stEm PEER Academy: the Power of Human Capital

Dr. Jennifer Ocif Love, Northeastern University

Dr. Jennifer Love is a full-time faculty member of Northeastern University's College of Engineering, most recently in the First Year Engineering program. She is currently the Associate Director for the Center for STEM Education. She has a Bachelor of Science in Mechanical Engineering from Rensselaer Polytechnic Institute (1993), a Master of Science in Biomedical Engineering from The University of Iowa (1997) and a Doctorate in Education from Northeastern University (2022) where she recently completed her dissertation in elementary STEAM education. She also worked as a professional engineer in the athletic footwear and medical device industries for 10 years before joining the faculty at Northeastern University in 2006.

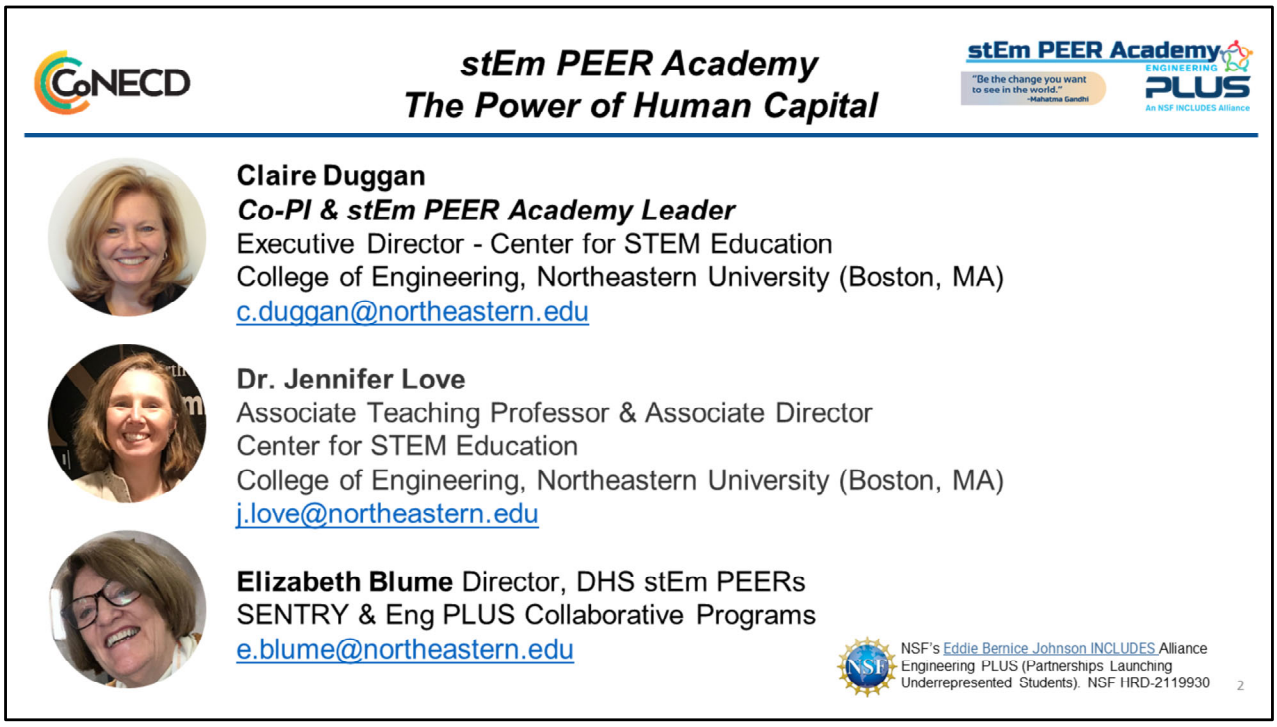
Ms. Claire Duggan, Northeastern University

Claire Duggan is currently the Executive Director for The Center for STEM Education at Northeastern University and Co-Principal Investigator for The Engineering PLUS Alliance. She is also current the Co-Principal Investigator for the REU site, REU Pathways and the S-STEM initiative, S-POWER.

Ms. Elizabeth H. Blume, Northeastern University Engineering PLUS Alliance

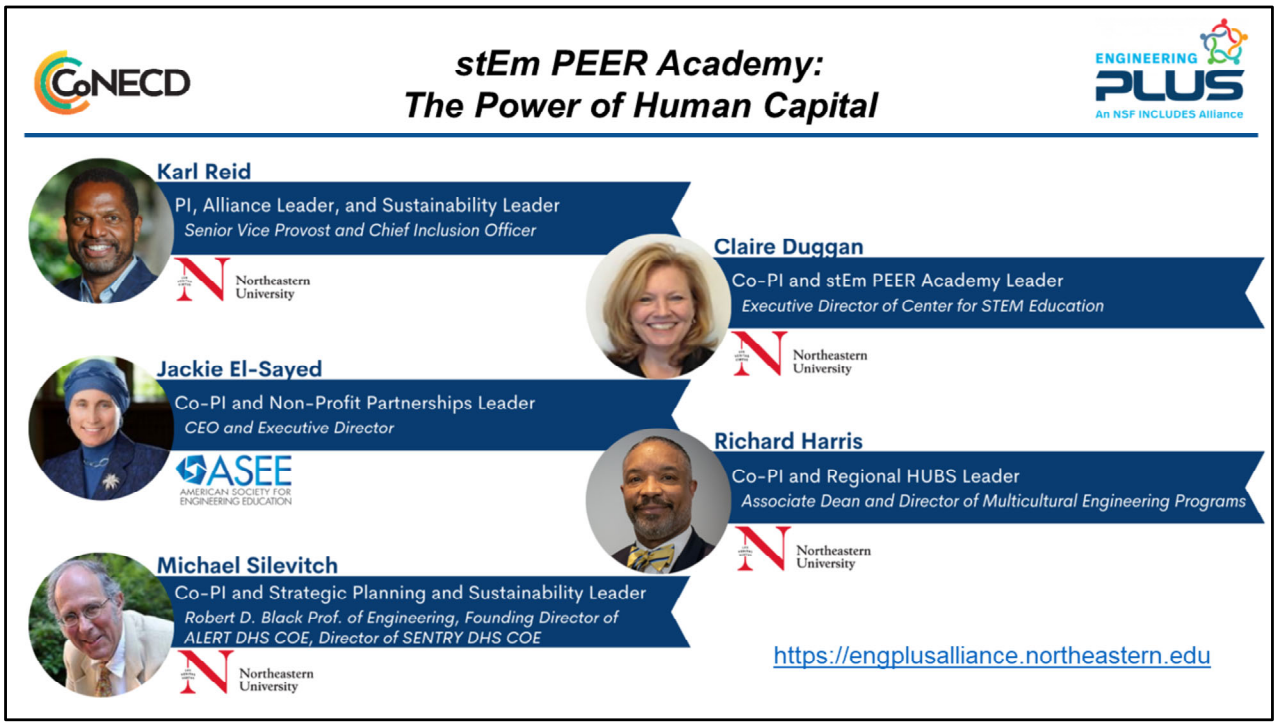
Elizabeth Blume is Manager of the Dept. of Homeland Security PEERs, SENTRY and Engineering PLUS Alliance Collaborative Programs, Northeastern University. She is also a member of the Leadership team for the Engineering PLUS Alliance.


CoNECD
CoNECD 2024
February 25-27, 2024
Crystal City Marriott
Crystal City, VA



Author slide

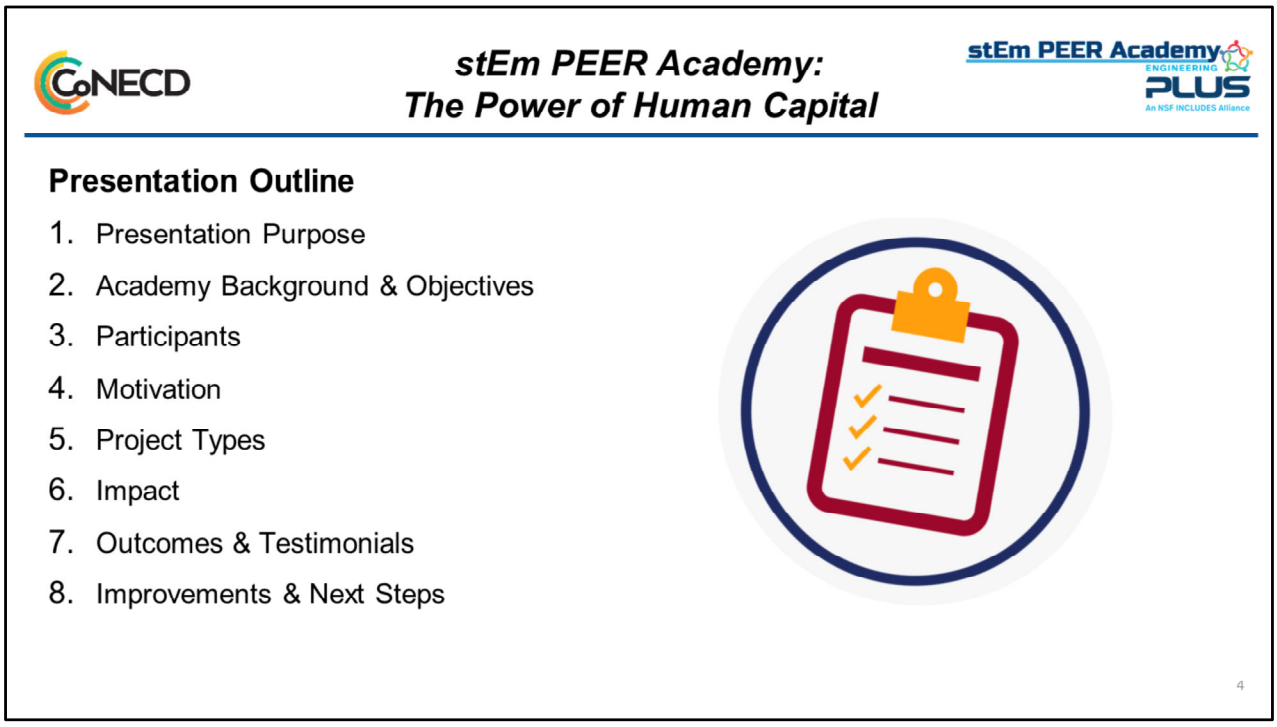
Claire Duggan, Jennifer Love & Elizabeth Blume



The NSF INCLUDES Engineering PLUS Alliance has 5 Principal Investigators & co-PIs.

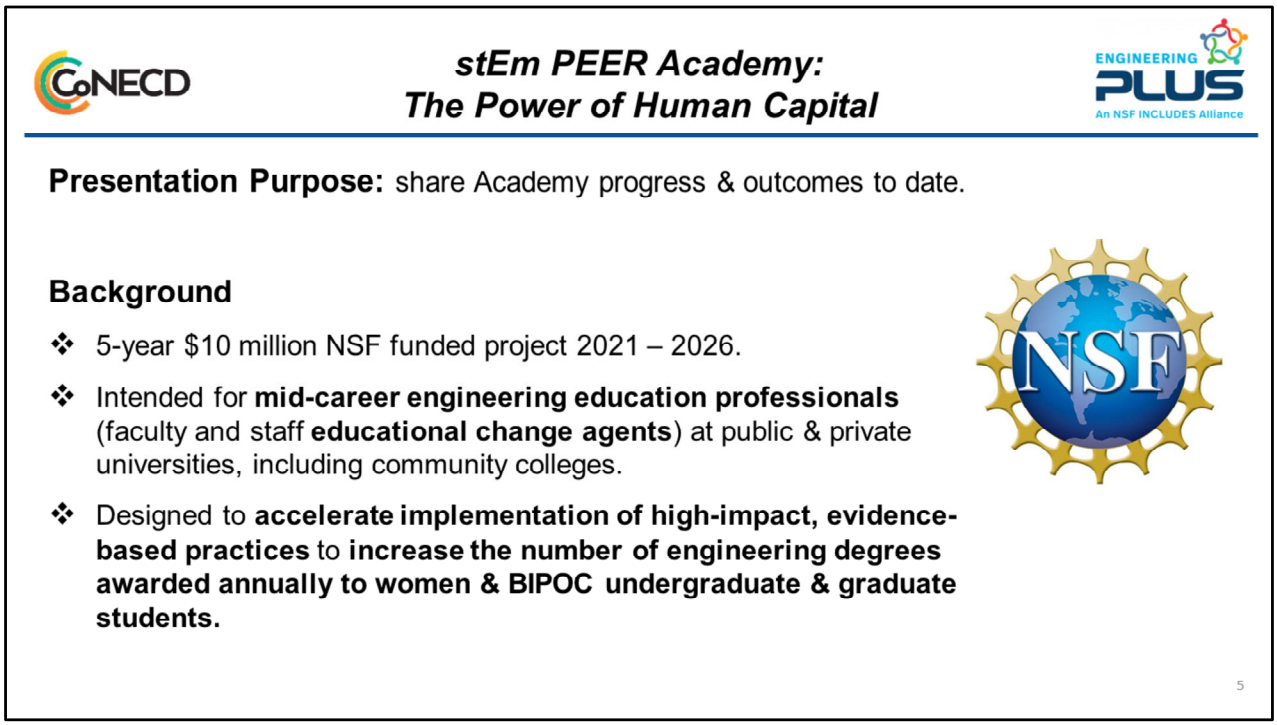
Engineering PLUS stands for “Partnerships Launching Underrepresented Students” and is the only INCLUDES Alliance that focuses solely on engineering.

https://engplusalliance.northeastern.edu/



This is our presentation outline for a NSF-funded project that is now in its 3rd year.

First, we will address the purpose of this presentation at CoNECD. Then we will briefly review stEm PEER Academy's background, objectives, participants and their motivation for applying in the first place. Then we will review the participants' project types and specific examples, followed by their impact on students, outcomes of the Academy and participants' testimonials. Finally, we will address improvements that we've incorporated over the past 2 years and our next steps in fulfilling the grant's objectives.



The purpose of this CoNECD presentation is to share our Academy's progress to date with the CoNECD and ASEE community, who are well aware of women and BIPOC engineering students' challenges to pursuing, persisting and finishing undergraduate and graduate degrees in the United States. More importantly, since we last presented at CoNECD 2023, we would like to share specific outcomes, impacts, and case studies about stEm PEER Academy Fellows themselves.

This presentation will focus on the "power of human capital" to leverage knowledge & networks to achieve systemic, transformative and sustainable change in engineering education diversity. It is our intention to include a panel of Academy "leaders" at the CoNECD 2024 conference to share their stories directly with CoNECD attendees.

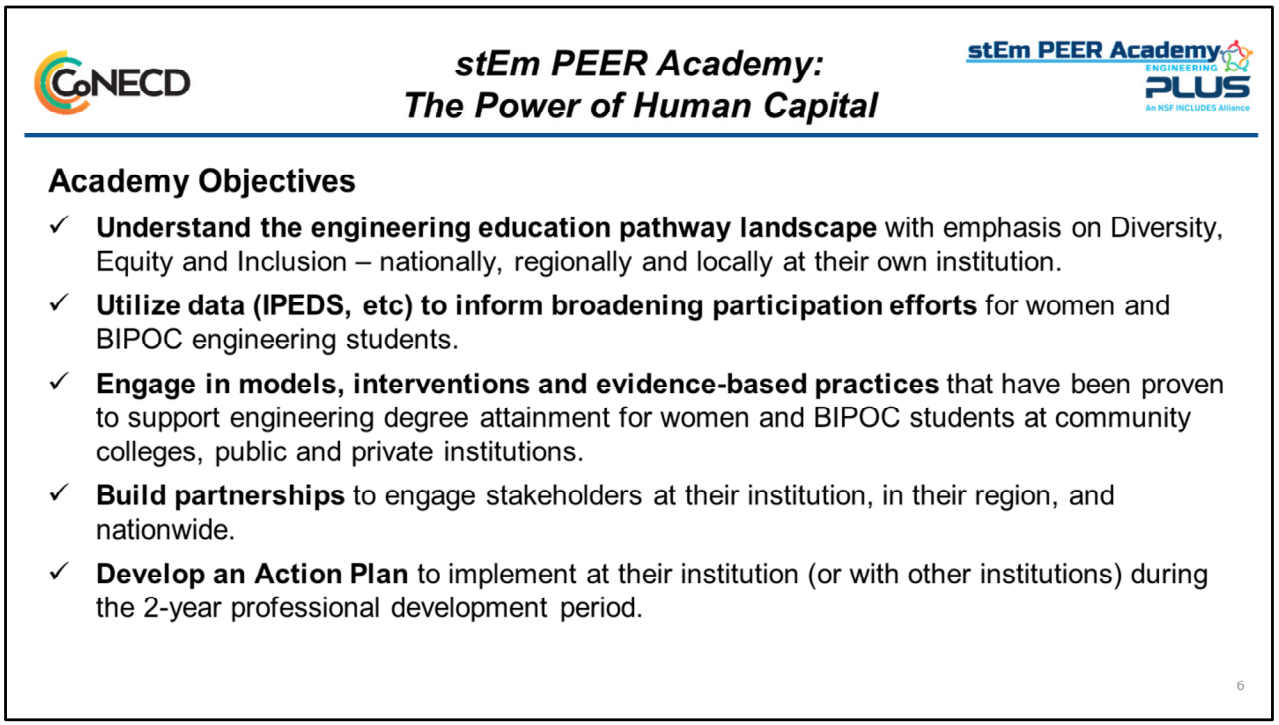
What is stEm PEER Academy?

Academy is part of a large **5-year $10 million NSF funded initiative** to address the number of women and BIPOC engineering undergraduates and graduate students at public & private institutions across the country, including community colleges.

It is designed to **accelerate high-impact evidence-based practices for mid-**

career faculty or professional staff in engineering education roles.

We are now in year 3 of the 5 year grant.

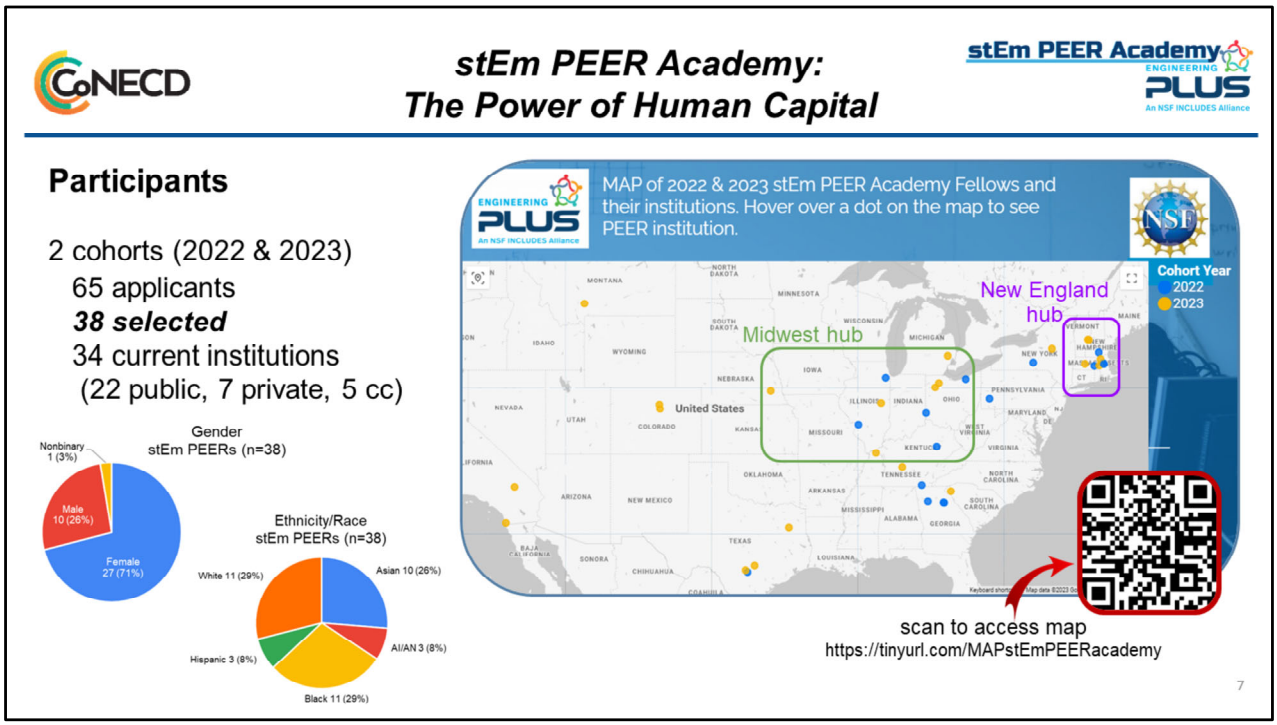


Specifically, the Academy's mission is train, empower, resource and support a national network of educational change agents through **5 objectives**, based on a 2-year professional development & research experience that guides participants to **design and implement an engineering-focused high-impact Implementation Project at their home institution**.

stEm PEER Fellows as change agents will:

- ✓ **Understand the engineering education pathway landscape** with emphasis on Diversity, Equity and Inclusion – nationally, regionally and locally at their own institution.
- ✓ **Utilize data (IPEDS, etc) to inform broadening participation efforts** for women and BIPOC engineering students.
- ✓ **Engage in models, interventions and evidence-based practices** that have been proven to support engineering degree attainment for women and BIPOC students at community colleges, public and private institutions.
- ✓ **Build partnerships** to engage stakeholders at their institution, in their region, and nationwide.
- ✓ **Develop an Action Plan** to implement at their institution (or with other

institutions) during the 2-year professional development period.



To date, 65 people (faculty, professional staff, postdocs) have applied over the 2 years. 40 were invited to participate (17 in cohort 2022 & 23 in cohort 2023) and 38 invited participants are currently active. Each participant is paid a $1,000 stipend and invited to attend CoNECD or ASEE national conferences (all eligible expenses are covered).

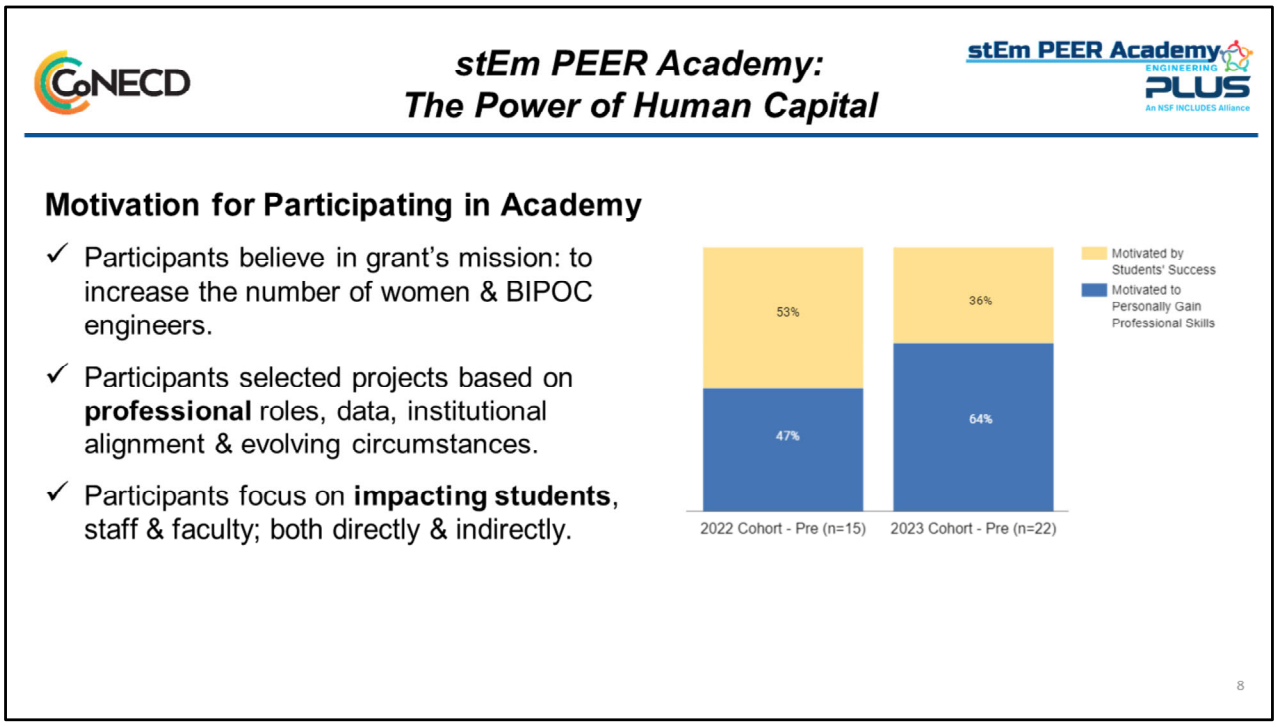
34 different institutions are represented (27 public universities including 5 community colleges plus 7 private colleges/universities), from small community colleges to large public research institutions.

This map (color coded by cohort year) illustrates where the current change agents are located by institution, as of December 2023.

Engineering PLUS also organized **regional hubs**, starting with the **New England hub** and the **Midwest hub**, as shown on the map above. Regional hubs are designed to be the collective alliance of networked communities 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. The goal is for three to five Engineering PLUS hubs to collaborate with the Urban Massachusetts LSAMP (UMLSAMP), the Northeast

LSAMP (NELSAMP), the Louis Stokes Midwest Regional Center of Excellence (LSMRCE) and other LSAMP alliances and non-LSAMP institutions as new regional hubs are formed.

The QR code links to https://tinyurl.com/MAPstEmPEERacademy, a Google Data Studio dashboard (now called Looker Data Studio) with a map on page 1 of the dashboard and a list of current stEm PEER Fellows, titles, institutions, ADRP status, and their hub region on page 2.



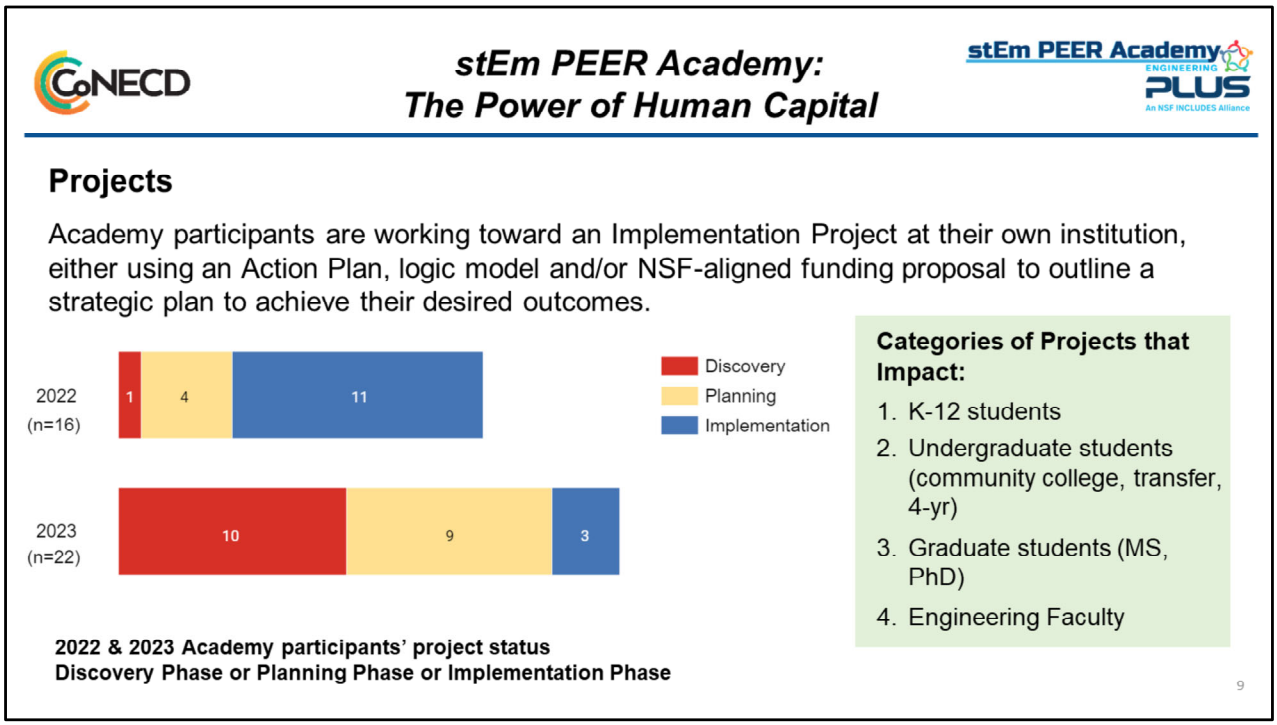
Academy participants are motivated by the work they do in this arena and many are women and/or BIPOC engineers themselves.

They are motivated to affect change at their own institutions based on their professional roles in engineering education, based on data (national, regional & local), and based on their institution's goals pertaining to diversity, equity and inclusion.

They are focused on directly and indirectly impacting current & future students and current & future staff/faculty, **to achieve systemic, transformable and sustainable change**.

According to qualitative survey questions administered to each cohort of participants at the beginning of their Academy experience asking about their **motivation for participating in the Academy**, they were either motivated by *personally gaining professional skills* in supporting women & BIPOC students or by *students' success*. The former is participant-focused while the latter is student-focused. These 2 categories were deduced from coding open responses collected in surveys administered by the eternal evaluator (IRB approved).

For the 2022 cohort, 7 participants (47%) wrote that they were motivated to personally gain professional skills (participant-focused) while 8 participants (53%) were motivated by students' success (student-focused). For the 2023 cohort, 14 (64%) were motivated to personally gain professional skills (participant-focused) while 8 (36%) were motivated by students' success (student-focused). Regardless, all participants eventually connected improvements in their own professional skills to improved outcomes for their women & BIPOC students. Perhaps the participants who were more student-focused haven't fully realized their own gains in professional skills, as this was early in the Academy.



Based on 1-on-1 mentoring meetings and all-participant monthly Academy meetings with the Academy leadership team (authors for this paper/presentation), participants have been categorized as currently being in 1 of 3 chronological phases of their projects: 1) **Discovery Phase** (still exploring data, talking with allies at their own institution, beginning to write an Action Plan or Logic Model or funding proposal), 2) **Planning Phase** (documentation complete, writing & submitting proposals for funding from any source) and 3) **Implementation Phase** (funding in progress, plans in place, action being taken).

The first cohort (2022) was introduced to the Academy during Summer 2022 through 6 half-days of virtual presentations, breakouts & discussion. They were charged with writing a NSF-aligned proposal to implement a project at their own institution. These participants are 1.5 years into a 2-year professional development experience so many have progressed to the Implementation phase, as shown in the top bar of the graph above. Projects include various types of Summer Bridge programs for undergraduates and transfer students, both in-person and virtual experiences. For example, 2022 stEm PEER Fellow **Henry Griffith** is currently implementing a transfer Summer Bridge program for historically marginalized community college students transferring from San Antonio College to the University of Texas at San Antonio, both are Hispanic Serving Institutions (HSIs). Case

studies of several stEm PEER Fellows' projects follow in the next slides. Other projects include K-12 pathways to engineering or undergraduate pathways to graduate engineering school.

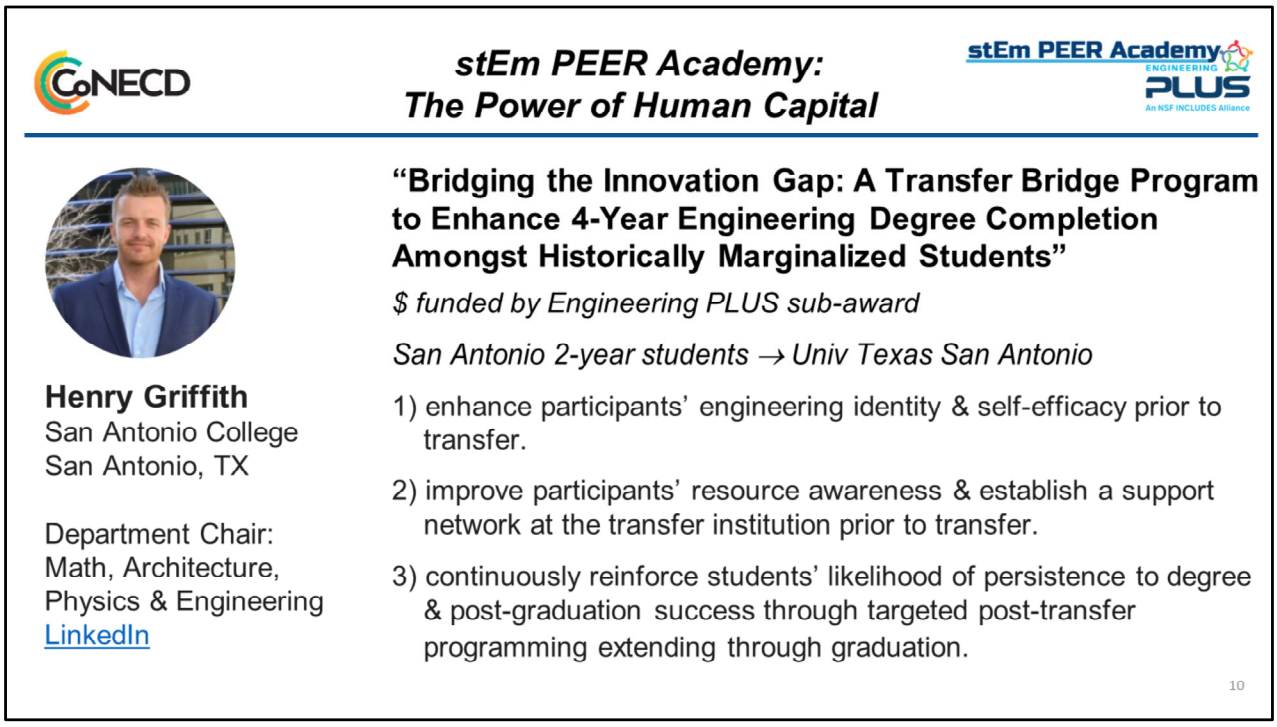
Specifically, the sixteen 2022 stEm PEER Fellows's projects can be grouped into 3 categories based on their intended impact:

1. Projects that **impact K-12 students and their potential engineering pathways** [n=5]. Examples include "broader impact" efforts with research faculty, a calculus-ready program for high school students, neurodiversity, artificial intelligence in K-12 teaching, and agriculture/STEM summer programs for girls.
2. Projects that **impact undergraduate students** (scholarships, Summer Bridge programs, transfer bridge programs, wrap-around supports, persistence to graduation) [n=10]
3. Projects that **impact graduate students** (scholarships, path to doctorate) [n=1]

The second cohort (2023) was introduced to the Academy during Summer 2023 through 6 half-days of similar presentations, breakouts & discussion. They were charged with developing an Action Plan first, and then ultimately a proposal. These participants are only 6 months into their 2-year PD experience so many are still in their Discovery phase. However, more than half of the 2023 cohort are already planning & implementing pilots of their proposed Implementation Projects to continue developing their ideas and evaluation tools.

Specifically, the twenty-two 2023 stEm PEER Fellows's projects can be grouped into 4 categories based on their intended impact:

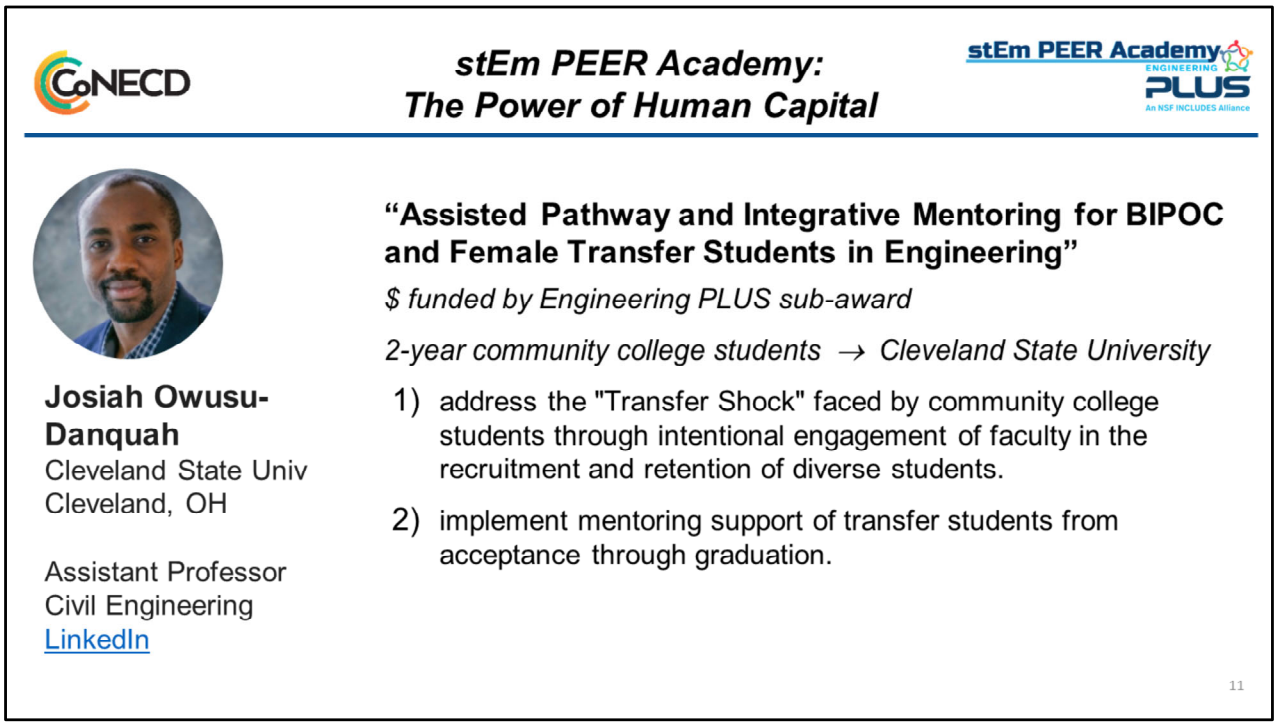
1. Projects that **impact K-12 students** and their potential engineering pathways [n=1]. Example involves a potential residential program for high school students.
2. Projects that **impact undergraduate students** (scholarships, Summer Bridge programs, transfer bridge programs, wrap-around supports, persistence to graduation) [n=15]
3. Projects that **impact graduate students** (scholarships, graduate student summer bridge programs) [n=4]
4. Projects that **impact faculty** (DEI training, growth mindset) [n=2]



Implementation Phase

2022 stEm PEER Fellow Henry Griffith has 2 appointments: one at San Antonio College and the other at the University of Texas San Antonio, which provides him with a unique position to design and deliver a novel transfer bridge program between the 2 institutions. He is targeting 50 undergraduate engineering students/year. He invited another 2022 stEm PEER Fellow Angela Birkes at Univ of Georgia to be a virtual speaker at Henry's 2023 Summer Bridge program when Angela spoke about pathways to graduate school.

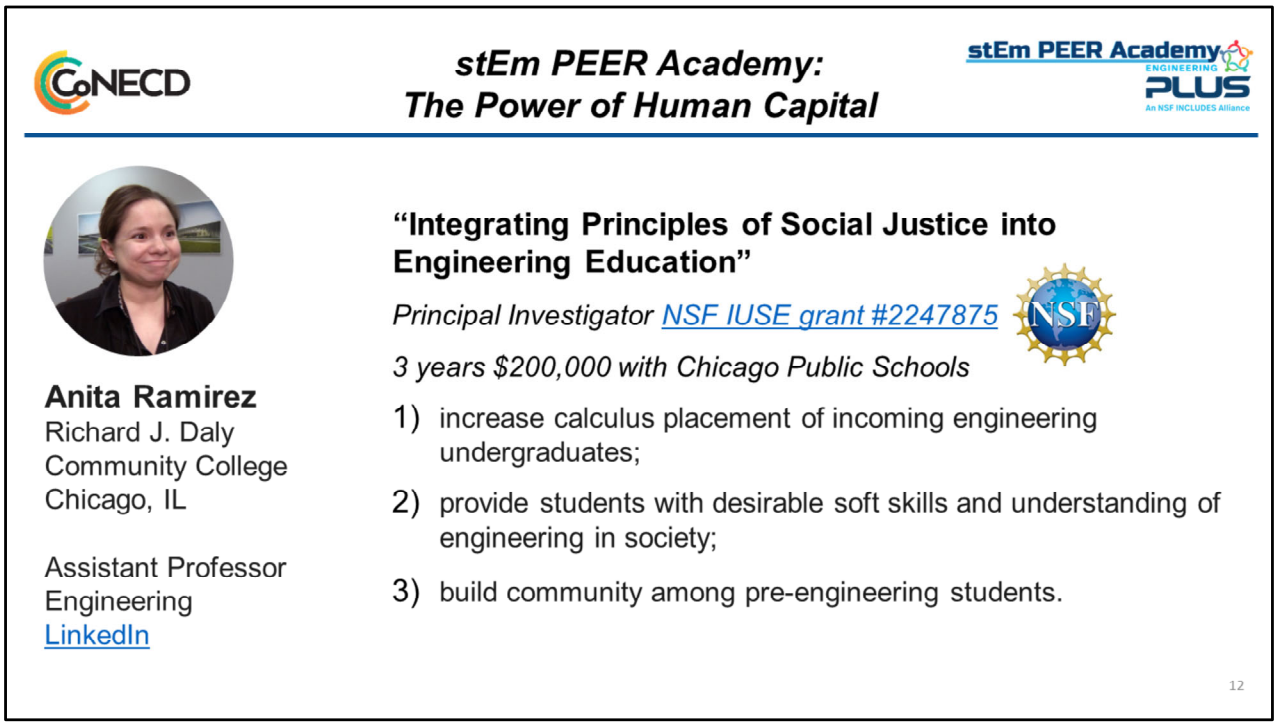
This is 1 of 2 Engineering PLUS sub-awards.



Implementation Phase

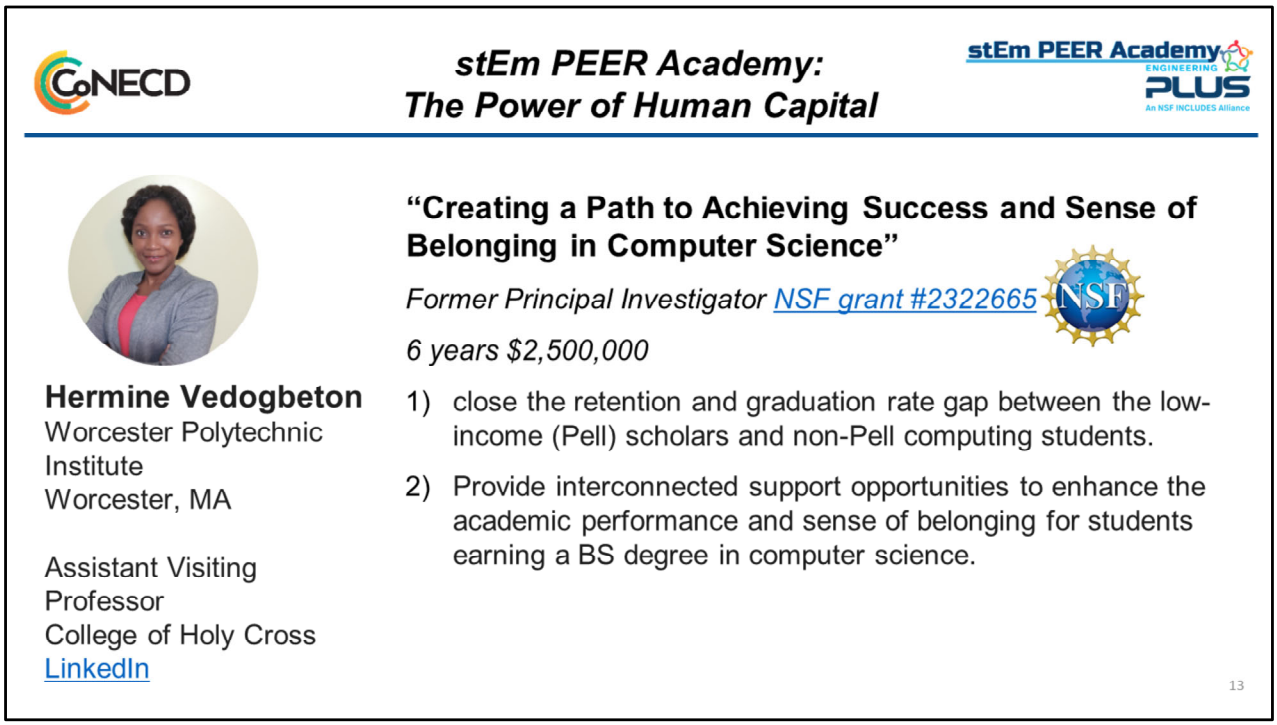
2022 stEm PEER Fellow Josiah Owusu-Danquah has also created a transfer program from a local community college to Cleveland State University where he is an Assistant Professor of Civil Engineering. Joshiah would also like to target a few dozen undergraduate engineering students per year.

This is the 2nd of 2 Engineering PLUS sub-awards.



Implementation Phase

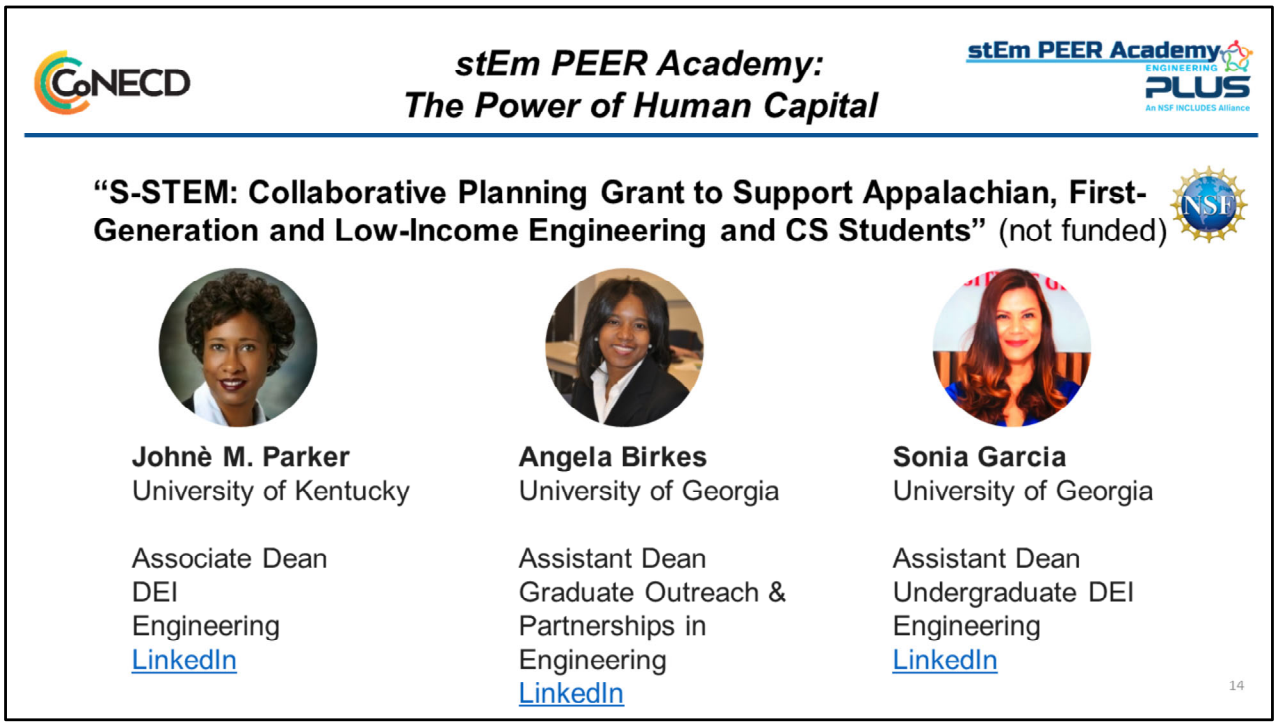
First ever NSF grant for Richard J. Daly Community College! 2022 stEm PEER Fellow Anita Ramirez is an engineering professor at Richard J. Daly Community College on the southside of Chicago. Anita directly attributes her participation in stEm PEER Academy as the reason she was able to prepare such a winning grant proposal.



Implementation Phase

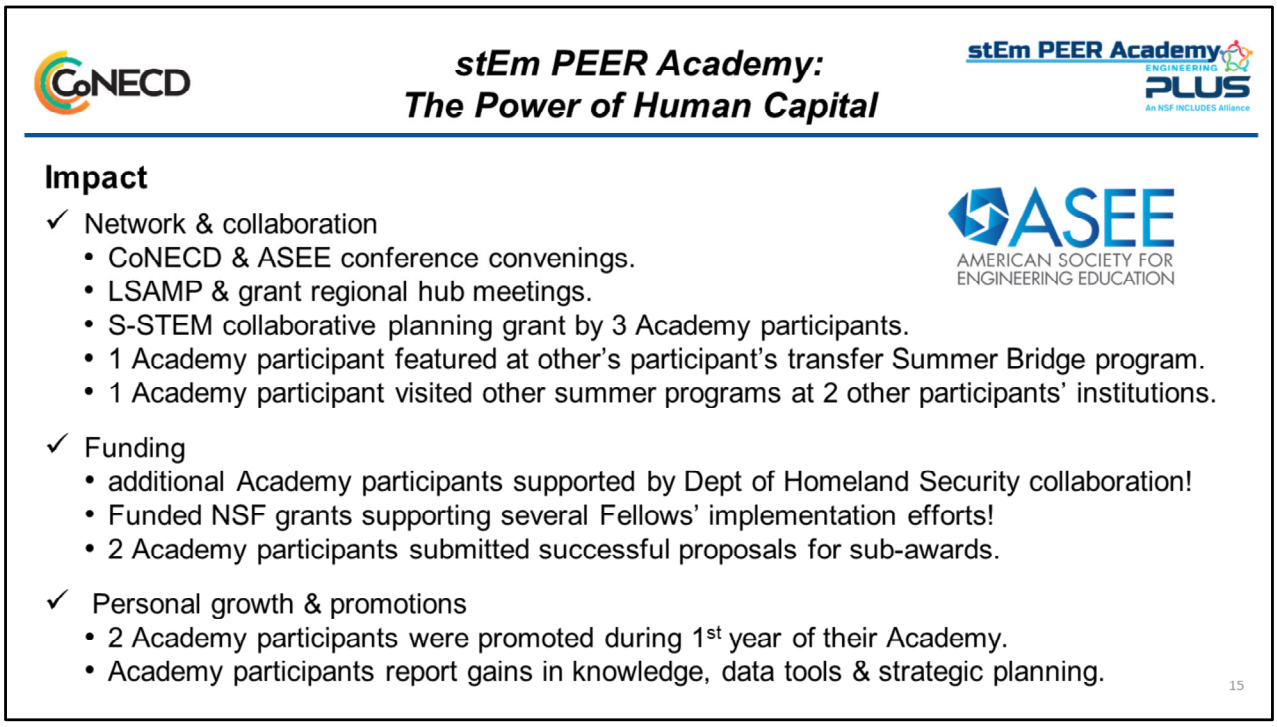
2022 stEm PEER Fellow Hermine Vedogbeton was one of the original Principal Investigators for this S-STEM award. She is now working at a different university so other Worcester Polytechnic Institute personnel are now managing this project. Hermine plans to continue her teaching and DEI advocacy work at the College of Holy Cross, also in Massachusetts.

Hermine visited Northeastern University's Summer Bridge program during 2022 and then travelled to another 2022 stEm PEER Fellow's summer program at Georgia Institute of Technology to observe their program.



Planning Phase

These 3 stEm PEER Academy Fellows wrote a collaborative S-STEM planning grant together after meeting each other through Engineering PLUS and stEm PEER Academy. Although the proposal was not funded, they have continued their collaboration together.



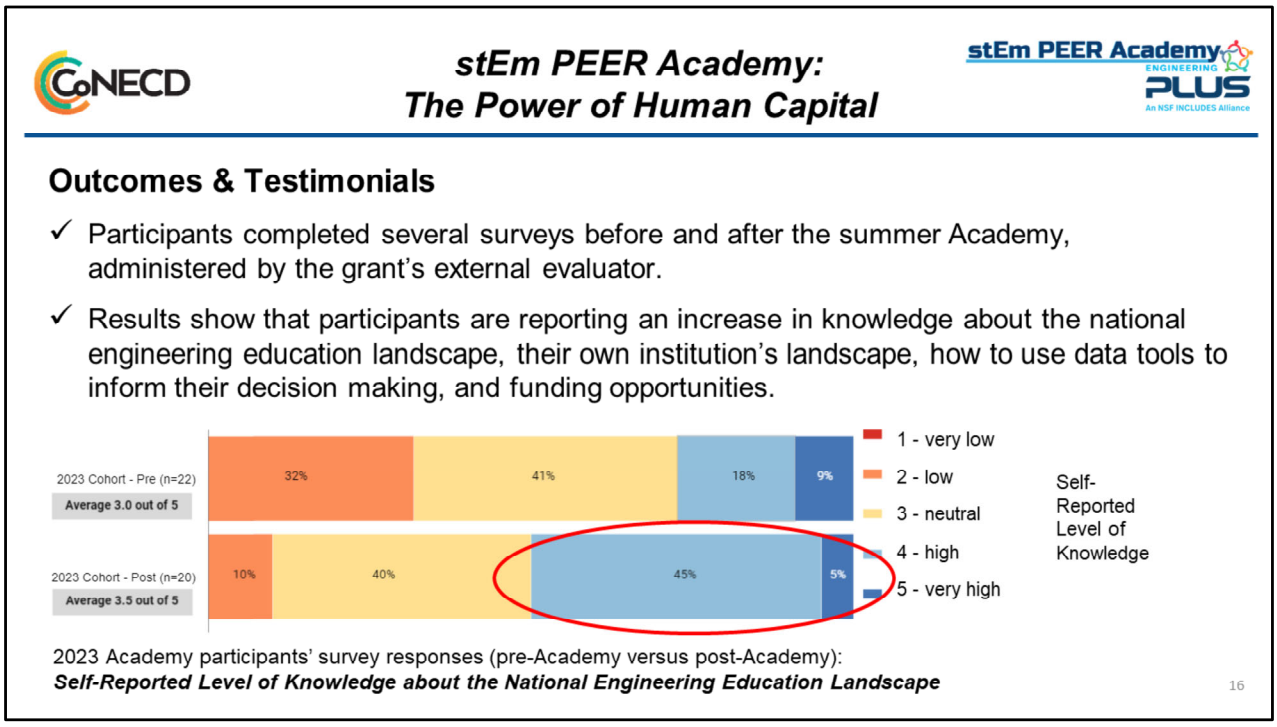
The most notable impact of this grant has been the "**Power of Human Capital" and how participants are networking, collaborating, seeking funding and growing professionally.**

For example, Academy participants have intentionally engaged with each other at recent CoNECD and ASEE national conferences. This was part of the grant's original proposed budget as face-to-face interactions were identified as critical to the grant's success.

Participants have joined LSAMP meetings in partnership with regional hub convenings of this NSF-funded grant.

3 Academy participants from the 2022 cohort collaborated to submit an S-STEM planning grant proposal together across 2 different institutions in early 2023. Although it was not funded, they plan to resubmit in 2024.

Funding has been awarded through Department of Homeland Security collaborations, NSF and grant sub-awards (at least 2 currently pending).

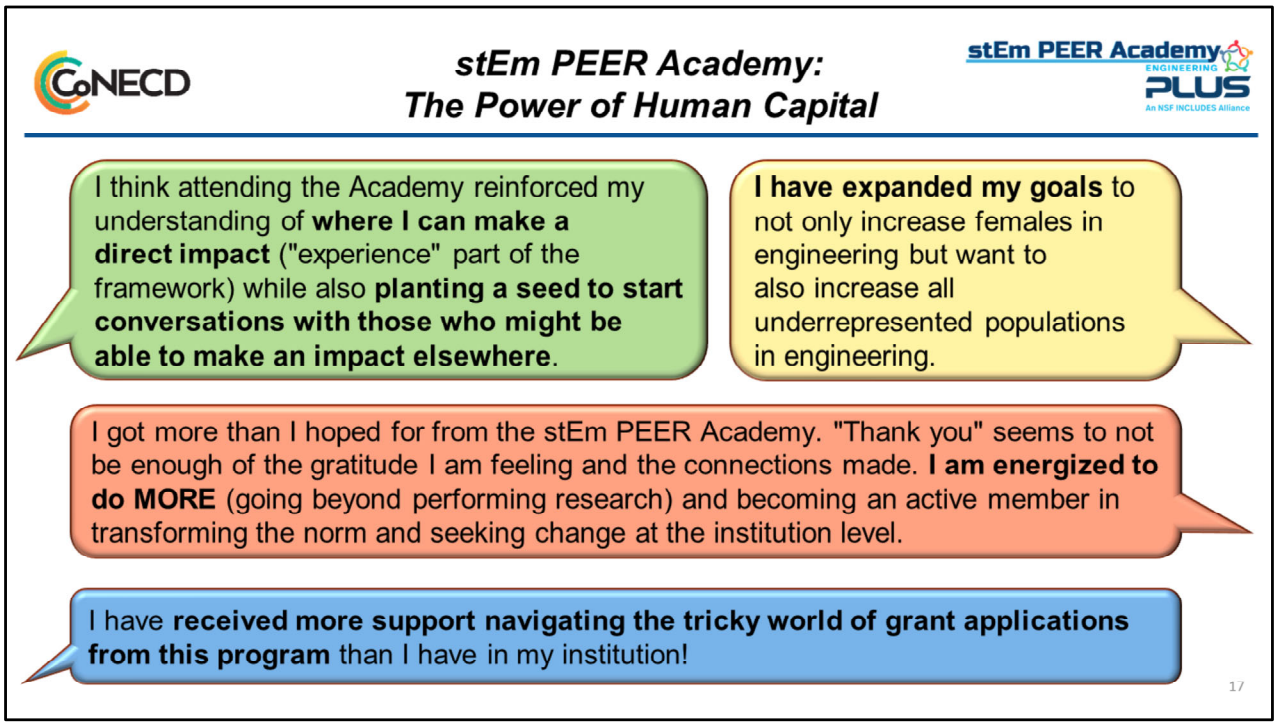


External evaluation and internal assessments have been administered to guide the Academy's operations and operations.

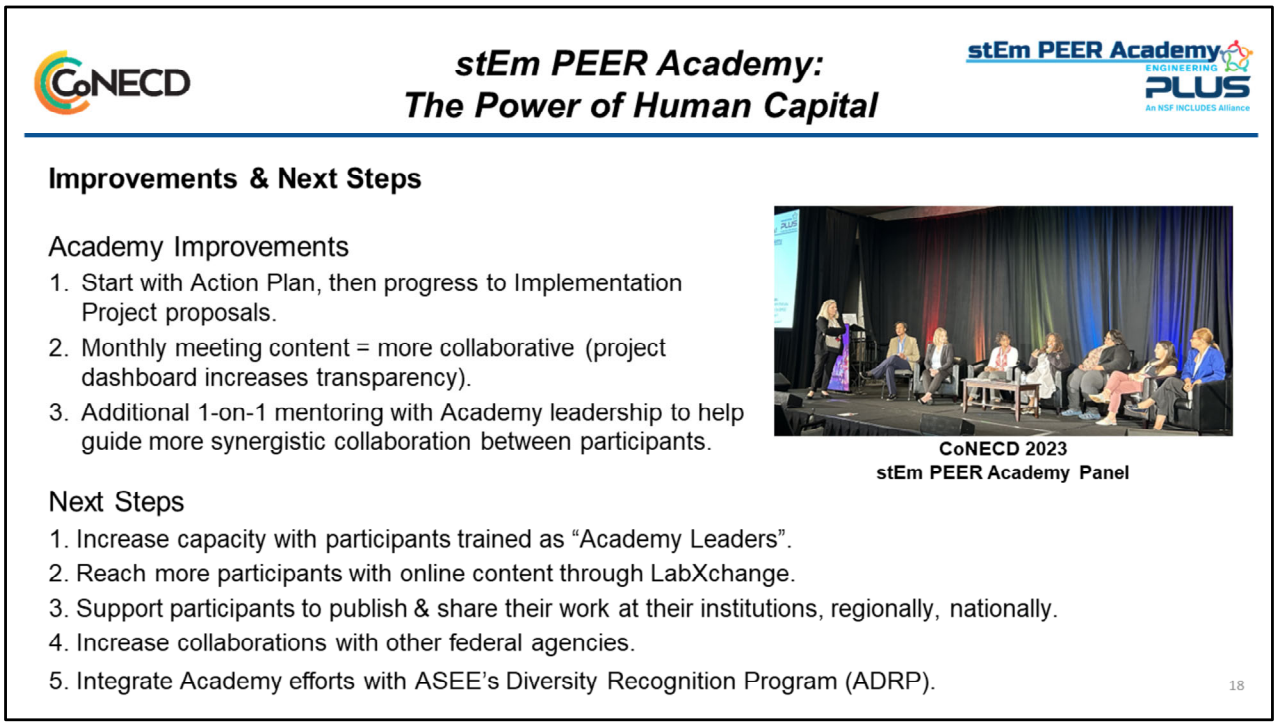
External evaluation:
Participants were asked to rate their own level of understanding for several attributes on a 5-point scale where 1=Very Low, 2=Low, 3=Neutral, 4=High, 5=Very High:

1. Knowledge about the national engineering education landscape
2. Knowledge about their institution's engineering education landscape
3. Knowledge about using data tools to inform institutional decision-making
4. Knowledge about national funding opportunities

Pre vs Post results show an **increase in knowledge for all 4 of these attributes**. Results for knowledge about the national engineering education landscape are shown in this figure.



When asked to elaborate on what they learned at the Academy, the majority of participants responded with very positive accolades. The only negative feedback has been attributed to lack of time & personal planning capacity to accelerate change quickly at their own institutions.



Academy Improvements

Based on feedback from the 1st year, several improvements have been made for the 2nd year. The 2023 cohort were charged with developing an action plan before progressing to writing an Implementation Project proposal. This helped to better scaffold the strategic planning & writing process for participants new to proposal writing.

After the initial 3 weeks of the summer Academy, monthly meetings have progressed as originally planned. Now with 2 cohorts meeting together, more intentional collaborations have been planned for monthly meetings and future engineering education conferences, such as at CoNECD.

Additional 1-on-1 mentoring has been initiated for both cohorts. Synergistic efforts have been identified so that Academy participants can network and collaborate with each other, to work on similar projects and objectives.

Therefore, given the first 2 years of success, our **next steps** are to increase the Academy's capacity by training eligible participants as "Leaders", who will then lead regional efforts and guide other Academy participants.

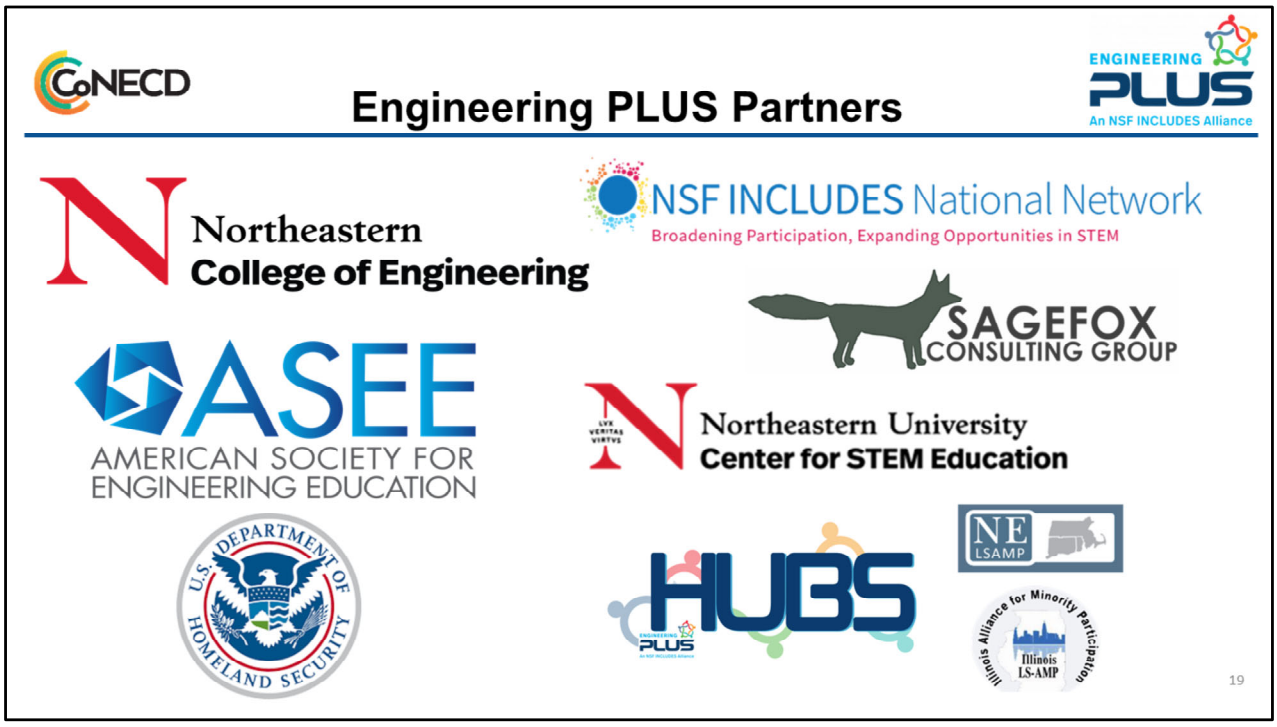
In order to accelerate and scale up outcomes from the Academy, the summer program, which includes learning about various high impact evidence-based practices, will be made more accessible to more participants through online course sites such as LabXchange. This online content platform is free, comprehensive, and highly effective in STEM education fields.

We also plan to continue supporting participants in writing their own proposals and publications so they can share their work more broadly.

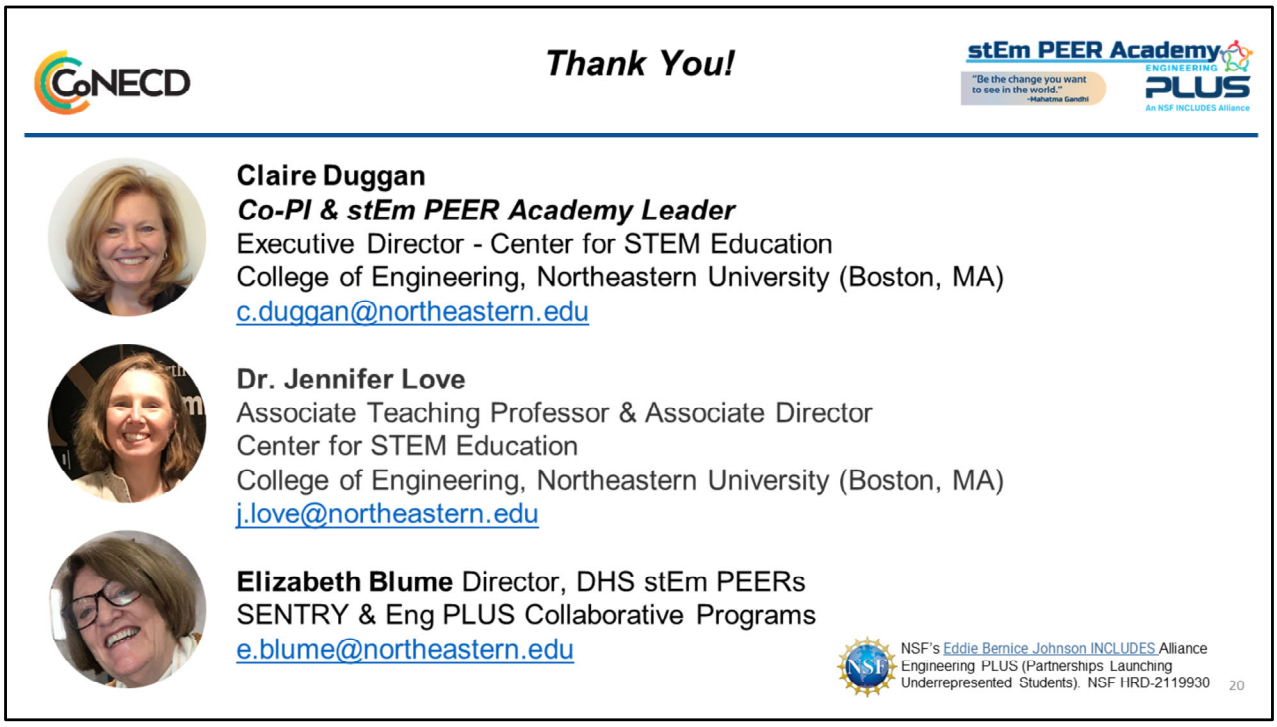
We will continue to seek collaborations with other federal funding agencies.

We will continue to leverage our partnership with ASEE and the Diversity Recognition Program by recruiting & supporting Academy participants and their institutions who are working toward ADRP recognition.

And finally, we will continue to recruit, train, empower & support a growing network of educational change agents through this NSF-funded Engineering PLUS grant project and stEm PEER Academy.



All of our partners with Engineering PLUS, and growing!



Author slide

Claire Duggan, Jennifer Love & Elizabeth Blume

Applications Open for next stEm PEERs!

https://engplusalliance.northeastern.edu/academy

Claire Duggan
c.duggan@northeastern.edu
Jennifer Love
j.love@northeastern.edu

Application Deadline: March 20, 2023

Notifications by April 10, 2023

Virtual Orientation April 18, 2023

Virtual Summer Institute
10am-1pm (Eastern Time) each day
May 23 & 24, May 30 & 31, June 6 & 7

Virtual Monthly Meetings
60-90 min July 2023 – May 2024

Resume, 2 recommendations, Question Prompts:

- *What is one evidence-based strategy or program that you believe has the potential to be most beneficial for BIPOC and/or women students at your own institution?*
- *How could you implement this strategy or program?*

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.

formatted IEEE style…