasing the number of underrepresented minorities (URMs)[76] in STEM fields due to the lackluster recruitment and poor retention of URM students.[77] This may be attributed, in part, to the culture in STEM education. URM students' experiences in STEM education differ significantly from the experiences of their White counterparts.[78] URM students commonly face racism, micro-aggressions, biases, and a lack of support. White

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[75] *See generally* Ebony O. McGee & Danny B. Martin, *You Would Not Believe What I Have to Go Through to Prove My Intellectual Value! Stereotype Management Among Academically Successful Black Mathematics and Engineering Students*, 48 AM. EDUC. RES. J. 1347-1389 (2011), http://research.pomona.edu/janice-hudgings/files/2017/08/McGee_and_Martin_2011.pdf.

[76] The term under-represented in this context means a minority group whose number of scientists and engineers per 10,000 population of that group is substantially below the comparable figure for scientists and engineers who are White, non-Hispanic. The term minority means American Indian, Alaskan Native, Black (non-Hispanic), Hispanic (including persons of Mexican, Puerto Rican, Cuban, and Central or South American origin), Pacific Islander, or other ethnic group. *See* Higher Education Resources and Student Assistance, 20 U.S.C. §§ 1067k(2),(5) (2008).

[77] Mica Estrada, *Ingredients for Improving the Culture of STEM Degree Attainment with Co-Curricular Supports for Underrepresented Minority Students*. UNIVERSITY OF CALIFORNIA, SAN FRANCISCO (2020), https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_088832.pdf.

[78] McGee & Martin, *supra* note 75.

students benefit psychologically in predominantly White educational environments.[79] The culture in any educational environment determines the experiences of educators and students, forming the foundation for teaching and learning.[80] The culture that permeates STEM education therefore plays a pivotal role in attracting and engaging all students,[81] and has a profound effect on their interest, connectedness, and persistence in these disciplines.[82]

STEM education culture constitutes the shared patterns of normative behaviors, customs, and values and manifests itself in the way courses are taught and how the classroom is experienced.[83] The relationship between institutional or disciplinary culture and race, ethnicity, and gender is especially relevant in STEM fields, where racial and ethnic minorities and women are more underrepresented than in most other fields.[84]

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[79] Albert Bandura, *Perceived self-efficacy in cognitive development and functioning*, 28 EDUCATIONAL PSYCHOLOGIST 117-148 (1993).

[80] Alicia Santiago, *Equity in STEM Education: It's All About Culture!*, NATIONAL SCIENCE TEACHING ASSOCIATION (Mar. 4, 2020), https://www.nsta.org/blog/equity-stem-education-its-all-about-culture

[81] *Id.*

[82] SHIRLEY MALCOM & MICHAEL FEDER, BARRIERS AND OPPORTUNITIES FOR 2-YEAR AND 4-YEAR STEM DEGREES: SYSTEMIC CHANGE TO SUPPORT STUDENTS' DIVERSE PATHWAYS (2016), https://www.ncbi.nlm.nih.gov/books/NBK368176/.

[83] PHILIP BELL, BRUCE LEWENSTEIN, ANDREW W. SHOUSE, AND MICHAEL A. FEDER, LEARNING SCIENCE IN INFORMAL ENVIRONMENTS: PEOPLE, PLACES, AND PURSUITS (2009).

[84] Gregory Anderson, Jeffrey C. Sun, & M. Alfonso, *Effectiveness of Statewide Articulation Agreements on the Probability of Transfer: A Preliminary Policy Analysis*, 29 THE REVIEW OF HIGHER EDUCATION 261-291 (2006); Julie A. Bianchini, *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*, 97 SCIENCE EDUCATION 163-

For historically underrepresented students, how race, ethnicity, and gender function in their college environment are especially important in their social and academic adjustment.[85] URM students who experience a college culture with a hostile or unwelcoming racial environment are at increased risk for adverse consequences, including social withdrawal[86] and isolation.[87]

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166 (2013), https://onlinelibrary.wiley.com/doi/full/10.1002/sce.21032.

[85] Landon D. Reid & Phanikiran Radhakrishnan, *Race Matters: The Relation Between Race and General Campus Climate*, 9 CULTURAL DIVERSITY AND ETHNIC MINORITY PSYCHOLOGY 263–275 (2003), RaceMatters-Reid-Colgate-2003.pdf (morrisville.edu).

[86] Alberto F. Cabrera, Amaury Nora, Patrick T. Terenzini, Ernest Pascarella, & Linda S. Hagedorn, *Campus Racial Climate and the Adjustment of Students to College: A Comparison between White Students and African-American Students*, 70 JOURNAL OF HIGHER EDUCATION 134–160 (1999), Campus Racial Climate and the Adjustment of Students to College: A Comparison between White Students and African-American Students on JSTOR; Sylvia Hurtado, Deborah F. Carter, Diana Kardia, *The Climate for Diversity: Key Issues for Institutional Self-study*, NEW DIRECTIONS FOR INSTITUTIONAL RESEARCH 53–63 (1998); Tara J. Yosso, William A. Smith, M. Ceja, D. Solorzano, *Critical Race Theory, Racial Microaggressions, and Campus Racial Climate for Latina/o Undergraduates* 79 Harvard Educational Review 659–691 (2009).

[87]MICHAEL T. NETTLES & A. ROBERT THOENY, TOWARD BLACK UNDERGRADUATE STUDENT EQUALITY IN AMERICAN HIGHER EDUCATION 57–86 (1988); JACQUELINE FLEMING, BLACKS IN COLLEGE: A COMPARATIVE STUDY OF STUDENTS' SUCCESS IN BLACK AND WHITE INSTITUTIONS (1st ed. 1984); Azad Ali, Federick Kohun, *Dealing with Isolation Feelings in IS Doctoral Programs*, 1 INTERNATIONAL JOURNAL OF DOCTORAL STUDIES 21–33 (2006), Dealing with Isolation Feelings at IS Doctoral Programs (informingscience.org); Terrell Strayhorn, *When Race and Gender Collide: Social and Cultural Capital's Influence on the Academic Achievement of African American and Latino Males,* 33 THE REVIEW OF HIGHER EDUCATION 307–322 (2010).

Many students receive messages that success in STEM fields requires either natural ability in math or science or prior exposure to high-quality training.[88] No one demographic has better inherent ability, talent, or drive to succeed in STEM.[89] Lack of representation in STEM comes from a lack of support and not from lack of drive, motivation, intellect, or capability.[90]

Without race-conscious admissions policies in STEM education, institutions will have fewer Black, Hispanic, Native American, and Asian American students.[91] "The result will be institutions that are less representative, less intellectually stimulating, and less equipped to serve an increasingly diverse America."[92] In addition to the better science and enhanced economic competitiveness that results from diverse STEM programs, the scientific community at large should reflect America's diversity because leading the advancement of scientific discovery and innovation is our nation's common endeavor. Depriving institutions of the ability to consider the race of URM students as a positive factor in admissions ensures the STEM community will remain or become even more homogenously White and male.

Research demonstrates the importance of student belonging and the destructive effect of stereotype

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[88] Malcolm & Feder, *supra,* note 82.

[89] AMERICAN INSTITUTE OF PHYSICS, The Time is Now: Systemic Changes to Increase African Americans with Bachelor's Degrees in Physics and Astronomy 38 (2020), https://www.aip.org/sites/default/files/aipcorp/files/teamup-full-report.pdf.

[90] *Id.* at 11.

[91] Jennifer Lee, *Affirmative action and anti-Asian racism*, SCIENCE (Feb. 3, 2022), https://www.science.org/content/blog-post/affirmative-action-and-anti-asian-racism.

[92] *Id.*

threat in STEM education.[93] "Retention and participation of a professional community that comes from, interacts with, and returns to a diverse set of cultures can be achieved only by ensuring belonging for each of its members."[94] A multicultural STEM education built on equity-advancing values furthers STEM access and a sense of belonging for all.[95] "Attention to cultural membership and cultural practices is central to equity goals and national needs, but also equally important for the construction of knowledge and for the enterprise of science itself."[96] Indeed, "validity in the sciences involves … choices about what problems to study, what populations to study, and what procedures and measures should be used. In making these choices, diverse perspectives and values are important."[97]

Diversity initiatives positively affect both minority and majority students, including their attitudes toward racial issues, institutional satisfaction and academic growth.[98] Diversity in STEM disciplinary work contributes to the research agendas of individual faculty and their departments, aligns with scholarly values, and promotes academic excellence.[99] Three key benefits follow:

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[93] CIA VERSCHELDEN, BANDWIDTH RECOVERY: HELPING STUDENTS RECLAIM COGNITIVE RESOURCES LOST TO POVERTY, RACISM, AND SOCIAL MARGINALIZATION (2017).

[94] *Supra,* note 9.

[95] *Id*.

[96] Medin & Lee, *supra,* note 39.

[97] *Id*.

[98] DARYL SMITH, DIVERSITY WORKS: THE EMERGING PICTURE OF HOW STUDENTS BENEFIT (1997).

[99] JAMES A. ANDERSON, DRIVING CHANGE THROUGH DIVERSITY AND GLOBALIZATION: TRANSFORMATIVE LEADERSHIP IN THE ACADEMY (Illustrated ed. 2008).

First, structural diversity allows all students to experience diversity in ways that would not occur in a homogeneous environment.[100] Second, students who experience the most diverse classrooms and informal interactions with peers demonstrate the greatest engagement in active thinking, motivation, and intellectual and academic skills.[101] Third, higher education plays a central role in helping students become active citizens and participants in a pluralistic democracy.[102]

Science relies heavily on consensus about verifiable results as well as future research directions, making diversity among scientists a crucial aspect of objective, bias-free science.[103] Public investment in scientific research should benefit from all of our nation's talent to achieve the best possible return.[104] Bias in science harms all components of research: its design, analysis, interpretation, and reporting.[105] Data scien-

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[100] Patricia Gurin, Eric L. Dey, Sylvia Hurtado, Gerald Gurin, *Diversity and higher education: Theory and impact on educational outcomes*, 71 HARVARD EDUCATIONAL REVIEW 332–366 (2002).

[101] *Id.*

[102] *Id.*

[103] Amy L. Graves, *Has Feminism Changed Physics?*, 28 SIGNS 881-899 (2003), Has Feminism Changed Physics? (swarthmore.edu).

[104] *Combatting Sexual Harassment in Science: Hearing before the Committee on Science, Space, & Technology,* 116th Cong. (2019) (Opening Statement of Chairwoman Eddie Bernice Johnson, (D-TX)), https://science.house.gov/imo/media/doc/CJohnson%20OS%20Sexual%20Harassment%20in%20Science%20Hearing.pdf.

[105] David L. Sackett, *Bias In Analytic Research*, 32 J. CHRONIC DISEASES 51-63 (1979), PII: 0021-9681(79)90012-2 (arizona.edu)

tists can be vulnerable to inherent flaws in their models if they do not consider cognitive bias.[106] Bias may lead to mistaken conclusions about causation and linkages between variables, resulting in incorrect predictions and judgments.[107] Admission policies that aim to address racial inequalities in STEM education are an important weapon in the battle against bias in scientific research.

CONCLUSION

Diversity in the STEM community is crucial to arriving at better and more innovative solutions. Mismatch theory is not supported by credible evidence; rather, evidence confirms diverse students thrive in highly ranked educational environments. Race-conscious admissions policies serve as a catalyst to enact change in STEM culture and advance innovation. To promote diversity, equity, and inclusion in STEM education, to stimulate the economy, and to provide a significant competitive advantage in research and development, innovation, and the science community, *Amici* urge the Court to preserve race-conscious admissions policies.

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[106] *See* John P. A. Ioannidis, *Why Most Published Research Findings Are False*, PLOS MEDICINE (2005), Why Most Published Research Findings Are False | PLOS Medicine; John P. A. Ioannidis, *Meta-research: Why research on research matters*, PLOS BIOLOGY (2018), Meta-research: Why research on research matters (plos.org).

[107] *Id*.

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