ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #36437

stEm Peer Academy: Building a Community of Practice

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Jennifer Love is a full-time faculty member at Northeastern University in the College of Engineering's Center for STEM Education. She earned a BS in Mechanical Engineering from Rensselaer Polytechnic Institute in 1993, a MS in Biomedical Engineering from The University of Iowa in 1997 and a Doctorate in Education (EdD) from Northeastern University in 2022. She worked as a professional engineer in the medical device and athletic footwear industries for 10 years before joining the faculty at Northeastern in 2006. Her most recent teaching position was in the First Year Engineering Program at Northeastern for 10 years, where she helped to establish the First Year Engineering Learning & Innovation Center makerspace and their new "Cornerstone" integrated project-based learning curricula.

Mrs. Claire Jean Duggan, Northeastern University

Claire Duggan is the Executive Director of The Center for STEM Education at Northeastern University. She has led and/or collaborated on multiple educational initiatives impacting the science and engineering landscape.

Dr. Jacqueline A. Isaacs, Northeastern University

Dr. Jacqueline Isaacs joined Northeastern in 1995 and has focused her research pursuits on assessment of the regulatory, economic, environmental and ethical issues facing the development of nanomanufacturing and other emerging technologies. Her 1998 NSF Career Award is one of the first that focused on environmentally benign manufacturing. She also guides research on development and assessment of educational computer games where students explore environmentally benign processes and supply chains in manufacturing. She has been recognized by Northeastern University, receiving a University-wide Excellence in Teaching Award in 2000, the President's Aspiration Award in 2005, and a College of Engineering Excellence in Mentoring Award in 2015. An ELATE Fellow, Dr. Isaacs has served in numerous administrative leadership roles at Northeastern, currently as Vice Provost for Faculty Affairs..

Prof. Johne' M Parker, University of Kentucky

Johné M. Parker is Acting Associate Dean, Diversity, Equity and Inclusion for the College of Engineering and an Associate Professor of Mechanical and Aerospace Engineering at the University of Kentucky. She received her BME, MSME and Ph.D. degrees from the George W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology and has industrial experience with Shell Oil Company and Mobil Chemical Company. Dr. Parker has received both federal and industrially-sponsored funding, including an NSF CAREER award; her research interests include systems and controls, focusing on the use of emerging technologies to provide feedback. She is also very interested, and actively engaged, in engineering education research, particularly as it relates to broadening participation.

Ms. Keisha Marie Norris, Miami University

Keisha Norris is the Assistant Director of academic advising and diversity initiatives in the College of Engineering and Computing at Miami University.


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5th Annual Conference of CoNECD
Collaborative Network for Engineering and Computing Diversity
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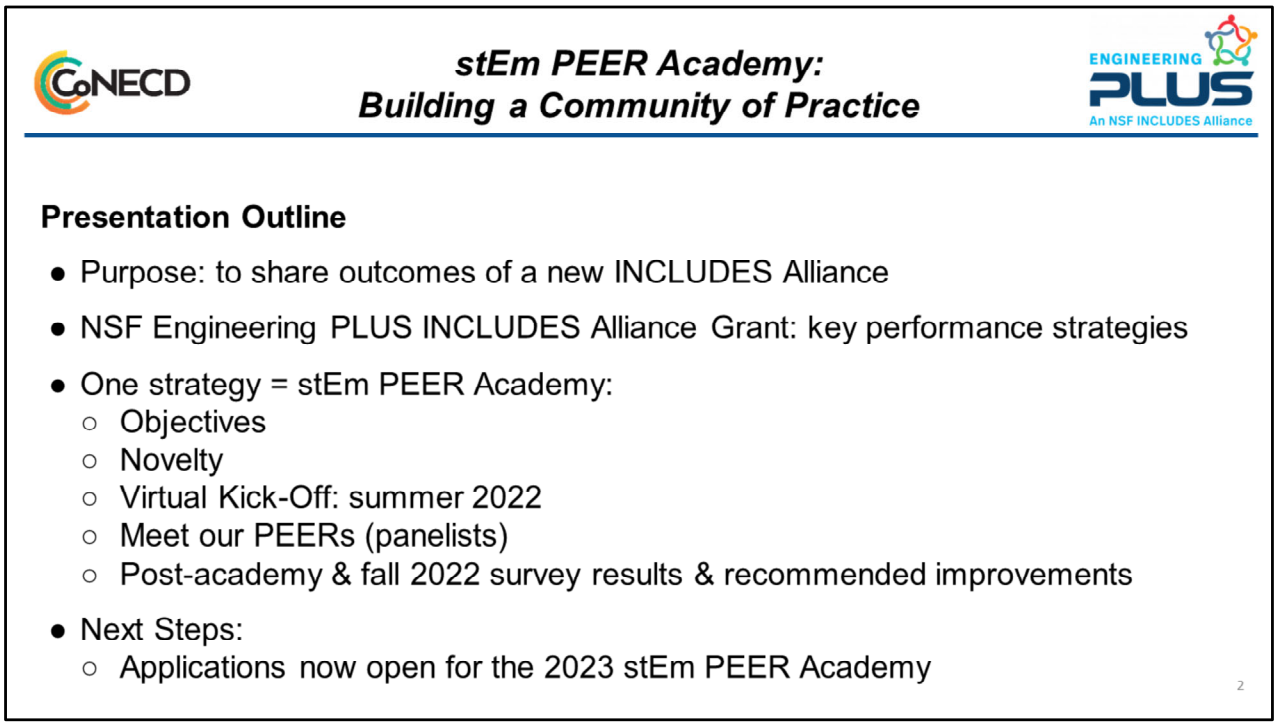
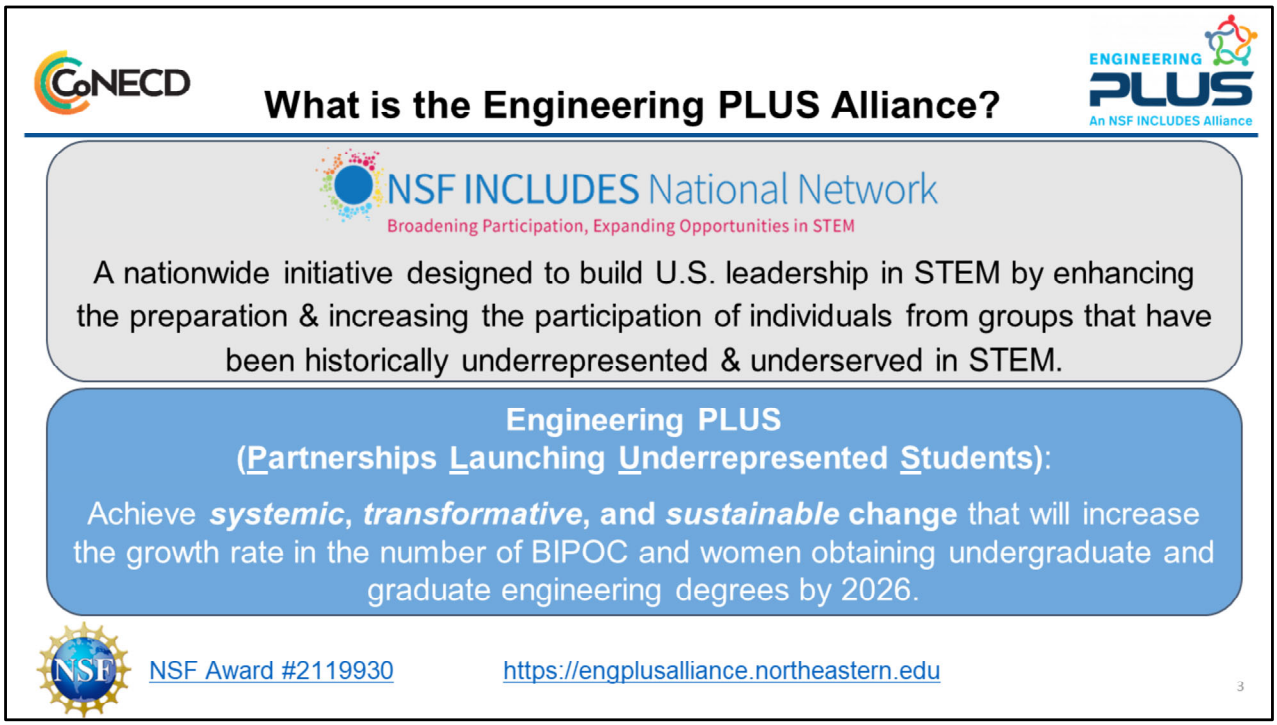


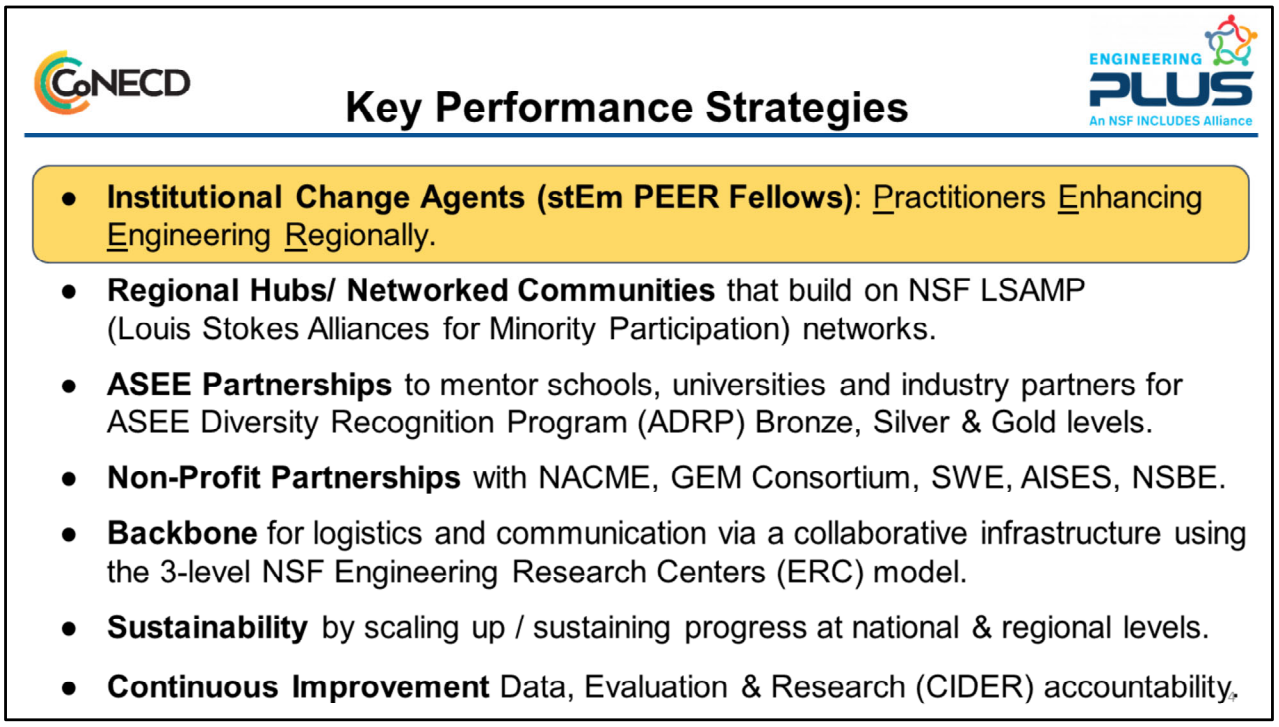
Presentation Outline

Authors Slide will be added for the actual presentation in New Orleans.



One of 17 alliances in higher education funded by NSF.

Despite several decades of research, initiatives and best practices in this area, we still have not achieved systemic, transformative and sustainable change with respect to the numbers of underrepresented, underserved students.



While this grant has many key performance strategies, this "paper" presentation will focus on **Institutional Change Agents** and the **stEm PEER Academy** of Fellows.

Non-Profit Partnerships:
NACME = National Action Council for Minorities in Engineering https://www.nacme.org
National GEM Consortium https://www.gemfellowship.org
SWE = Society of Women Engineers https://swe.org
AISES = American Indian Science and Engineering Society https://www.aises.org
NSBE = National Society of Black Engineers https://www.nsbe.org

What Are the Matriculation Trends?

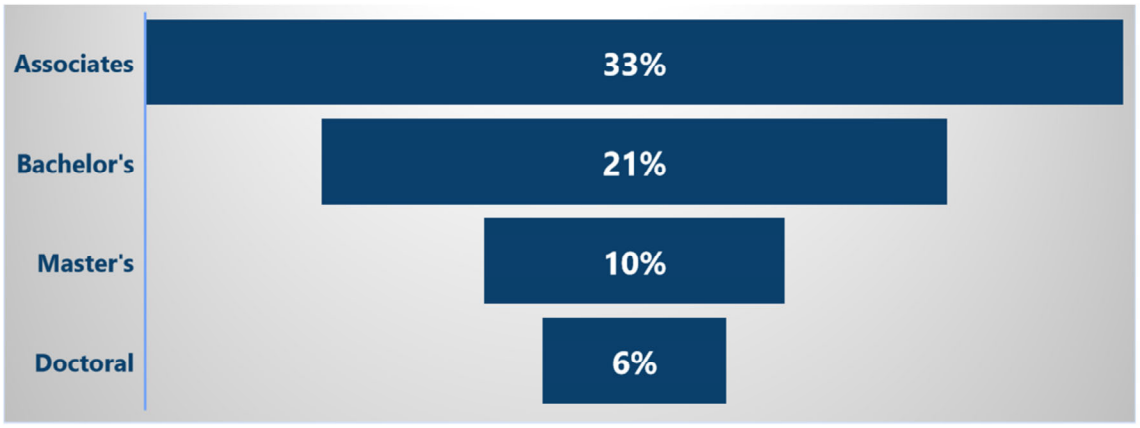
Percent of total degrees		2011	2021
Undergraduate	Total Degrees	77,802	134,694
	Women	18.9%	24.1%
	BIPOC Men	14.7%	16.2%
Graduate	Total Degrees	47,581	58,985
	Women	22.1%	27.3%
	BIPOC Men	9.3%	6.7%

Percent of Women and BIPOC Men Awarded Degrees Compared to Engineering Total (Source: IPEDS, 2022 [1]).

Although there is progress in the number and % of women in the last 10 years, engineering is still a discipline graduating predominantly male students.

Even more concerning is the *drop* in BIPOC men at the graduate degree level.

Reducing Matriculations by Level



2021 Graduation Data for Historically Marginalized Groups (source: IPEDS, 2022 [1]).

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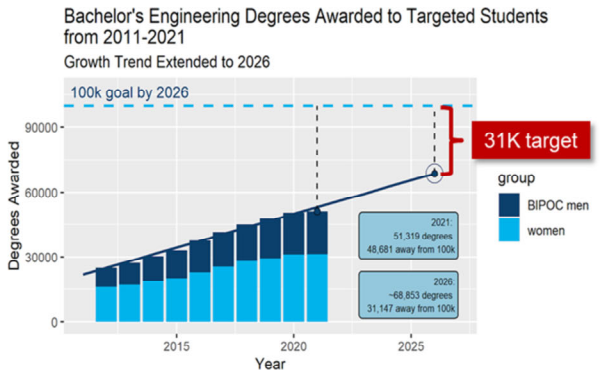
Engineering drop-offs occur at key transition points but it's not a simple "leaking pipeline" analogy.

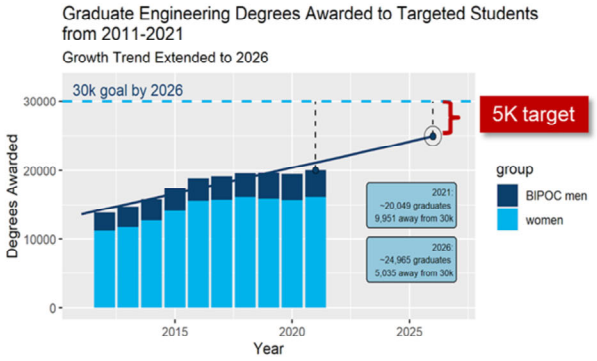
Associates level includes engineering technology and engineering.

What's not shown is that students can't always get "back into the pipeline" (Cannady, Greenwald & Harris, 2014) [2].

We prefer to refer to "pathway" not pipeline because a pathway is open, while a pipeline is closed.

Graduation Rate Targets: *Beyond* the Expected Trends





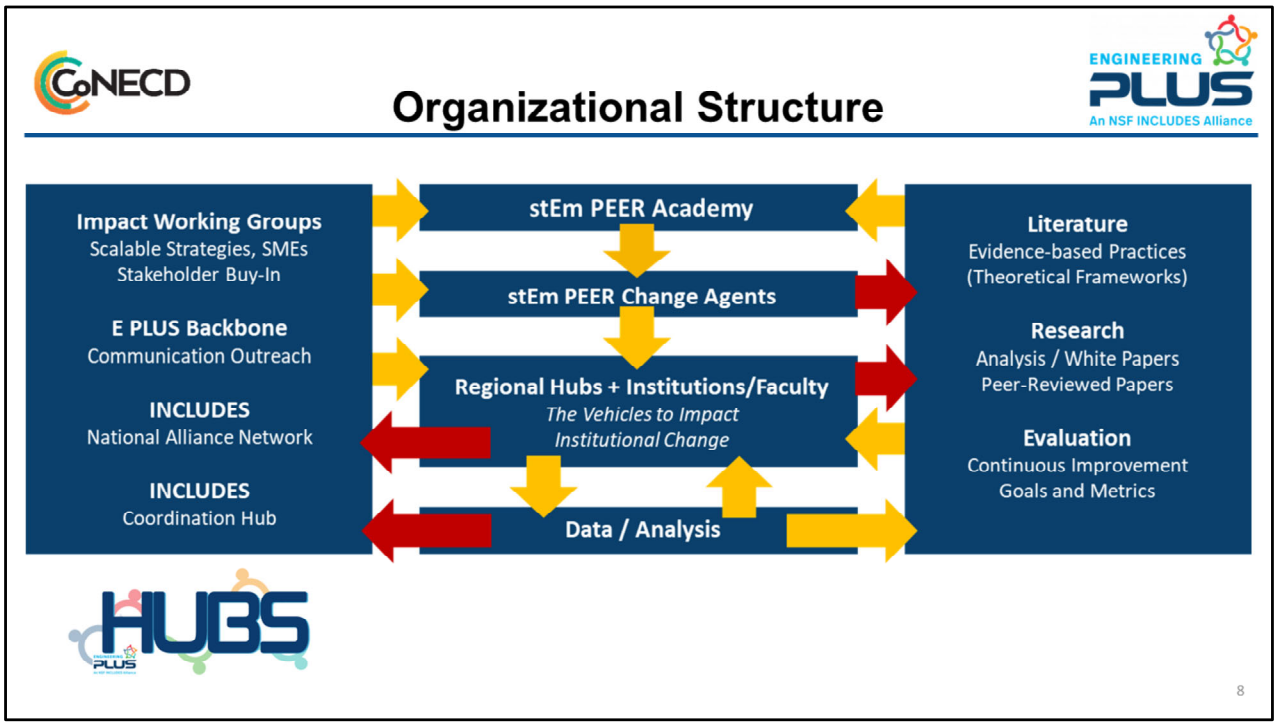
Source: IPEDS, 2022 [1].

Targets were identified from previous work with the "50k Coalition" (https://50kcoalition.org).

Target #1: substantially increase the number of BIPOC and women **undergraduate degrees** to **100,000 by 2026** (more than 31,000 *beyond the current trajectory*).

Target #2: substantially increase the number of BIPOC and women **graduate degrees** to **30,000 by 2026** (more than 5,000 *beyond the current trajectory*).

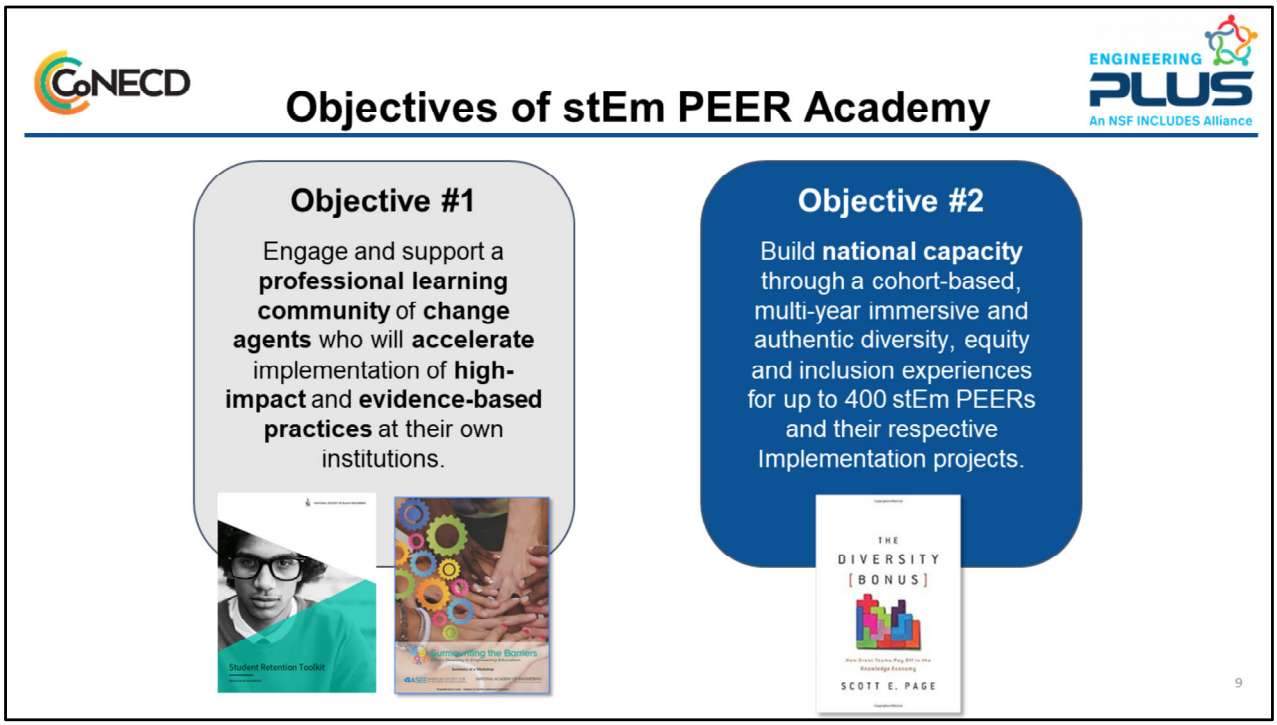
A **collective alliance of networked communities** is needed to build an **inclusive infrastructure** that will **drive and sustain the systemic change** needed to markedly increase the diversity of engineering students enrolled and graduating across the country.



Why Engineering PLUS & how?

Contemporary efforts to broaden participation in engineering **fail to consistently leverage evidence-based, high impact practices** and **address obstacles** necessary to catalyze institutional change at scale.

The Engineering PLUS ecosystem has been designed to equip change agents (stEm PEERs) with evidence-based, high impact practices and to collectively address obstacles as PEERs deploy regionally and connect nationally to each other and various partners in a BIG WAY! (see diagram). **This ecosystem is NOVEL because it connects people to each other, to their regional hubs, TO NEW HUBS, and across existing INCLUDES Alliances. stEm PEER Academy focuses on catalyzing change agents and helping them to SCALE UP their evidence-based practices in a BIG WAY, since they're not alone as part of the Academy & the Alliance.**



Objective #1: **leverage existing evidence-based and high-impact practices** such as the NSBE Student Retention Toolkit [3] and ASEE research and reports [4] to engage & support a professional learning community of change agents (faculty, staff, administrators, industry professionals).

Objective #2: **build national capacity** with up to 400 stEm PEERs and their respective projects through an immersive and authentic DEI experience. “Many of our complex challenges involve understanding the actions, preferences, and capabilities of diverse people.” -Scott Page, University of Michigan, author of *The Diversity Bonus* [5].

stEm PEER Academy is NOVEL because it is a 2-year professional development and research experience (with stipends) to support the design and implementation of an engineering-focused Implementation Project at faculty/administrators’ home institutions, with the institution’s support.

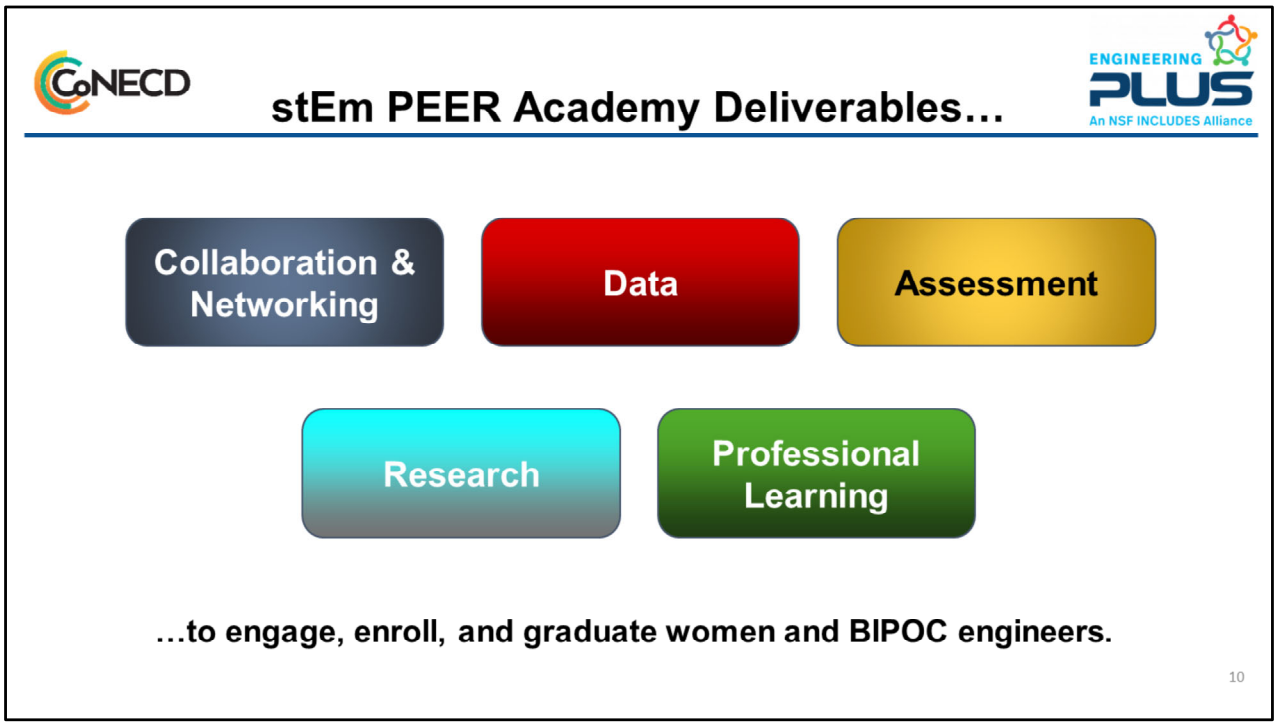
PEERs will have the opportunity to learn and engage with program experts, researchers and practitioners at various universities.

Participants will deepen their knowledge and understanding of the challenges and successful strategies guiding the transformation of our national Engineering landscape.

PEERs will utilize data and assessment to inform not only their specific implementation project but also to support their synergistic program efforts at their respective institutions and beyond.

PEERs will also be guided and supported to submit project outcomes as publications to LSAMP, ASEE and/or the National INCLUDES Network to inform future broadening participation collaborations.

PEERs will launch (and join) a growing national community of engineering education equity leaders.



There are 5 deliverables of stEm PEER Academy:

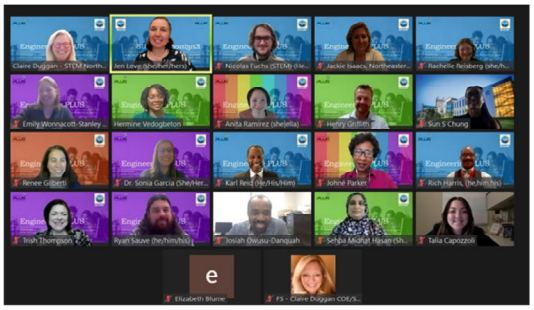
1. Collaboration & Networking
    a. Guide & support PEERs' in the broader NSF INCLUDES Alliance.
    b. Expand access to a robust network of leaders in the engineering education landscape.
2. Data
    a. Deepen & extend PEERs' knowledge & understanding of national engineering landscape.
    b. Expand PEERs' use of data & tools that inform decision making at their own institutions.
3. Assessment
    a. Deepen & extend PEERs' knowledge & understanding of national engineering landscape.
    b. Expand PEERs' use of data & tools that inform decision making at their own institutions.
4. Research
    a. Deepen & extend PEERs' knowledge of foundational research in student retention and other evidence-based practices that engage, enroll, and graduate their women and BIPOC engineers.

5. Professional Learning
    a. Provide a **toolbox of resources** to guide collaboration and partnerships at their respective institutions, with partners, and with each other (broader impact/broadening participation, proposal development, writing research papers, etc.).
    b. Expand PEERs' understanding of **national funding opportunities** aligned with their institutional goals (NSF grants, national education grants, industry grants, etc).

First Cohort of 2022 PEER Fellows

Virtual Kick-Off
May & June 2022

2 orientation meetings
4 full virtual days



Topics

- ❑ Understanding the engineering education pathway landscape & a deep dive into data, both with emphasis on Diversity, Equity and Inclusion (DEI).
- ❑ Models & interventions that work for women & BIPOC students.
- ❑ Building partnerships & engagement of stakeholders.
- ❑ Planning, implementing, assessing & scaling their Implementation Projects.

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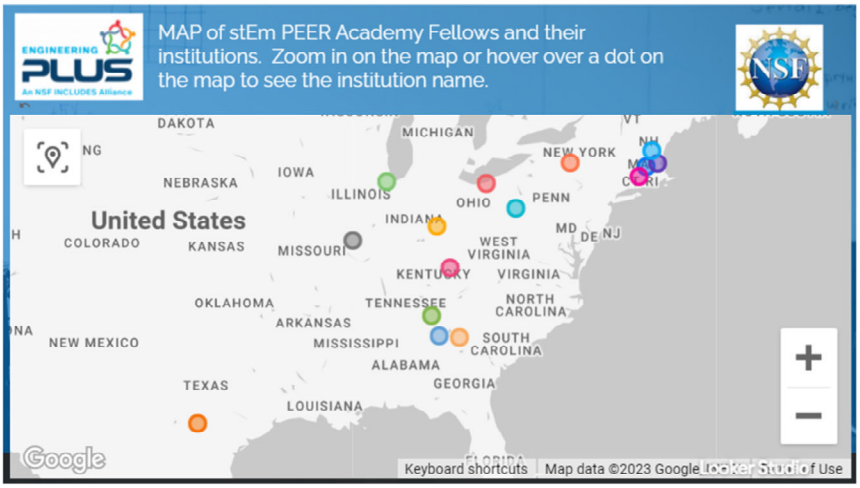
17 PEERs were selected from a pool of applications, each application with a support letter from the applicant's unit head or "sponsor".

Application required a brief statement about a potential evidence-based project or program that could be pursued at the applicant's home institution to address the lack of BIPOC and women in engineering. This PEER's project/program was subsequently called an "Implementation Project".

Topics during the virtual summer kick-off events included:
1) understanding the engineering education pathway landscape and a deep dive into data, both with an emphasis on DEI;
2) models & interventions that work for women & BIPOC students (women in engineering programs, Summer Bridge programs, First Year Engineering programs, mentoring, etc..), specific to regional landscapes;
3) building partnerships & engagement with stakeholders;
4) planning, implementing, assessing & scaling the PEER's "Implementation" project.

Map of Current PEER Fellows' Institutions



https://tinyurl.com/stEmPEERacademyMAP

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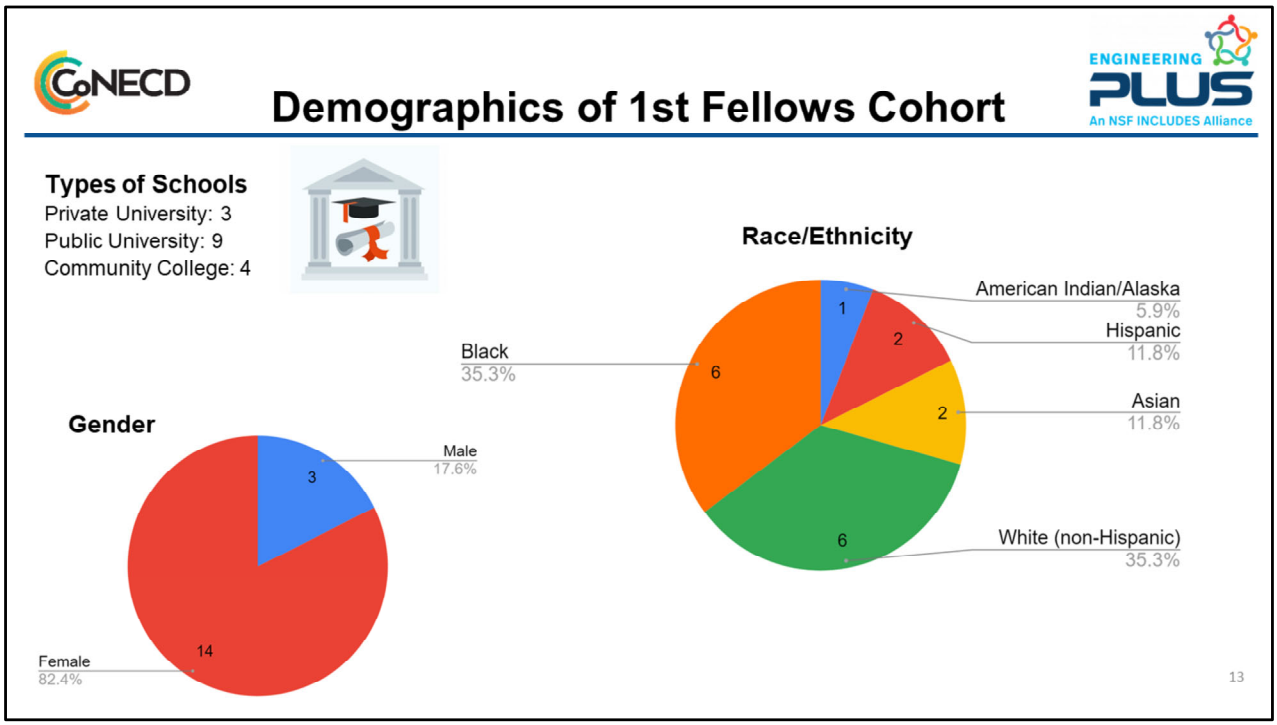
This interactive map (click on the image or link) exhibits all 15 institutions represented by 17 stEm PEERs in the inaugural 2022 cohort. This map will be updated with future cohorts and regional hub partners to illustrate the far-reaching span of this alliance network as it grows and expands. *Satellite map view has been changed to white background for better accessibility to all viewers.*

https://tinyurl.com/stEmPEERacademyMAP



Demographics of 17 PEERs

High relative % of black & hispanic PEERs.
High % of women vs men.
Majority are public institutions plus several community colleges.

stEm PEER Academy Fellow Profiles

Johné M. Parker, PhD - University of Kentucky [panelist today]
Associate Dean: Diversity, Equity & Inclusion
College of Engineering
Summer Bridge & seminar series for students

Keisha Norris - Miami University, Ohio [panelist today]
Assistant Director: Academic Advising & Diversity
College of Engineering & Computing
2nd Year Female Engineering Living Learning Community (LLC)
ACES Early Arrival Program: 2nd Year eng/computer science students

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PEER panelists:
Johne Parker and Keisha Norris (and others) will be attending the CoNECD conference and co-presenting with us for this presentation/paper. Other stEm PEER Fellows who will not be attending the conference may also be featured if time allows. We will spend a significant amount of time on these panelists' experiences (and others), hearing from them directly about how they've leveraged this INCLUDES Alliance and evidence-based practices in their programs and supports of BIPOC and female engineering students.

This panelist part of the presentation will:

1. focus on PEERs who have leveraged the NSF INCLUDES Alliance and/or their institutional support in significant ways.
2. focus on PEERs who have greatest potential for scaling up.
3. identify any evidence-based and high-impact practices that several PEERs have implemented to date.

Survey Evaluation #1

- Post-academy summer survey sent to all 17 PEERs, completed by 15 (88% response rate), likely to be representative of the broader group.
- Post-academy focus group attended by 9 PEERs (53% response rate).
- PEERs expressed a high degree of **passion for DEI** in STEM education & were interested in **learning more about high-impact practices (HIPs) & how to apply them in their setting**. As one participant eloquently put it, they were participating because of their "personal experience as a BIPOC engineer, students deserve the most, [and I am] fighting for the survival of the engineering program at my school and servicing the demographic of its (my) community."
- Other primary motivation for attending the Academy was to have the opportunity to network and collaborate with colleagues.

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First survey evaluation administered by CIDER (Continuous Improvement Data, Evaluation & Research team, introduced in slide 4) right after the Summer 2022 virtual stEm PEER Academy, included focus groups too. Initial questions probed their reasons for applying to the Academy, what they got out of the virtual institute and their next steps.

Survey Evaluation #2

- Fall 2022 survey sent to all 17 PEERs, completed by 14 with a 82% response rate, likely to be representative of the broader group.
- PEERs: most valuable parts of the Academy were engaging with colleagues who were knowledgeable and dedicated to the same purpose, learning about various tools, practices, and strategies, and being taken seriously as a professional.
- What's missing: an assessment of what challenges the PEERs' institutions are facing toward achieving their desired numbers of BIPOC and female graduates. Is there a way to identify actual interventions that would be most effective for recruitment, persistence, performance and graduation rates of BIPOC and female engineers at their own institutions?
- **"If there were more opportunities to think through the projects together, there might be more collaboration."**

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Second survey evaluation administered by CIDER during November 2022.

14 participants completed an evaluation survey administered by the grant's evaluation team, continuing with questions from the summer evaluation and probing with more questions about PEERs' progress this fall, particularly about their Implementation Project proposals, plans and next steps.

PEER Fellows want more dialogue with each other, collaboration, collaboration!!!!

Fellows' Recommendations

- PEERs expressed a desire for **deeper contact with other PEERs** and a more deliberate focus on networking (which may possible through in-person summer interaction at ASEE National Conference in Baltimore).
- The idea of **developing mentoring relationships was very important** among PEERs. Each PEER had different areas in which they could offer expertise and in which they needed help. They suggested that the leadership team develop an inventory of skills and knowledge available both among the PEERs and workshop leaders and speakers and post this information. This would enable PEERs to make inquiries and set up one-to-one or one-to-few sessions, establishing deliberate relationships and helping them advance their work.

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Recommendations to implement through academic year 2022 - 2023 and beyond, especially as next cohort of Fellows are being recruited (applications now being accepted on the website https://engplusalliance.northeastern.edu/)

Academy Guidance & Expectations

- Many of the fellows were in the process of trying to **plan next steps**, such as presenting their projects to **higher-ups at their institution** or attempting to **seek out additional resources** (such as NSF grant funding).
- **5 out of 17 PEER Fellows** reported to have made progress on their Implementation Projects during academic year 2022 - 2023, including preliminary programs, proposals to external funding sources, and draft proposals to this grant leadership team.
- PEER Fellows have been invited to **submit individual proposals** to the stEm PEER Academy leadership team for up to $10,000 to kick-off their Implementation Project (with logistical support from their own institution) and to anticipate submitting **future proposals to national funding agencies and/or industry partners**.

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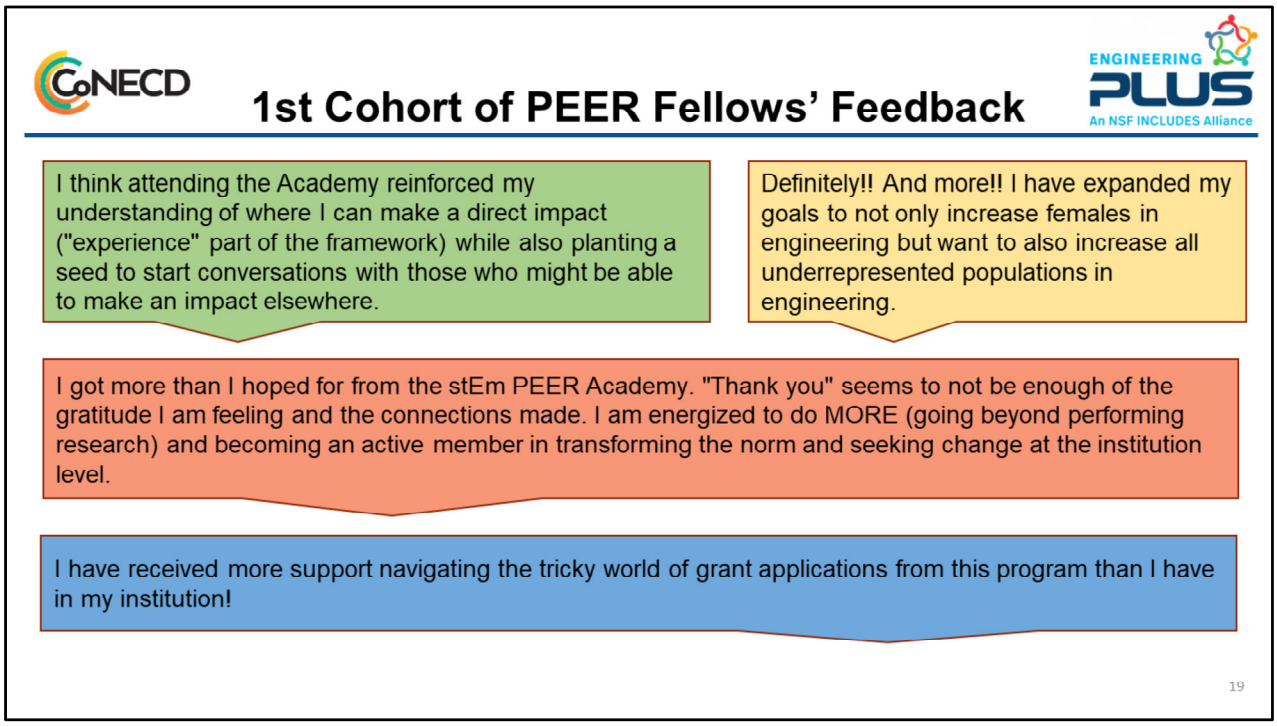
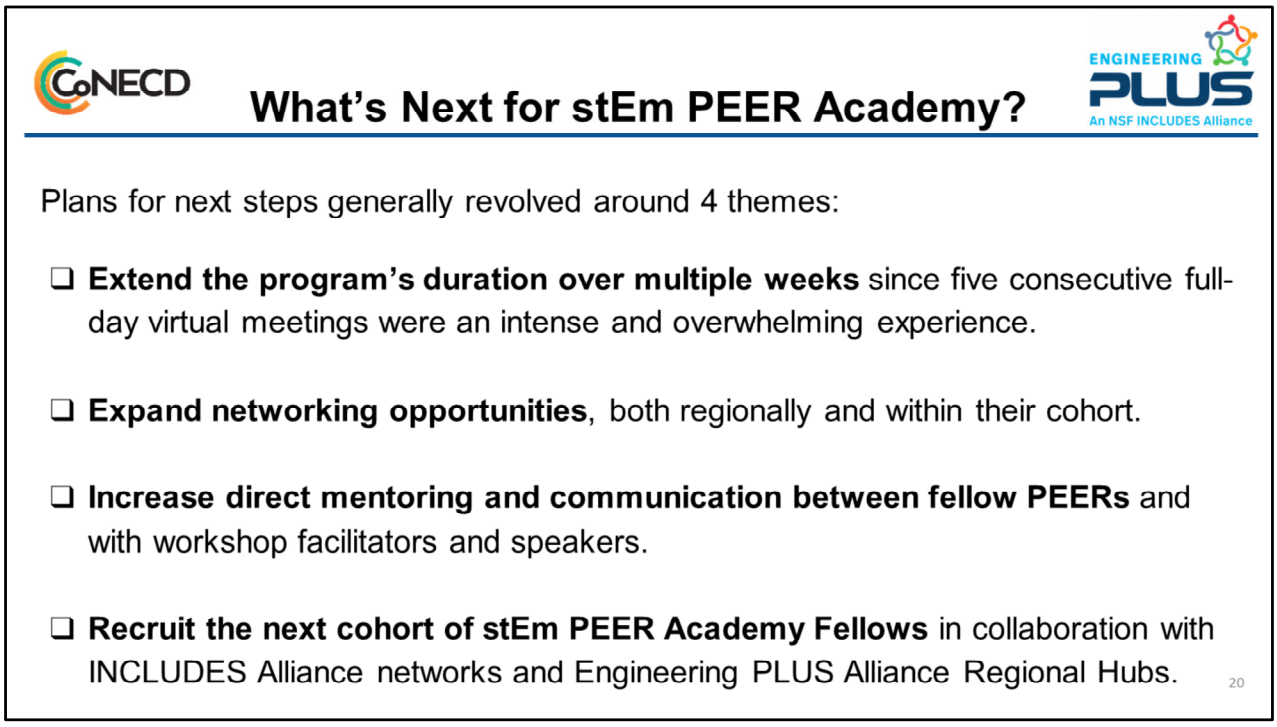
The majority of the fellows were just getting started in their Implementation projects, as many are faculty teaching full-time or administrators with various responsibilities.

All fellows are invited to submit individual proposals to stEm PEER Academy for kick-off money for their Implementation Projects, provided they have logistical support and buy-in from their host departments and/or colleges. Some Fellows may bypass this step to secure funding from other sources (NSF, Google, etc…), and some already have.



Their own words are very telling…



Plans are already in motion for next year's summer Academy.

Applications for the next cohort are also available now:
https://engplusalliance.northeastern.edu

References

[1] Integrated Postsecondary Education Data System, 2022. Retrieved from https://nces.ed.gov/ipeds/use-the-data.

[2] M.A. Cannady, E. Greenwald & K.N. Harris, "Problematizing the STEM Pipeline Metaphor: Is the STEM Pipeline Metaphor Serving Our Students and the STEM Workforce?", *Science Education*, vol. 98, no.3, pp.443-460, 2014. doi: 10.1002/sce.21108.

[3] National Society of Black Engineers, *Student Retention Toolkit*. National Society of Black Engineers, 2017.

[4] ASEE & National Academy of Engineering, *Surmounting the Barriers: Ethnic Diversity in Engineering Education: Summary of a Workshop.* Washington, D.C.: National Academies Press, 2014.

[5] S.E. Page, *The Diversity Bonus: How Great Teams Pay Off in the Knowledge Economy.* Princeton, NJ: Princeton University Press, 2019.

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