To:	New Jersey Institutions of Higher Education
From:	The Office of the Secretary of Higher Education
Subject:	Guidance for Addressing Barriers to STEM Recruitment of Underrepresented Students
Date:	April 13, 2022

The Office of the Secretary of Higher Education (OSHE) is pleased to announce the release of its "Guidance for Addressing Barriers to STEM Recruitment of Underrepresented Students," issued pursuant to P.L.2021 c.76 This guidance builds on the commitments made in the New Jersey State Plan for Higher Education: Where Opportunity Meets Innovation.

OSHE would like to thank Senators Pou and Kean, Assemblywoman Jasey, Assemblyman Benson, and the Murphy Administration for supporting this important piece of legislation.
Please find the guidance below.
Questions regarding this guidance document can be directed to OSHE@oshe.nj.gov.

Office of the Secretary of Higher Education
Guidance for Addressing Barriers to STEM Recruitment of Underrepresented Students
April 6, 2022

The Office of the Secretary of Higher Education (OSHE) has developed guidance to increase the recruitment and retention of underrepresented students in Science, Technology, Engineering, and Mathematics (STEM) programs at institutions of higher education. This guidance builds on the commitments made in the *New Jersey State Plan for Higher Education: Where Opportunity Meets Innovation*[1] and is in accordance with P.L. 2021 C. 76.

As of 2020, STEM-related jobs in New Jersey were projected to grow nine percent – nearly double the growth expected for other careers.[2] All residents—regardless of life circumstance—should be offered equitable and affordable pathways to earn high-quality credentials and valuable job training. New Jersey's next generation of leaders must reflect the State's rich diversity to propel New Jersey forward as an innovation hub. Identifying specific barriers to entry, as well as ensuring support initiatives are implemented across campuses for underrepresented students, are critical components of mitigating inequities within STEM programs across institutions of higher education in the State.

This focus on New Jersey's greatest asset - its people - alongside the goal of expanding opportunity so that "all career-seeking New Jerseyans have the education and training necessary to access high-quality employment,[3]" has resulted in several statewide initiatives that institutions can utilize to help address the STEM pipeline. These initiatives include, but are not limited to, the following

- In 2019, Governor Murphy unveiled his Computer Science for All State Plan to provide K-12 students with early exposure to computer science.
- In 2021 New Jersey Economic Development Authority and Office of the Secretary of Higher Education made New Jersey a leader in offshore wind, awarding a Wind Turbine Technician Training grant and an Offshore Wind Safety Training Challenge grant to institutions of higher education.
- In 2020, Governor Murphy announced the expansion of the Pathways in Technology Early College High School (P-Tech) program into another high school for 150 more students to participate.
- In March of 2022, OSHE established a Career Accelerator Internship Grant Program to provide funding for experiential learning programs within the STEM industry and other key industry sectors in New Jersey.[4]

[1] https://nj.gov/highereducation/documents/pdf/StateEducationplan.pdf
[2] https://njspe.org/2020/08/05/importance-stem education/#:~:text=Over%20the%20next%2010%20years,available%20in%20the%20United%20States.
[3] https://www.njeda.com/jobsnj/
[4] https://www.state.nj.us/highereducation/internshipgrantprogram.shtml

- Graduates of New Jersey colleges and universities employed in STEM fields can participate in a STEM loan redemption program.[5]

Several New Jersey institutions of higher education have model programs for consideration and scaling. Some of these programs are highlighted below, including the Rutgers Governor's School of Engineering & Technology and Drew University's Governor's School in the Sciences, which provide summer residential programs for juniors with an interest in STEM projects. Additionally, many institutions of higher education participate in the New Jersey STEM Pathways Network as part of STEM ecosystems designed to create an education-to-workforce pathway. New Jersey institutions of higher education are encouraged to utilize these statewide STEM initiatives, as well as this guidance, as a resource to diversify the recruitment and retention of women and people of color in their STEM programs.

This guidance focuses on four areas aimed at increasing the recruitment and retention of underrepresented students in STEM: (1) institutional diversity, equity, and inclusion assessment; (2) recruitment and enrollment management; (3) student support services; and (4) labor market success.[6]

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INSTITUTIONAL DIVERSITY, EQUITY, AND INCLUSION ASSESSMENT

Addressing barriers in STEM recruitment of underrepresented students requires institutions to collect and use data to identify academic, social, and personal factors that negatively impact students enrolled in STEM programs. It is important to understand student trends to identify causes of gender and racial equity gaps, and create initiatives to bridge those gaps. Institutions can solicit student feedback through surveys and provide faculty and staff with professional development opportunities to incorporate inclusive pedagogical practices. The student voice plays a critical role

[5] https://nj.gov/governor/news/news/562018/approved/20181214a.shtml

[6] This document is not exhaustive and serves as a support in addressing barriers to the recruitment and retention of underrepresented students in STEM. Underrepresented minorities include but are not limited to students of color, LGBTQ+ students, first generation students, and veterans, among other populations.

in this process, as students should be included in decision-making processes that affect them. Institutions of higher education should consider:

- Assessing student enrollment, retention, graduation, employment, and financial outcomes data to identify where gender and racial equity gaps exist in STEM, and create initiatives to close gaps.
    - The following resources may support institutions in implementing assessments related to the above factors:
        - The National Institute of General Medical Sciences and the Howard Hughes Medical Institute convened a Joint Working Group on improving underrepresented minorities' persistence in STEM fields. The Working Group published five recommendations to increase underrepresented undergraduate students' persistence in STEM, including publishing disaggregated recruitment and enrollment data and establishing partnerships with successful peer STEM programs.[7]
        - Dr. Mickelson, et al. (2019), assessed the disparities in college STEM outcomes across race, gender, and class in North Carolina. The authors' findings suggest institutions of higher education can cultivate welcoming environments for women and underrepresented minority students by fostering a sense of belonging in STEM majors, hiring caring instructors, and encouraging active learning.[8]
        - Drs. Charlesworth and Banaji (2019) assessed the impacts of implicit gender biases on STEM leadership, finding inequities in representation, compensation levels, and research awards and publications.[9]
- Implementing a feedback model for underrepresented students to share ongoing challenges and existing barriers related to their educational experiences. Institutional leadership should directly respond to this input by developing and implementing action plans to mitigate these issues.
    - The State Plan for Higher Education's Safe and Inclusive Learning Environments Working Group[10] deliverable on "promoting campus climate surveying" offers best practices, serves as resource guides, and provides implementation techniques to help institutions administer campus climate surveys. For example, climate surveys offer opportunities for students to provide feedback related to campus culture

[7] Estrada, M., Burnett, M., Campbell, A.G., Campbell, P.B., Denetclaw, W.F., Gutiérrez, C.G., Hurtado, S., John, G.H., Matsui, J., McGee, R., Okpodu, C.M., Robinson, T.J., Summers, M.F., Werner-Washbourne, M., & Zavala, M. (2017). Improving underrepresented minority student persistence in STEM. *CBE Life Science Education, 15*(3). 10.1187/cbe.16-01-0038

[8] Mickelson, R.A., Stearns, E., Bottia, M.C., Rainey, K., Dancy, M., Moller, S., Allen, D., & Giersch, J. (2019). The Roots of Race, Class, and Gender Disparities in College STEM Outcomes in North Carolina. *Poverty & Race Research Action Council*. Retrieved November 9, 2021, from https://www.prrac.org/the-roots-of-race-class-and-gender-disparities-in-college-stem-outcomes-in-north-carolina-by-roslyn-arlin-mickelson-et-al-sept-dec-2019/

[9] Charlesworth, T.E.S., & Banaji, M.R. (2019). Gender in science, technology, engineering, and mathematics: Issues, causes, solutions. *The Journal of Neuroscience, 39*(37), 7228-7243. 10.1523/JNEUROSCI.0475-18.2019

[10] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/SafeandInclusiveLearningEnvironment-FullDocument.pdf

specific to their institution. The findings of these surveys should inform an action plan to make meaningful change and measurable progress.

- Providing professional development and support for faculty and staff to recognize barriers and develop culturally-responsive pedagogy.
    - The Research, Innovation, and Talent Working Group highlights research done to support junior and mid-career faculty in creating inclusive learning environments. The Working Group notes that providing resources for faculty to create or revise student-centered lesson plans can help women and underrepresented minority students feel more welcome in STEM programs.[11]
    - The Association of Public and Land-grant Institutions' (APLU) Aspire: National Alliance for Inclusive & Diverse STEM Faculty is an ongoing project aimed at developing more inclusive faculty practices at universities throughout the U.S., such as preparing faculty in teaching and mentoring undergraduates.[12]

RECRUITMENT AND ENROLLMENT MANAGEMENT

Barriers in recruitment and enrollment processes present access challenges to underrepresented students seeking STEM programs. Developing equitable recruitment and enrollment management practices is critical for institutions of higher education to dismantle these barriers. Institutions of higher education can partner with K-12 institutions to allow students to explore STEM careers early and create a pipeline of prospective applicants. Institutions can also prioritize recruitment efforts in diverse communities and strengthen faculty and staff diversity recruitment efforts alongside student recruitment.

- Institutions can work to dismantle barriers by considering test-optional, test-flexible, or test-free admission practices while navigating the application, admission, and enrollment process.
    - The Institute for Higher Education Policy found that standardized testing has long been used to identify high-achieving students considered most likely to succeed in college, despite their perpetuation of racial and economic disparities by advantaging students with the most resources.[13] However, evidence supports that test scores are not always the greatest indicator of a student's success, regardless of major. Revising standardized testing policies during the admissions process has the potential to close equity gaps. [14] For example, Worcester Polytechnic Institute (WPI), an institution specific to engineering and the sciences, found that going test-optional dispelled conventional wisdom that standardized testing is most needed to assess future performance of STEM majors. WPI's data showed an increase in

[11] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/Research-Innovation-and-Talent-Full-Document.pdf, p. 32
[12] https://www.aplu.org/projects-and-initiatives/stem-education/aplu-aspire/
[13] https://www.ihep.org/wp-content/uploads/2021/06/IHEP_JOYCE_REPORT_CH5_Stand_Testing.pdf
[14] https://www.ihep.org/wp-content/uploads/2021/06/IHEP_JOYCE_REPORT_CH5_Stand_Testing.pdf

applications among underrepresented minority groups of 146 percent, and 99 percent for women.[15]

- Prioritize recruitment visits to high schools and college fairs located in diverse and underserved communities.
    - Institutions in the Maryland Independent College and University Association recruit diverse student populations by traveling to high schools with diverse populations and holding on-campus recruitment events for prospective students of color and their families.[16]
- Increase the recruitment of diverse faculty and staff alongside student recruitment efforts. Strong evidence suggests that the academic environment in which students learn has an impact on student diversification. Having faculty and staff members who are also diverse can provide underrepresented students access to academic and professional mentors.
    - The APLU's Aspire: National Alliance for Inclusive & Diverse STEM Faculty aims to develop more inclusive faculty recruitment, hiring, and retention in STEM disciplines at universities throughout the U.S. One of the project's primary goals is to increase underrepresented student interest in STEM programs and help them succeed in their academic programs and careers.[17]
- Partner with K-12 institutions to introduce STEM career exploration early.[18]
    - The Governor's School of New Jersey is an example of a STEM pathway program offering a tuition-free, summer, residential program for high-achieving high school juniors who have an interest in STEM subjects through a state partnership with institutions of higher education. Currently, there are two programs: the Governor's School in the Sciences at Drew University and the Governor's School of Engineering & Technology at Rutgers, The State University of New Jersey. The programs are open to students from diverse economic backgrounds who are New Jersey residents and who have completed their junior year in any public or private high school or are home-schooled.
    - The College of New Jersey's Center for Excellence in STEM Education provides summer camps for students aged 7-12, focusing on different areas of STEM education, including computer coding and engineering. The Center also provides free computer science workshops to elementary, middle, and high school teachers who then implement lessons learned in their own classrooms.[19]
    - Stockton University's STEM Collaborative offers eighth-graders a one-week, residential camp where they learn about STEM careers. The Collaborative also

[15] https://www.insidehighered.com/admissions/article/2018/04/30/what-campus-based-studies-are-showing-about-test-optional-policies
[16] https://micua.org/index.php/32-member-colleges-a-universities/overview-of-member-colleges-a-universities/764-recruiting-diverse-students
[17] https://www.aplu.org/our-work/5-archived-projects/stem-education/aplu-aspire/
[18] https://njstempathways.org/
[19] https://stockton.edu/sciences-math/stem-collaborative.html

hosts a Research and Engineering Apprenticeship Program for rising-senior high school students.[20]

STUDENT SUPPORT SERVICES

Once institutions recruit and enroll underrepresented students in STEM programs, institutions must continue to support students through degree completion. Institutions of higher education must examine and redesign, if necessary, existing experiential learning opportunities and cohort-based learning opportunities, such as internships and summer-bridge programs, to help support underrepresented students.

- Redesign the curriculum in "gateway" courses to provide more engaging and equitable pedagogical experiences for students.
  - The Research, Innovation, and Talent Working Group deliverable on "increasing the number of women and underrepresented minority students graduating"[21] highlights institutions of higher education that have been successful in revising first-year STEM courses to promote the recruitment and retention of women and underrepresented minority students. One successful strategy is integrating active learning into lesson plans, including providing discussion-based or peer-led team learning.[22]
- Create supportive experiential learning opportunities in STEM (e.g., internships, apprenticeships, research opportunities, conference sponsorship) that provide mentorship and engagement with employers, unions, and other entities.
  - The New Jersey Office of the Secretary of Higher Education Career Accelerator Internship Grant Program[23] aims to connect employers and New Jersey institutions of higher education to generate opportunities while ensuring that there are positive educational impacts for all students. This grant program strives to ensure students have the right to experiential learning opportunities, as enumerated in the New Jersey Student Bill of Rights.
  - The Research, Innovation, and Talent Working Group deliverable on "increasing the number of women and underrepresented minority students graduating"[24] highlights ways in which institutions of higher education can partner with STEM career and technical education (CTE) programs offered at high schools and community colleges. CTE programs provide students with a base understanding of skills needed for STEM careers and make undertaking STEM coursework at

[20] https://stockton.edu/sciences-math/stem-collaborative.html
[21] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/RIT-Working-Group-Subgroup-3-Final-Deliverable.pdf
[22] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/Research-Innovation-and-Talent-Full-Document.pdf, p. 32
[23] https://www.state.nj.us/highereducation/internshipgrantprogram.shtml
[24] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/Research-Innovation-and-Talent-Full-Document.pdf

universities more attainable for students who have little experience or knowledge of STEM.[25]

- The South Jersey STEM & Innovation Partnership (SJSIP) is a collaboration among K-12 school districts, institutions of higher education, industry, and other organizations, working to ensure an inclusive STEM culture. The Partnership hosts Hackathons and the #NJSTEMTogether Communities Challenge, in which high school teams identify problems in the community and devise solutions.[26]
- The Atlantic City STEM ecosystem[27] has partnered with the Atlantic City school district, Atlantic Cape Community College, and Stockton University to offer a vision for pre-K-to-career pathways in New Jersey. The ecosystem has collaborated through a federal EDA grant to include a k-12 and community college pathway into Stockton University. The pathways subject matter is related to marine science, technology, and the blue economy.

- Publish resources related to STEM-specific opportunities particularly relevant to women and students of color and publicly celebrate achievements of these students.
  - Stevens Institute of Technology created the Accessing Careers in Engineering and Science (ACES) program to increase the number and percentage of underrepresented minority students in STEM study and careers.[28] Participating students will benefit from the Stevens Pre-College Program and will automatically be eligible to join one of Stevens' learning communities to help students thrive at their schools and in the workforce.

LABOR MARKET SUCCESS

Alongside student support services, women and underrepresented minorities in STEM also need support to transition successfully from institutions of higher education into high-quality STEM careers. Collaboration with potential employers and alumni can advance this goal. Institutions should consider the following efforts:

- Disaggregate data on STEM career outcomes by gender, race, and ethnicity on institutional websites so prospective students can easily access this information.
  - Stevens Institute of Technology annually publishes a Career Outcomes Report highlighting data related to career outcomes and salary for every graduating class.[29] The Class of 2020 report included data on career outcomes profiles for first generation graduates and women.
- Engage women and alumni of color working in STEM fields to offer career transition mentorship to program graduates.

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[25] https://www.state.nj.us/highereducation/documents/pdf/workinggroups/Research-Innovation-and-Talent-Full-Document.pdf, p. 32-34
[26] https://njstempathways.org/south-jersey-stem-and-innovation-partnership/
[27] https://www.southjerseysip.org/atlantic-cohort
[28] https://www.stevens.edu/admissions/undergraduate-admissions/special-programs/stevens-aces
[29]https://www.stevens.edu/sites/stevens_edu/files/files/Career/Class%20of%202020%20Career%20Outcomes%20Report_Final.pdf

- Rutgers University Bloustein School of Planning and Public Policy's Women's Leadership Coalition brings together graduate students from a variety of disciplines to foster networking, collaboration, leadership, and career-driven educational opportunities.[30] The Women's Leadership Coalition also hosts an annual conference held every spring, bringing together students, faculty, and professionals across the State.[31]

The Office of the Secretary of Higher Education, along with sister agencies and institutions of higher education, remains committed to eliminating barriers to STEM recruitment and persistence for underrepresented minorities. This includes continued awareness, monitoring and collaboration to address challenges and to ensure a stronger and fairer New Jersey for all.

To learn more about major State initiatives, visit: NJ Office of the Secretary of Higher Education.

[30] https://bloustein.rutgers.edu/wp-content/uploads/2020/08/Women%E2%80%99s-Leadership-Coalition-Orientation-PPT.pdf