



The Importance of Mentorship in Effective and Inclusive STEM Education

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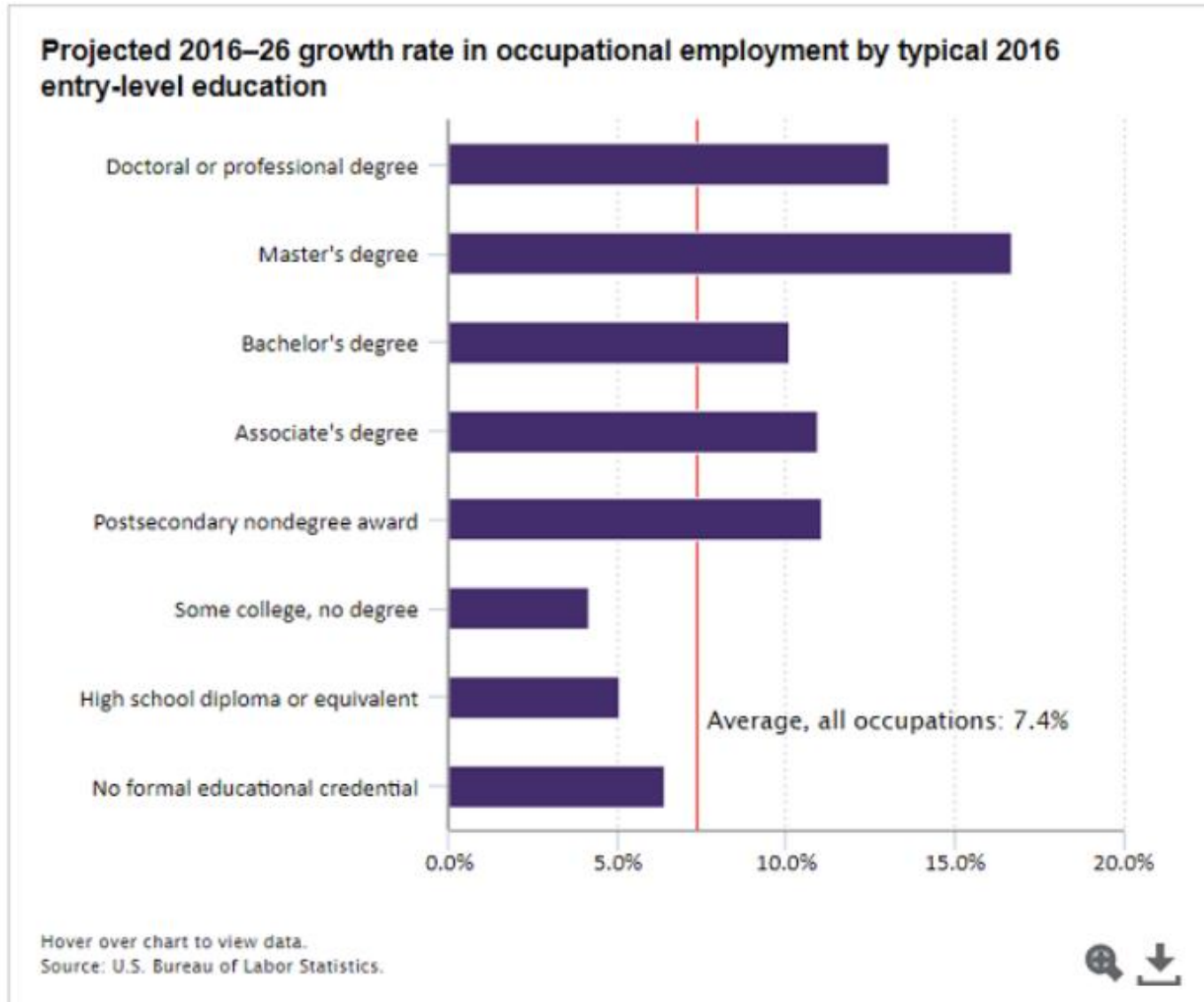


Overview

- Why do we need effective and inclusive approaches to education?
- Why are research experiences beneficial for students?
- How can we evaluate the importance of mentorship?
- Best practices in mentorship
- Importance of community
- Importance of training

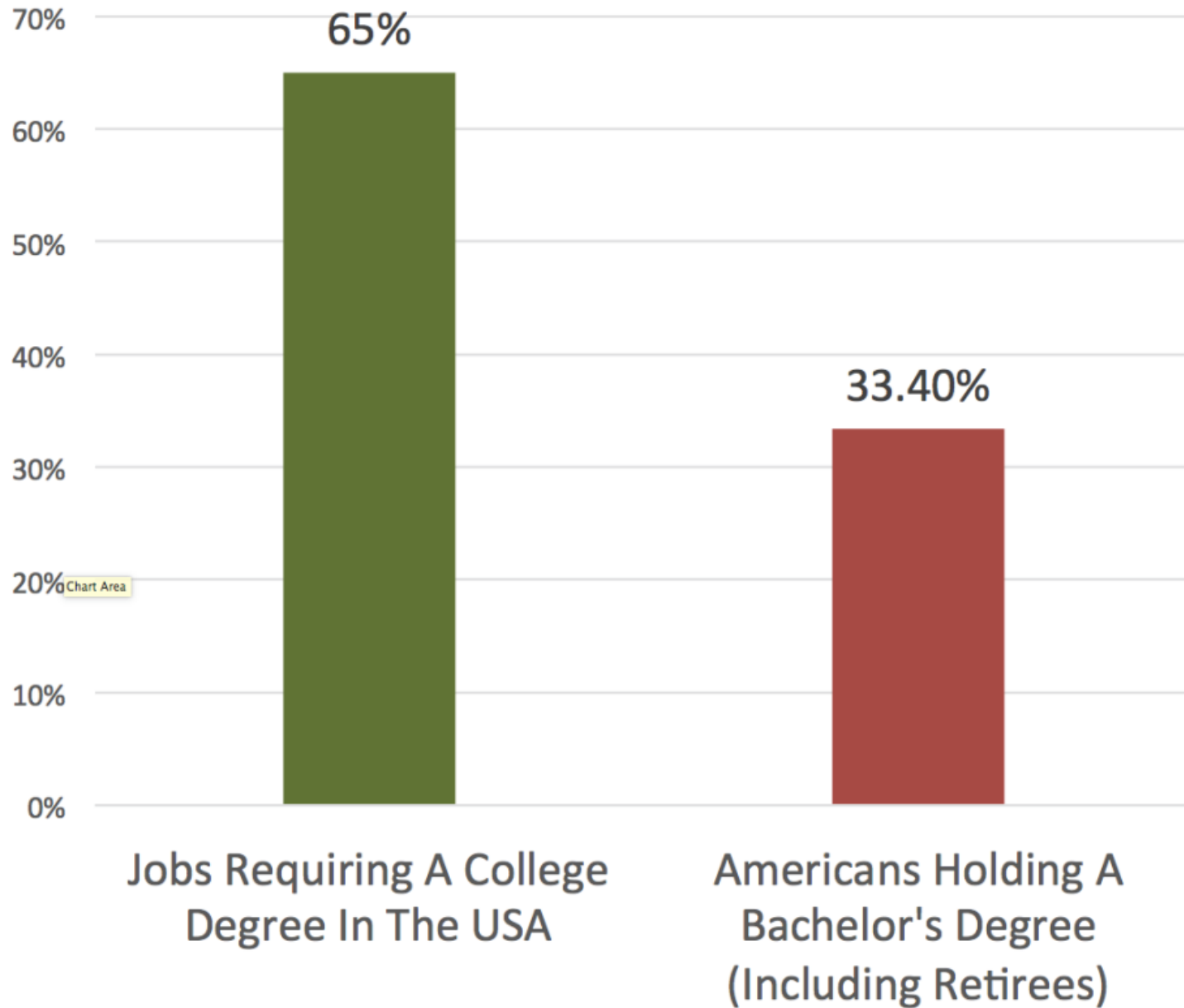


Why is it important to think about effective, inclusive mentorship?

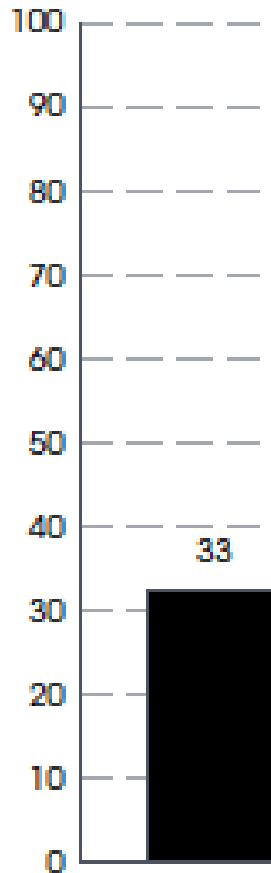


There is increasing demand for college educated employees
(Rolen, 2019)

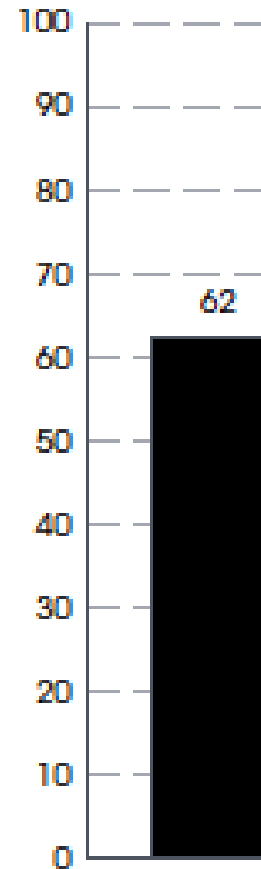
The Jobs-Degree Gap In America



Graduation Rates for Undergraduates



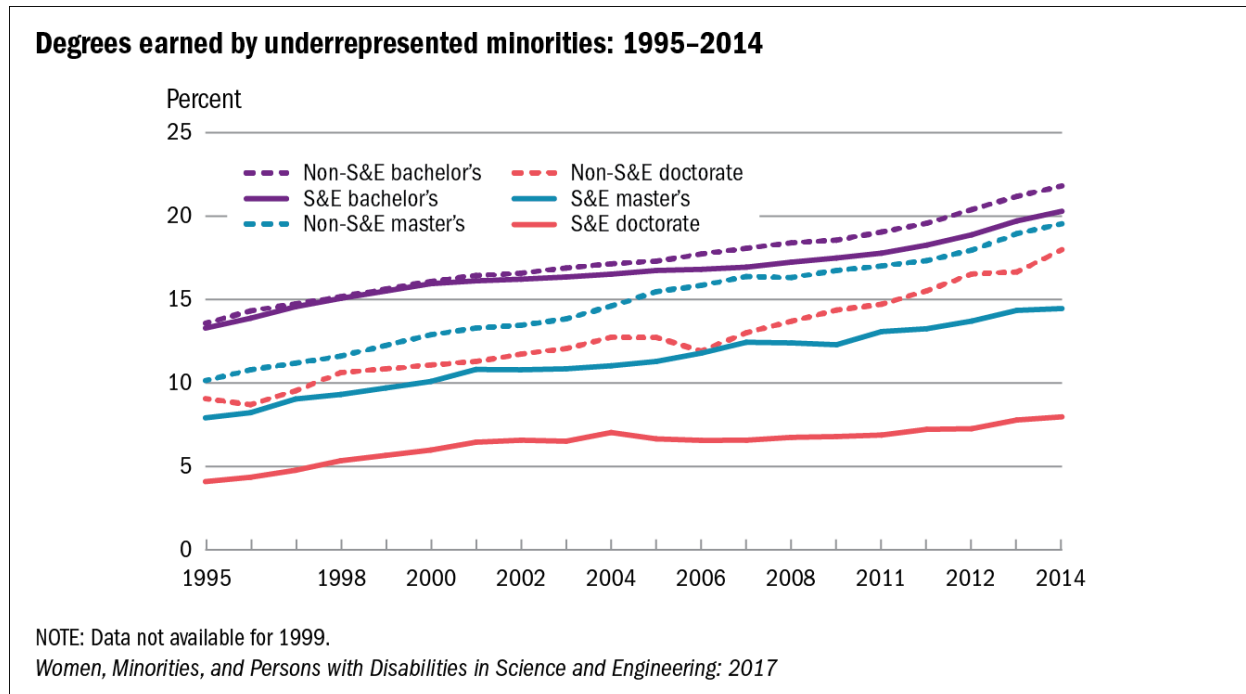
% of Students Completing
an Associates Degree



% of Students Completing
A Bachelors Degree

Diversity and Inclusion in STEM

- 32% of the US population is from a racial or ethnic group that is underrepresented in STEM (NSF: <https://www.nsf.gov/statistics/2017/nsf17310/digest/introduction/>)
- Many STEM occupations require at least some college education (US Bureau of Labor Statistics)



Diversity, Equity and Inclusion Matters

- Gibbs, 2014
 - Critical to excellence
 - Lack of diversity represents loss of talent
 - Important for economic growth and global competitiveness

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 - Critical to excellence
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- Output is not the only reason
 - Let's not alienate and discourage people for the wrong reasons

Isn't this just an academia problem?

- Why do students leave?
 - How courses are taught
 - Concerns about math ability
 - Financial reasons
 - Fixed mindset – natural ability determines capacity
 - Lack of support – focused on intelligence
 - Lack of esteem for the discipline
 - Lack of connection with others

Why is Research Important for Undergraduates?

- Known approach to improve retention
- Many other known benefits

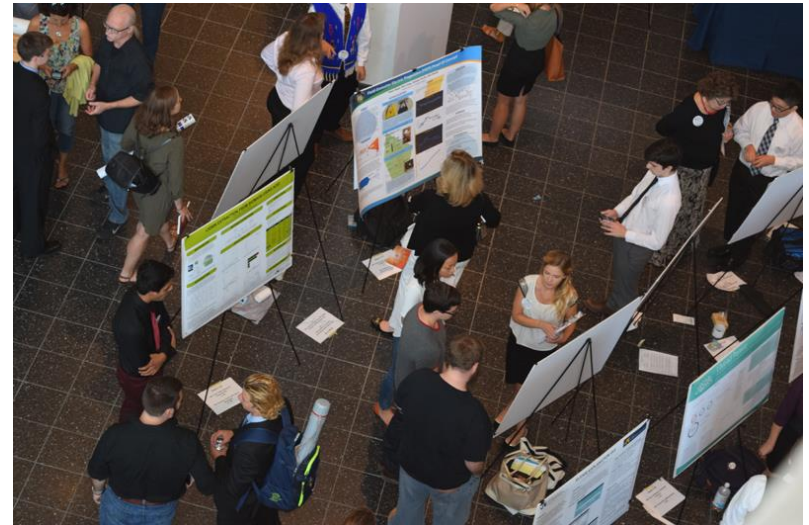
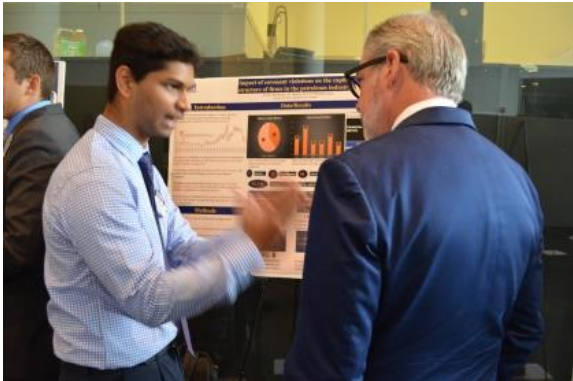


What are the known benefits of research?

- Provides sense of empowerment, instills confidence, integration into the culture of science
 - BIO 2010: Transforming Undergraduate Education for Future Research Biologists (National Academies)
- Increase students' interest in graduate careers, understanding of research, tolerance for obstacles
 - Vision and Change in Undergraduate Biology Education: A Call to Action (AAAS)
- Increased confidence in ability to think like scientists, preparation for graduate training, learning in a variety of areas, retention
 - Seymour, Hunter et al., 2004; Lopatto 2006; Lopatto 2007; Laursen, Hunter et al., 2010; Junge, Quinones et al., 2010
- Increased student retention
 - PCAST 2012
- Students from underrepresented groups who participate in research are more likely to retain and remain interested in a STEM career
 - Schultz et al., 2011

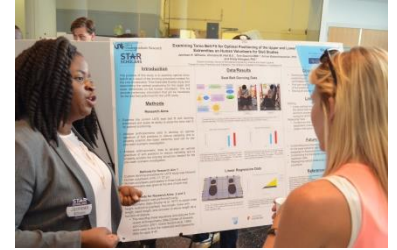
The STAR Scholars Program

- Undergraduate summer research
- Summer after Freshman year
- 10 Weeks
- Typically high-achieving students
- STEM and Non-STEM



Summary of Summer Research Outcomes

- Currently supports 5% of freshman
- 96% retention rate
- Students report gains in all skills assessed
- STEM & Non-STEM students report similar gains in all skills assessed, with few significant differences
- Of the responding STAR Mentors
 - The majority would participate again



Why is expanding access to research an important goal?

- Research experiences are beneficial
- Benefits should not be limited to a small group of students
- As of 2017, only 15% of employed scientists and engineers are individuals who are Hispanic/Latino/Black/African American/American Indian/Alaska Native/Native Hawaiian/Other Pacific Islander
 - (NSF Report – Women, Minorities, and Persons with Disabilities in Science and Engineering)
- Women earn only 36% of bachelor's degrees in STEM
- “...Benefits of some form of research experience are substantial even for students who do not pursue graduate study.”

How can undergraduate access to research be expanded?

- Offer more research experiences
- Partnership with labs outside of academia
- Course-Based Undergraduate Research Experiences
 - Less time in the lab, more students per experience, different populations reached, similar outcomes (Smith et al., 2021; Corwin et al., 2015; Linn et al., 2015; Lopatto et al., 2008)

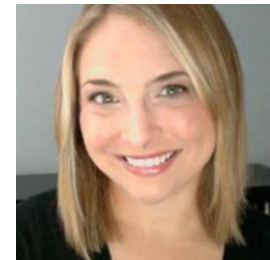
The importance of mentoring

- An expert can provide knowledge, structure, validation, support, guidance, connection
- An expert can address imposter syndrome
- Mentors can provide training and socioemotional support (Haeger and Fresquez, 2016)
- Mentorship can be critically important for students from underrepresented racial and ethnic groups (Haeger and Fresquez, 2016)



Research is a Type of Experiential Learning

- Definition from the 2016 Colonial Academic Alliance Pedagogy Summit on Experiential Learning
- Experiential learning is an intentionally-designed opportunity for students to learn by “doing” – an active, engaged process that connects content to context. Experiential learning requires students to purposefully apply knowledge, practice skills, and engage in critical reflection.



Lindsey Interlante – Colonial Academic Alliance

Understanding experiential learning



- Colleagues from College of Charleston and University of North Carolina, Wilmington, including: Jess Boersma, Lea Bullard, Xiushan Jiang, Beth Meyer-Bernstein, Paul Townend, Runa Winters
- Developing a survey instrument to study experiential learning

Experiential Learning Instrument

- Extensive development process
- Piloted with students from Drexel University, College of Charleston, and University of North Carolina Wilmington
- Has been revised
- 10 minutes in length
- Asks about: demographics, details of the experience, mentorship, who students talked with about their experience, guidance, motivation, activities, outcomes
- In the process of validating the instrument



Photo: DragonsTeach Hands-on Science



Photo: DragonsTeach Hands-on Science



Photo: Mentored Research

Best Practices in Undergraduate Research Mentoring

- Identify students needs and interests
- Set clear expectations
- Teach skills, methods and techniques
- Have high expectations and provide emotional support
- Build community
- Spend time one-on-one with mentees
- Increase student ownership over time
- Support student professional development
- Create opportunities for students to learn to mentor
- Encourage dissemination



Inclusive Mentoring

- Cultural sensitivity is important in cross-cultural mentorship
- Criticism should be paired with reassurance
- Communication and mutual trust is important
- Resistance to mentorship may be due to the need to build trust
- Avoid making assumptions - communicate



The importance of community

- Community can provide support, identity development, and safety (Bender et al., 2008)
- Communities of practice can allow people to receive training, feedback and exposure to new ideas (Laursen, 2019; Lave and Wenger, 1991; Wenger et al., 2002)
- Community can allow for vertical mentoring, which can provide social and academic support (Collier, 2017)

Forming Communities

- Within the lab
- Cohorting for additional support
- Among mentors
- Making use of the virtual space
- Cross-institution cohorting
- Consider issues of inclusivity
- Think about the goals
- Empower community members



The importance of training

- How have we learned about teaching and mentorship?
Cultural competence?
- There are bodies of literature on these subjects
- We can, and should, learn about effective ways to mentor inclusively
- Growth mindset
- Opportunities for self-reflection, engaging with change leaders and participating in a community of practice can be helpful (Shumar, Silverman, Moyer, Casino, Condon, Murasko, King, Stanford)

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