



Strategies for Inclusive Mentorship in Computing

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Reed Milewicz
Sandia National Laboratories

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Today, We Will Discuss...

- How diversity, equity, and inclusion (DEI) shape effective software development practice
- The value of mentorship in building and sustaining a capable HPC workforce
- How a DEI lens can aid our understanding of best practices in mentorship
- How we can put this information to good use!

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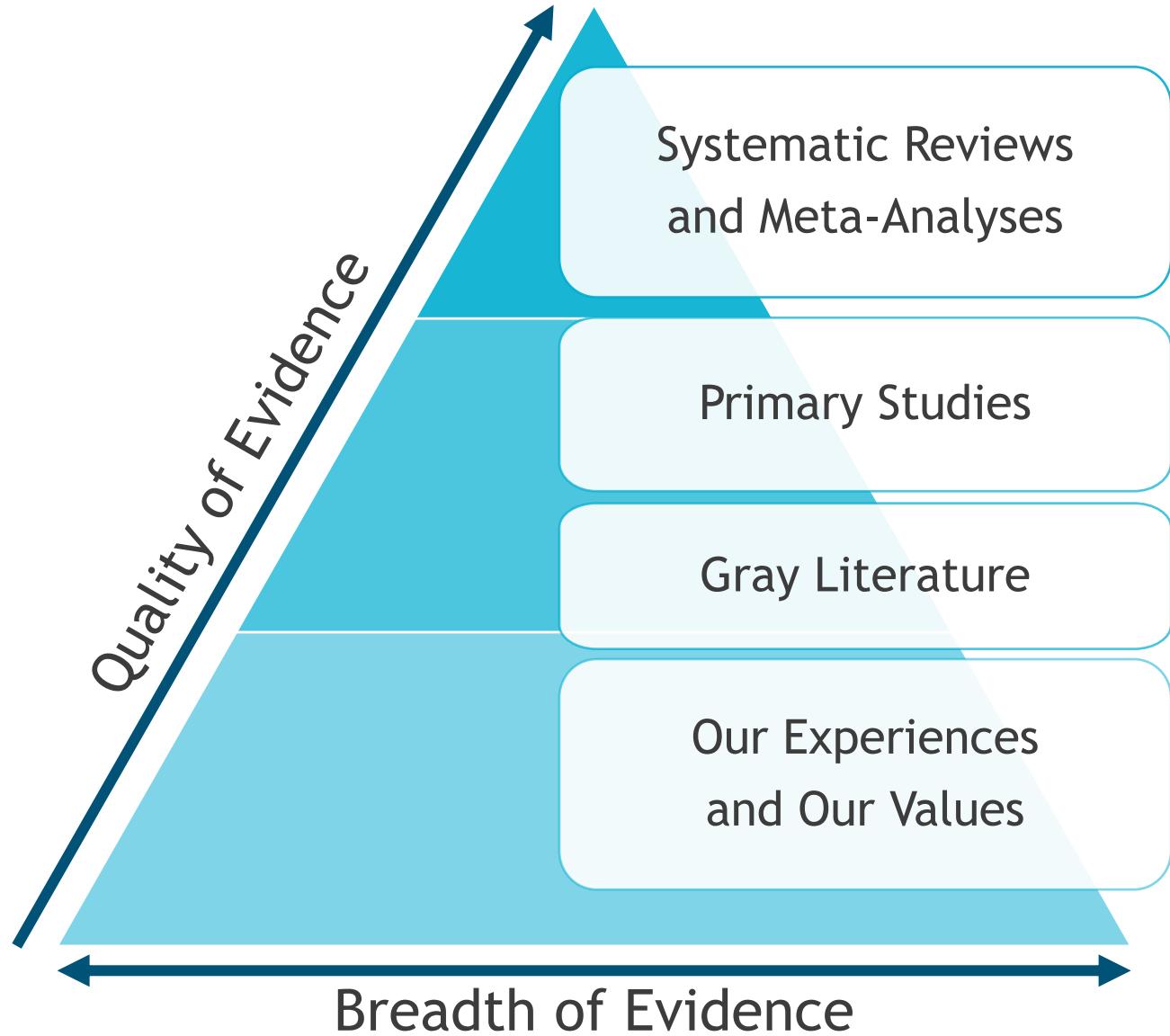
Diversity, Equity, and Inclusion in Software Development Practice

My Perspective as a Software Engineering Researcher

- As a researcher, I am interested in...
 - Understanding how people **work together** to create software
 - Finding better tools and processes that can **empower** those people
- I want to advance standards of **evidence-based practice** in the development of computational science and engineering software.

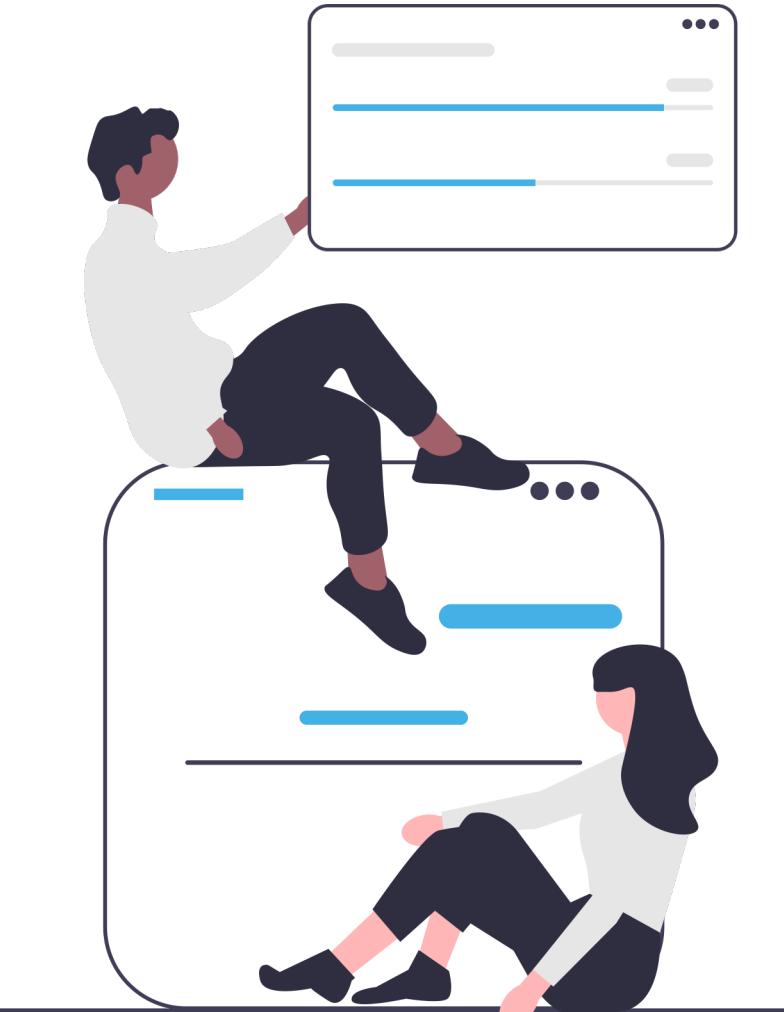


And By Evidence, I Mean...



- The foundation of all decision-making is our ***experiences as practitioners*** and ***our values***.
- Incorporating high-quality evidence helps ***reduce bias*** and ***mitigate risk***, enabling better decision-making.

To Code is Human



- Software development is a **fundamentally human activity**
- Our values and experiences are **key to achieving excellence** in practice
- As someone who is LGBTIQ+ and on the autism spectrum, I want to help create cultures that are **inclusive of everyone**

Evidence: DEI Matters in Software Development

- Gender diversity is correlated with **increased productivity** and **reduced turnover and conflict** in software teams [Vasilescu et al.]
- Software teams having diverse educational backgrounds tend to rank higher in **team efficiency** [Altiner and Ayhan].
- Among diverse, geographically distributed teams, teams with lower perceived distance tend to be **more collaborative and coordinated** [Robert]



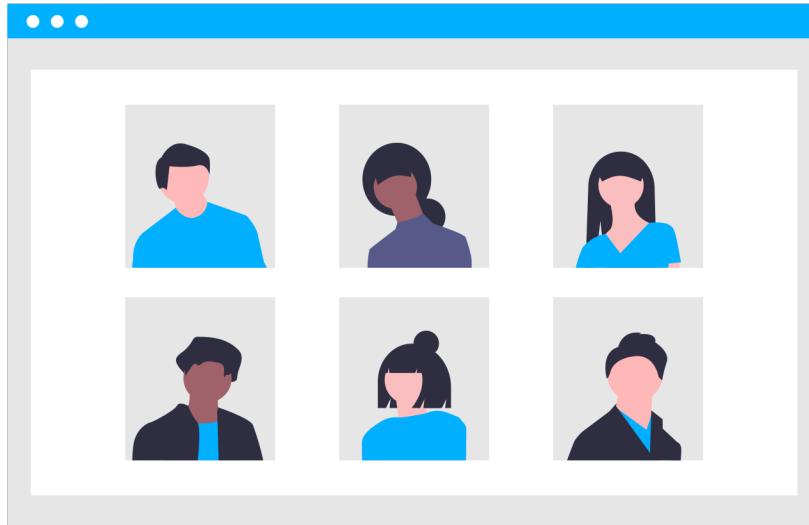
Vasilescu, Bogdan, et al. "Gender and tenure diversity in GitHub teams." *Proceedings of the 33rd annual ACM conference on human factors in computing systems*. 2015.

Vasilescu, Bogdan, Vladimir Filkov, and Alexander Serebrenik. "Perceptions of diversity on git hub: A user survey." *2015 IEEE/ACM 8th International Workshop on Cooperative and Human Aspects of Software Engineering*. IEEE, 2015.

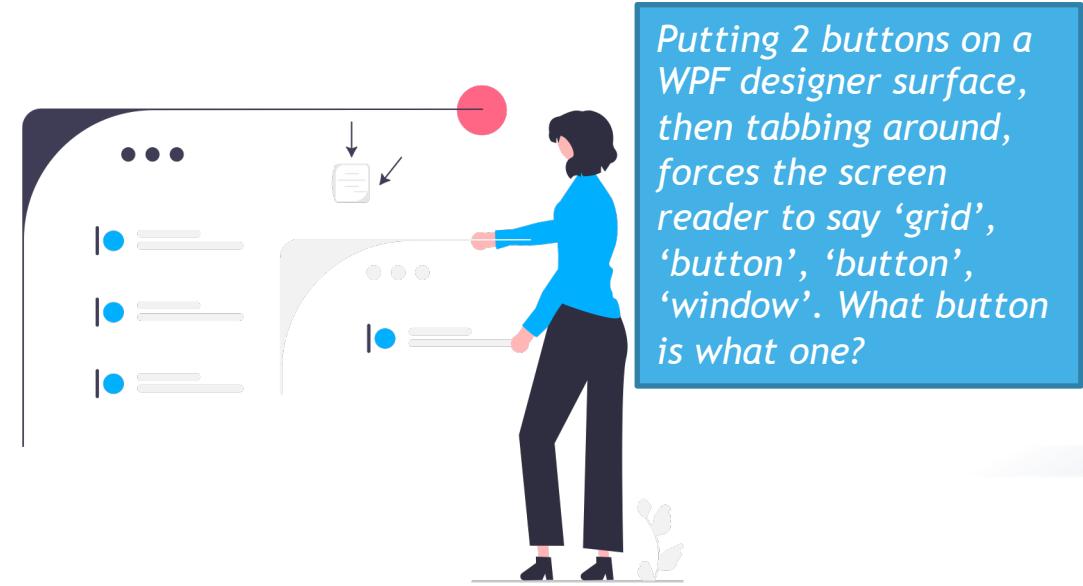
Robert, Lionel P. "Far but near or near but far? The effects of perceived distance on the relationship between geographic dispersion and perceived diversity." *Proceedings of the 2016 CHI Conference on human factors in computing systems*. 2016.

Altiner, Seher, and Mustafa B. Ayhan. "An approach for the determination and correlation of diversity and efficiency of software development teams." *South African Journal of Science* 114.3-4 (2018): 1-9.

A DEI Lens Can Inform the Design of Practices, Processes, and Tools: Examples



Remote work offers a *mechanism of control* for *identity disclosure and empowerment* of software developers from marginalized communities, such as transgender software developers^[Ford et al.].



For visually-impaired UI/UX developers, having descriptive comments and meaningful variable names makes it easier to *develop mental models* of code and to *collaborate more effectively*^[Pandey et al.].

Ford, Denae, Reed Milewicz, and Alexander Serebrenik. "How remote work can foster a more inclusive environment for transgender developers." *2019 IEEE/ACM 2nd International Workshop on Gender Equality in Software Engineering (GE)*. IEEE, 2019.

8 [Publication Pending] Pandey, Maulishree, Sharvari Bondre, Vaishnav Kameswaran, Hrishikesh Rao, Sile O'Modhrain, and Steve Oney. "UI Development Experiences of Programmers with Visual Impairments in Product Teams." *Equity, Diversity, and Inclusion in Software Engineering: Best Practices and Insights*. 2023.

The background of the slide features a complex, abstract network structure composed of numerous light blue lines and small teal dots, representing a mesh or a web of connections.

Mentorship in an HPC Workforce Development Context

Defining Mentorship

By **mentorship**, we mean a relationship in which a more experienced or more knowledgeable person (a mentor) helps to guide a less experienced or less knowledgeable person (a mentee).



The Benefits of Mentorship for Mentees



Career Support
(like training, coaching, and advocacy)



Psychosocial Support
(like role modeling, counseling, and friendship)

In mentorship, we aren't just learning a *mechanical set of skills*, we learn what it means to *be something*. We pick up all kinds of *norms* and *narratives* and *ways of seeing the world* that shape our identity as professionals.

Mentorship in a DEI Context



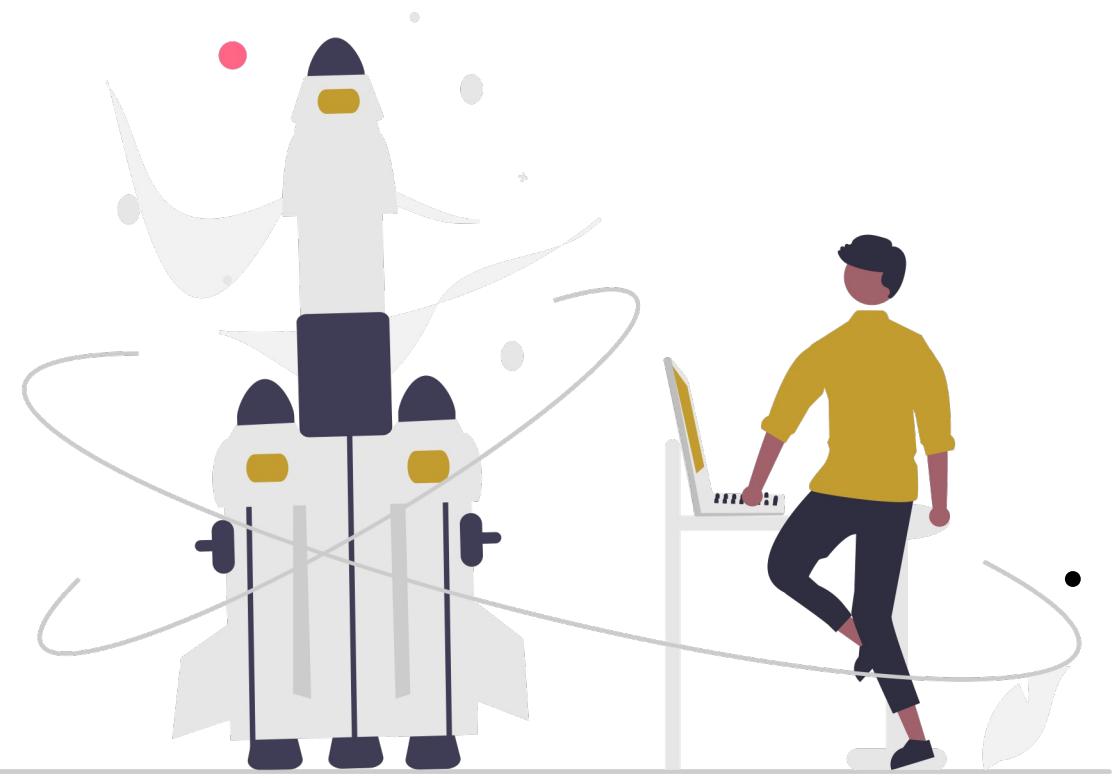
- Mentorship can support the growth and retention of professionals from underrepresented and marginalized groups by *bringing them into the fold* and *empowering* them.
- From a research perspective, a DEI lens on mentorship can also assist in developing a *comprehensive view on the practice*
 - Underrepresented and marginalized groups often face similar challenges as their peers but feel the effects of those challenges at a larger scale.

Why Mentorship? Why Now?

- The HPC workforce is continuing to diversify, as exemplified by the **research software engineering (RSE)** movement
 - RSE departments at universities and national labs
 - National, non-profit RSE organizations
 - RSE conferences, workshops, and other colloquia
- We must promote the ongoing **skill development** and **career advancement** of those professionals



Why Mentorship? Why Now?



- Looking beyond Exascale computing, we anticipate many more **disruptive cycles of innovation** in computing technologies. RSEs will need to keep growing and learning.
- This is also a retention challenge. We must sustain a **vibrant community of practice** capable of meeting present and future needs.

Common Themes We've Found In Mentorship of Software Developers (1/2)



- Among developers we've interviewed and surveyed...
 - Ideal mentors are **honest, active listeners, trustworthy, and accessible** to their mentees
 - Ideal outcomes of mentorship include **encouraging skill development, promoting self-awareness, coaching and vision-building, and navigating the institution.**

Common Themes We've Found In Mentorship of Software Developers (2/2)

- A **lack of time** to provide mentorship is the number #1 barrier
- Institutions must **allocate resources** for mentorship activities.



A complex network of blue lines and dots forms a geometric pattern across the entire background.

Mentorship Through a DEI Lens

Work Remains to Be Done on Inclusion in STEM

LGBTQ STEM professionals are more likely to experience career limitations, harassment, and professional devaluation than their non-LGBTQ peers^[Cech].

Women in STEM tend have lower social capital (e.g., support networks) and may also perceive their academic climate as unwelcoming and threatening^[Casad].

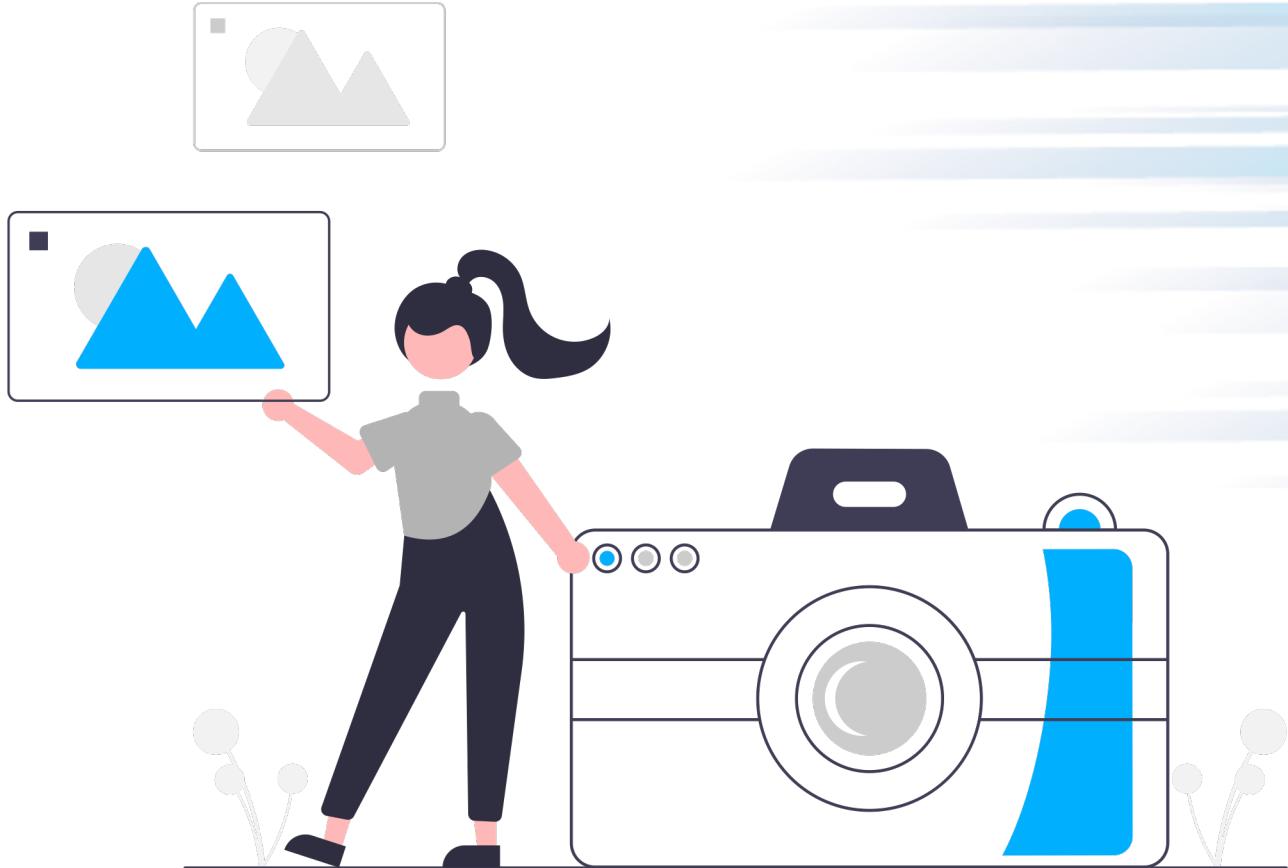
Discrimination and harassment are documented causes of underrepresentation of BIPOC in STEM^[Chaudhary].

Cech, Erin A., and T. J. Waidzunas. "Systemic inequalities for LGBTQ professionals in STEM." *Science Advances*. 7.3 (2021).
Casad, Bettina J., et al. "Gender inequality in academia: Problems and solutions for women faculty in STEM." *Journal of neuroscience research* 99.1 (2021): 13-23.

Chaudhary, V. Bala, and Asmeret Asefaw Berhe. "Ten simple rules for building an antiracist lab." *PLoS computational biology* 16.10 (2020): e1008210.

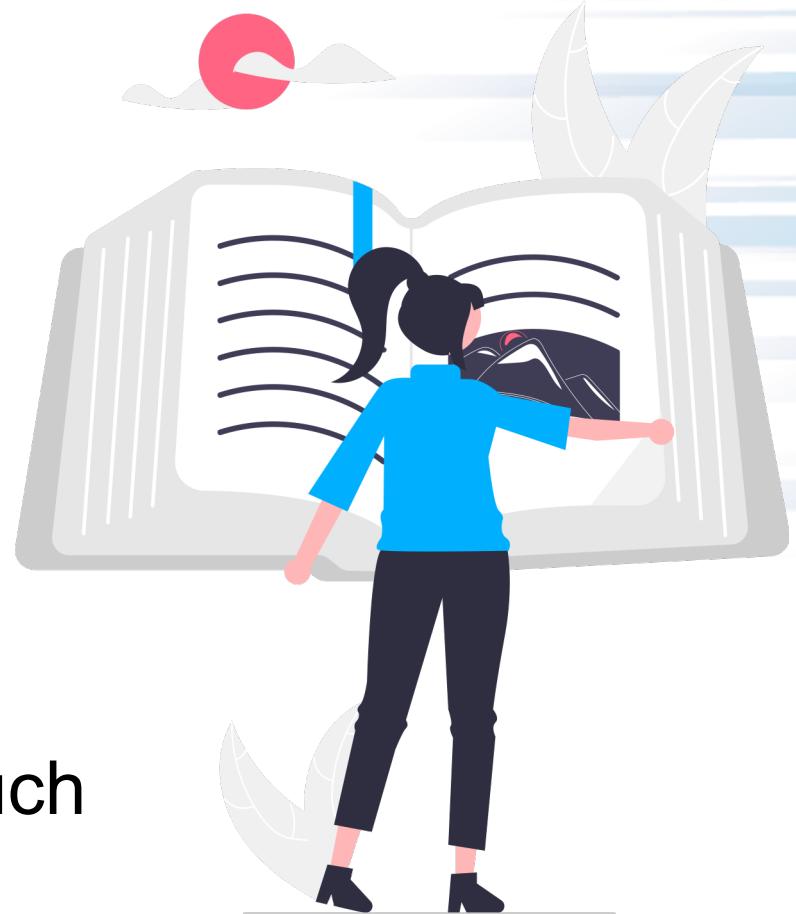
Getting at the Heart of Mentorship Practice

- As we mentioned earlier, studying software practices through the lens of DEI can ***enrich our understanding*** of those practices.
- Along these lines, we can study mentorship to surface useful ***strategies that promote inclusion***.

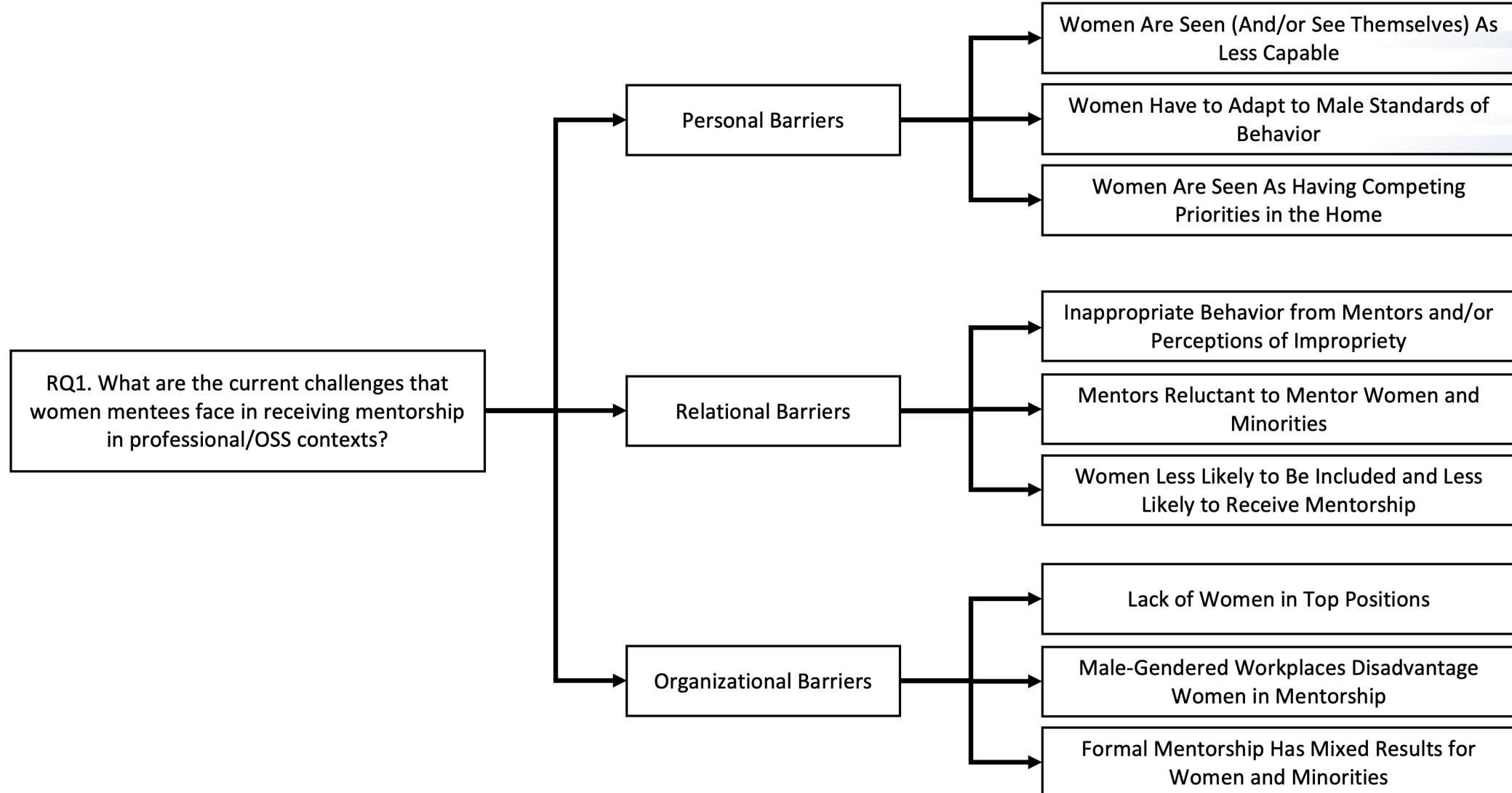


Mentorship of Women in OSS Projects: A Cross-Disciplinary, Integrative Review

- We investigated the *challenges* women mentees face in open-source software (OSS) and possible *strategies* that may help overcome those challenges.
- Double literature mapping study:
 - Mentorship of women in OSS contexts
 - Mentorship of women in the broader workforce outside software engineering (such as nursing, K-12 education, policing, etc.)



Reported Barriers to Women Receiving Mentorship (Of Which There Are Many)

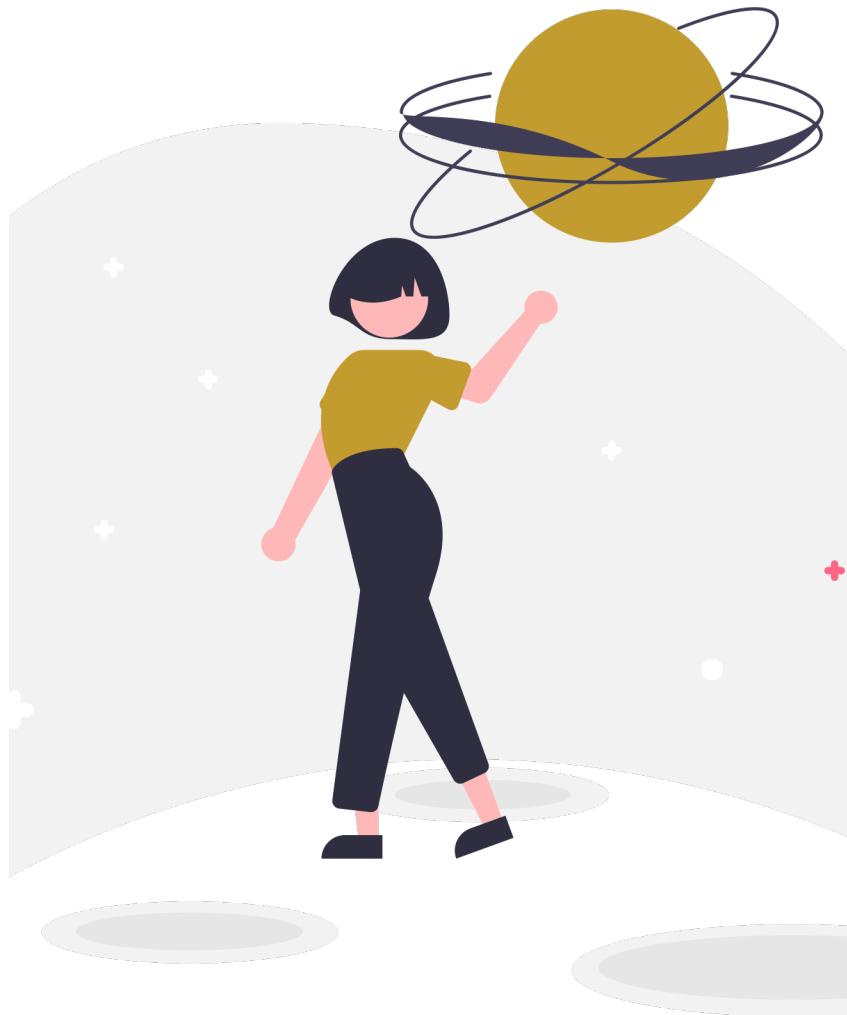


Recommended Mentorship Practices (1/2)

- Matching women with **women mentors**
- Encourage having **multiple mentors** (e.g., mentor networks, peer mentoring, group mentoring)
- Make goals of mentorship (e.g., psychosocial support) **explicit and anticipated outcomes**



Recommended Mentorship Practices (2/2)



- Provide **inclusivity-aware mentorship training**
- **Monitor progress** and allow women to exit dysfunctional mentor-mentee relationships
- **Recognize and reward** mentorship, especially mentorship of women
- Connect women with **online support communities**

In General, We Find That...



- Mentees from underrepresented and marginalized groups often seek mentors who...
 - Are **understanding and accepting** of their whole selves
 - Who promote a culture of **welcoming** and **openness**
 - Engender a sense of **belonging**
 - Are able and willing to provide **career** mentoring and **psychosocial** mentoring as needed

A complex network of blue lines and dots forms a geometric pattern across the entire background.

What We Need To Do

Take Action Now!

- Mentorship is something we can start taking action on **now**.
- In the long-run, RSEs would benefit from **explicit institutional support** for mentorship.
 - Formal mentorship programs,
 - Tailored training for RSEs who want to offer mentorship
 - Incentives for engaging in mentorship
 - Protected time for mentors and mentees to interact.



Highlight: Center for the Improvement of Mentored Experiences in Research (CIMER)



Mission of CIMER: To improve the research mentoring relationships for mentees and mentors at all career stages through the development, implementation and study of evidence-based and culturally-responsive interventions.

Highlight: Center for the Improvement of Mentored Experiences in Research (CIMER)

Complete Entering Mentoring Curricula

Curricula are organized by discipline. Each curriculum denotes the career stage of the mentee which whom the mentors work. Click on the magnifying glass to see a preview. Click on the lock to log in and download the curriculum as a PDF.

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|  Astrophysics ✓ Astronomy and Astrophysics ✓ Undergraduate Preview Download |  Biology ✓ Biology ✓ Undergraduate Preview Download |  Biomedical Research ✓ Biomedical ✓ Graduate ✓ Post Doc Preview Download |  Chemistry ✓ Chemistry ✓ Undergraduate Preview Download |  Clinical and Behavioral Research ✓ Clinical and Behavioral Sciences ✓ Junior Faculty ✓ Post Doc Preview Download |  Clinical and Translational Research ✓ Clinical and Translational Sciences ✓ Junior Faculty ✓ Post Doc Preview Download |
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Tailored curricula for different disciplines and organizational contexts!

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| ✓ Community Engaged Health Sciences ✓ Junior Faculty ✓ Post Doc Preview Download | ✓ Engineering ✓ Undergraduate Preview Download | ✓ Multidisciplinary ✓ Junior Faculty Preview Download | ✓ Field Biology ✓ Junior Faculty Preview Download | ✓ Math ✓ Undergraduate Preview Download | ✓ Multidisciplinary ✓ Undergraduate Preview Download |
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|  Physics |  Psychology |  Social Sciences | Adaptación del Entering Mentoring Series para Mentores de | Entering Mentoring Version 2 | Mentoring for Research Development Professionals |
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Facilitating Entering Mentoring Practice Facilitation Activity #3 Maintaining Effective Communication

Practice Facilitator Instructions: You will have 15 minutes to facilitate this activity. To download a personal copy of this document that you can edit, go to File > Download.

| Introduction Good communication is a key element of any relationship, and a mentoring relationship is no exception. As research mentors, it is not enough to say that we know good communication when we see it. Rather, it is critical that mentors reflect upon and identify characteristics of effective communication and take time to practice communication skills in the session and with their mentees. | | | | |
|---|--|-----------------|----------------------------------|--|
| Learning Objective 1. Provide constructive feedback | | | | |
| Overview of Activities for the "Maintaining Effective Communication" Session | | | | |
| <table border="1"><thead><tr><th>Learning Objectives</th><th>Core Activities</th></tr></thead><tbody><tr><td>1. Provide constructive feedback</td><td>Read and discuss the case scenario, "The Slob"</td></tr></tbody></table> | Learning Objectives | Core Activities | 1. Provide constructive feedback | Read and discuss the case scenario, "The Slob" |
| Learning Objectives | Core Activities | | | |
| 1. Provide constructive feedback | Read and discuss the case scenario, "The Slob" | | | |
| Electronic participant materials needed for session: <ul style="list-style-type: none">Case scenario "The Slob" | | | | |

Interactive exercises with measurable learning outcomes!

| | |
|---|---|
| Session Learning Objectives TELL: Share session learning objectives Case Scenario: The Slob Link to case scenario "The Slob" ASK: Ask a participant to read the case aloud or to read the case to themselves. Case Scenario: Instructions TELL: Provide case scenario instructions (based upon how you decide to implement the discussion) Case Scenario: Guiding Questions | Facilitator: <ul style="list-style-type: none">Facilitate activity (e.g., open discussion verbally, type in chat room, etc) Host/ Tech Support: <ul style="list-style-type: none">Assist participants having challenges with any of the platform functionsPlace any links to documents the facilitator refers to in the CHATProvide feedback to the facilitator and facilitate feedback discussion |
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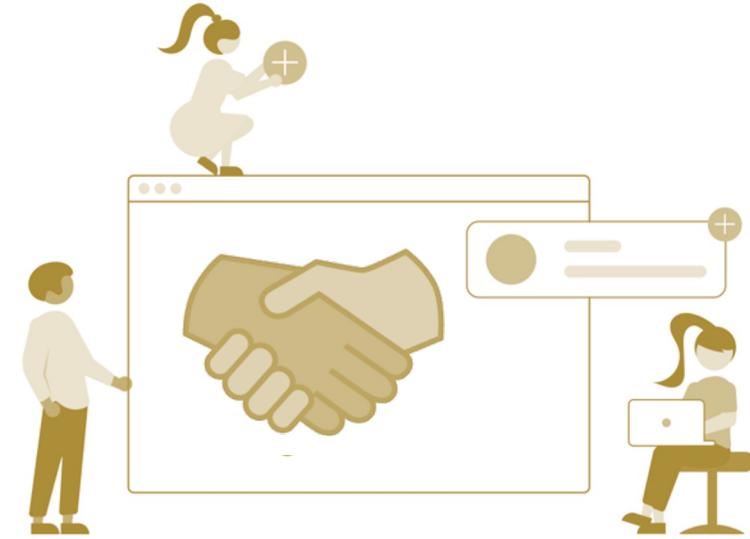
Mentorship Needs of RSEs



**Interdisciplinary
Mentorship
Networks**



**Long-term
Mentoring
Relationships**



**Training
Soft Skills**

Interdisciplinary Mentorship Networks

- A unique trait of RSEs is their interdisciplinary backgrounds and the interdisciplinary character of their work.
- A unique requirement for effective RSE mentorship is the availability of multiple mentors across different domains.
- No single mentor will be able to supply the necessary organizational, engineering, and domain expertise to a new RSE.



Need: Interdisciplinary software engineers must be conversant in multiple disciplines. An effective network of willing software engineers, domain experts, and organizational culture mentors will boost an RSE's confidence, skill set, and career growth opportunities.

Long-Term Mentoring Relationships

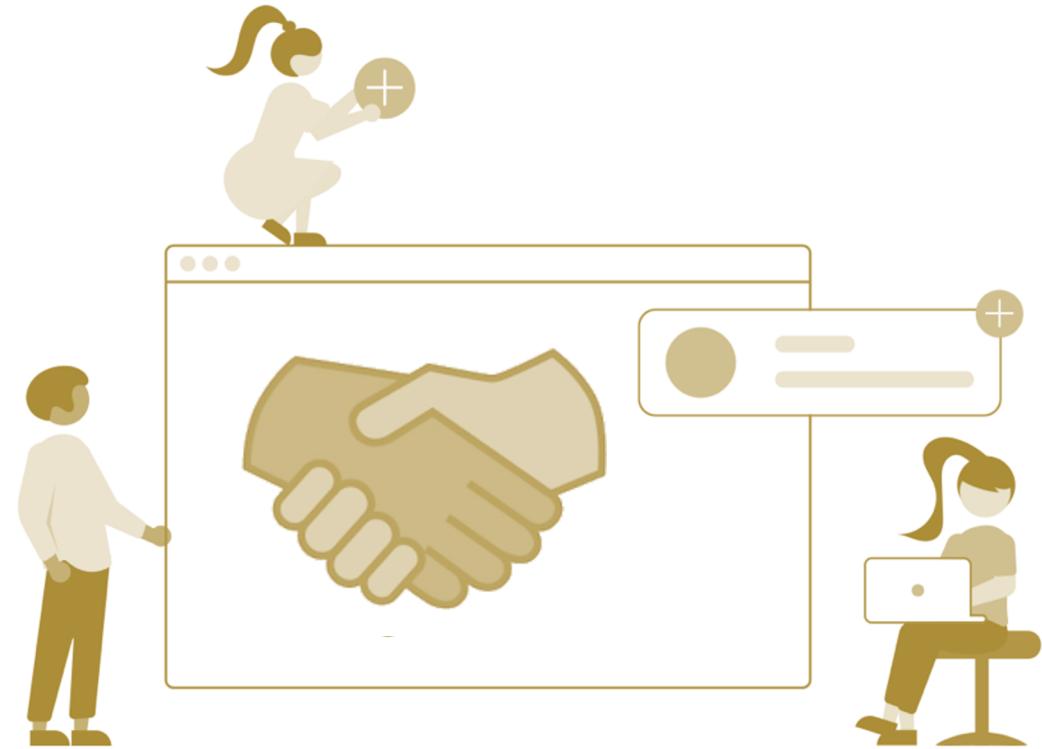
- Developers at major tech firms tend to hop between jobs frequently. At universities and national labs, professors and staff scientists may remain with the same institution for decades.
- If we intend to retain RSEs, we need a mentoring model that facilitates long-term, ongoing career growth.
- This is distinct from most mentorship programs in software industry, which focus on onboarding.



Need: Mentorship should not stop once an RSE shows a certain level of independence but instead needs to remain a high-level priority throughout the career of any RSE.

Training Soft Skills

- RSEs must communicate with domain experts, navigate research institutions as a software professional, and articulate software engineering best practices in the scientific domain.
- Soft skills are key to success. Unfortunately, RSEs almost never receive any formal training on applying those kinds of skills.



Need: Mentorship can and should include counseling mentees on relationships with colleagues, encouraging self-reflection, and lining up work opportunities to exercise soft skills.

Today, We Discussed...

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- How we can put this information to good use!