ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

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An Ecosystem of Support Initiatives for BIPOC, Women, and Domestic Graduate Students in STEM

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CoNECD 2024

2024

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Abstract Highlights

- Institutions often fail to implement or replicate the ecosystems of support for graduate students in engineering and computing disciplines that exists at the undergraduate level.
- The College of Engineering, Computing, and Applied Sciences (CECAS) at Clemson University has implemented several programmatic initiatives since 2018 to support the recruitment, retention, and matriculation of BIPOC, women, and domestic graduate students.
- Featured initiatives include and Inclusive Excellence Strategic Plan, STEM ALL IN, ASPIRE Peer Mentors, and the Future Scholars Academy.

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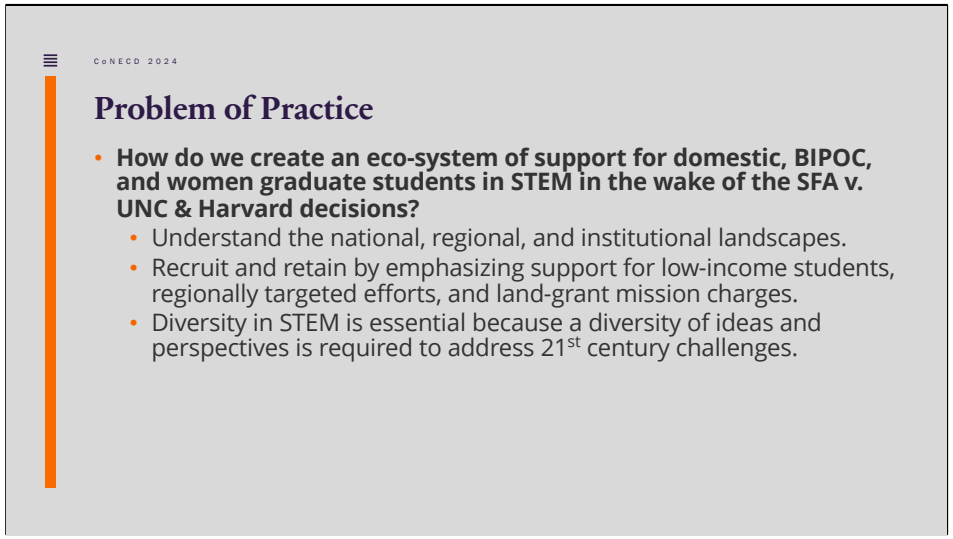
Overview

- Problem of Practice/Challenge
- Theoretical Framework
- Ecosystem of Support Elements
- Lessons Learned and Next Steps
- Discussion



Presenters will frame the problem of practice and define what we mean by an eco-system of support. Emphasis will be placed on differing approaches based on regional climates and institutional settings. Discussion of effective approaches for recruiting and identifying domestic, women, and BIPOC graduate students – without explicating asking students to self-identify will be discussed. Finally the priority to ensure that we continue to welcome diverse identities and perspectives in STEM graduate programs will be made and supported with examples of problems which domestic, women, and BIPOC student can provide unique perspective on.

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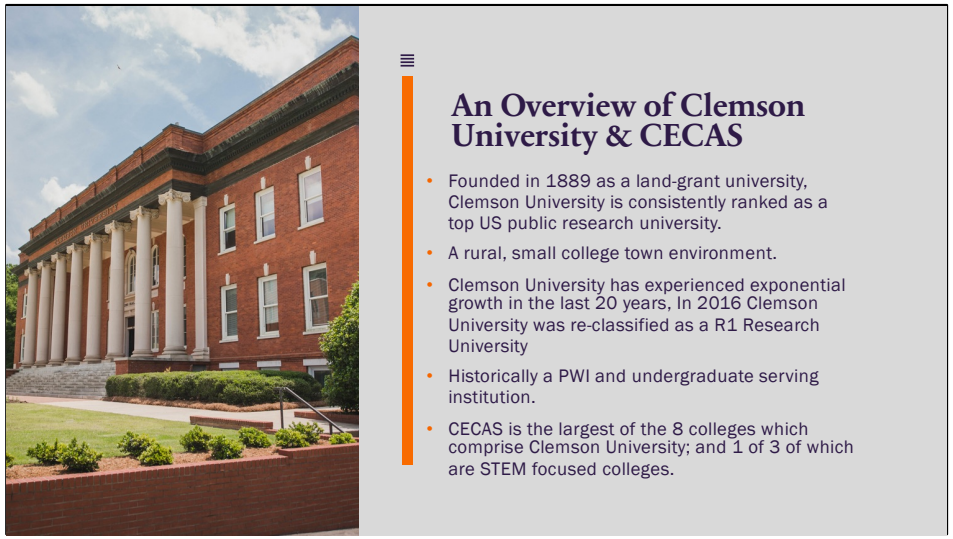
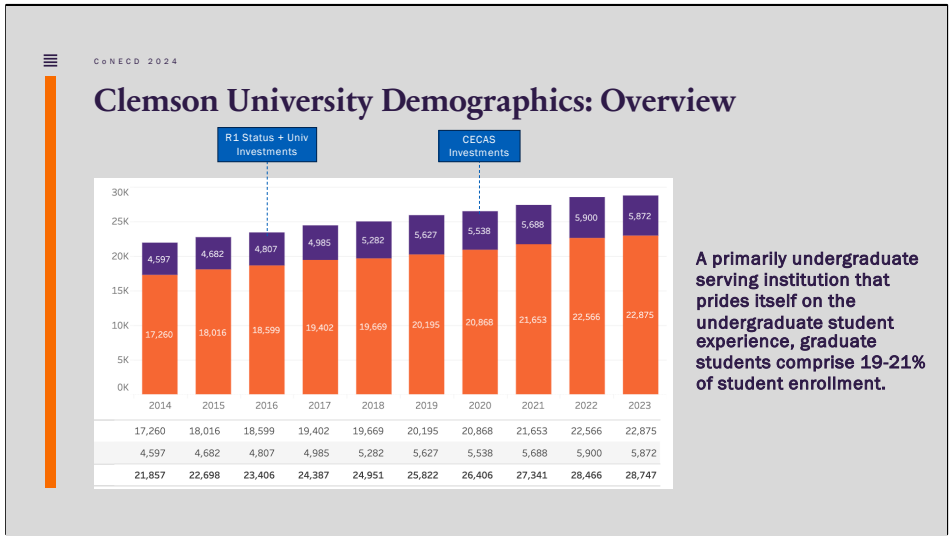
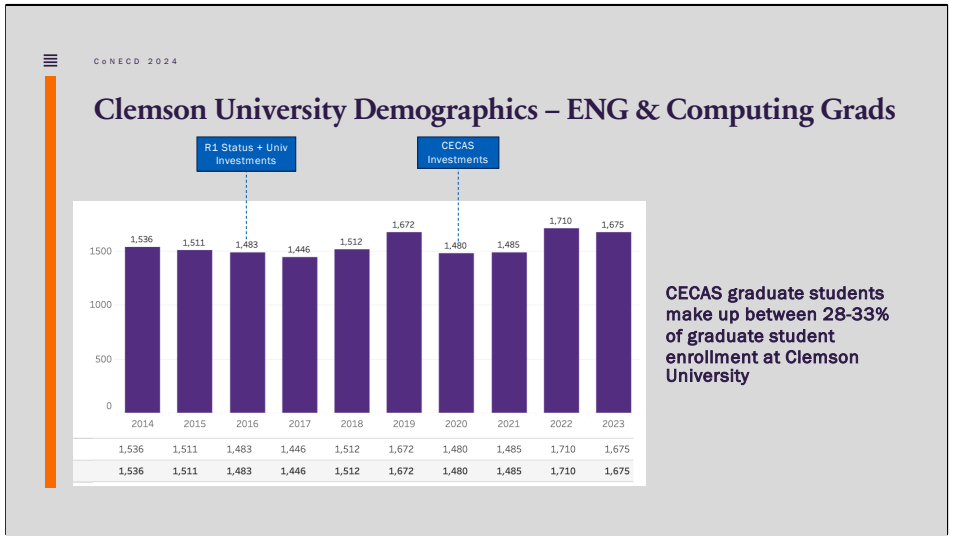
Problem of Practice & Theoretical Framework



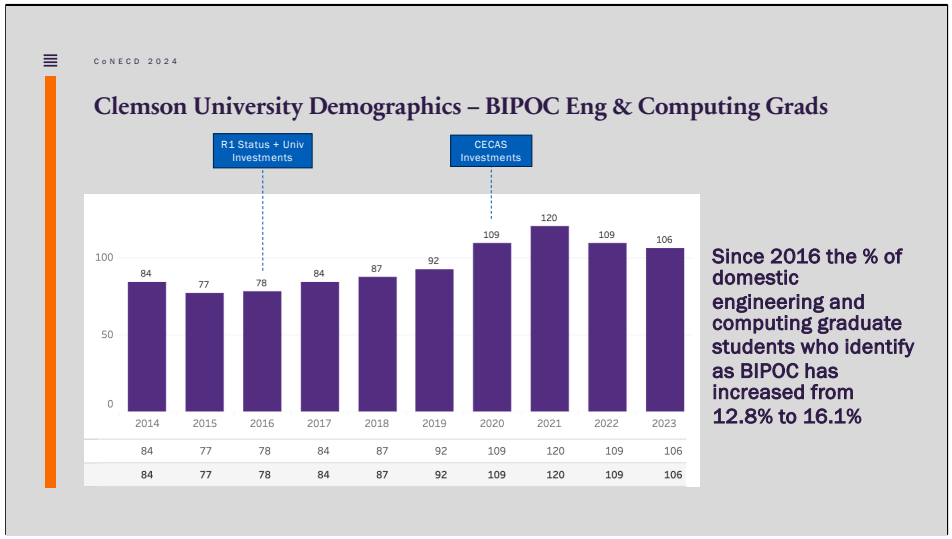
Presenters will introduce Clemson University with a brief introduction and help participants make connections or parallels between their own institutions and the context and factors at play at Clemson University which impact STEM BIPOC and women graduate students.



Presenters will uses graphic aids to demonstrate the historical dominance of undergraduates at the institution so that other participants can make connections to their primarily undergraduate serving institutions. Subsequent slides will take a deeper dive into university demographics, graduate student representation, gender, BIPOC representation among engineering and computing graduate students. This data will promote transparency, successes and setbacks.



The graphics on this slide show the overall trends in graduate student enrollment in engineering and computing graduate programs (domestic and international students combined). These graphics will reflect fluctuations and illustrated that as overall enrollment at the university has increased at a rate of ~2% graudate student enrollment in engineering and computing has fluctuated. If accepted this slide will also include counts of other STEM graduate students at Clemson University which will show (because we do not have a medical school) that engineering and computing graduate students make up the overwhelming majority of STEM graduate students at Clemson University.



Presenters will discuss growth and fluctuations in BIPOC ENG and Computing graduate student enrollment at Clemson University with connections to key milestones. While the total count of BIPOC students has fluctuated the overall % of students who identify as BIPOC has increased. This distinction is important because a simple increase in numbers doesn't reflect a community and ecosystem of support; the proportional increase of BIPOC student enrollment is a positive reflection of the efforts we will describe in subsequent slides.

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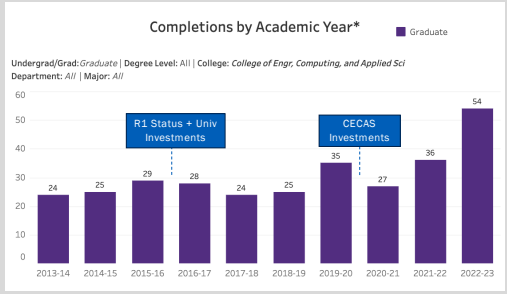
Clemson University Demographics – BIPOC Eng & Computing Grads



Annual completions for BIPOC Engr & Computing graduate students has DOUBLED (increase of 100%) since 2020.

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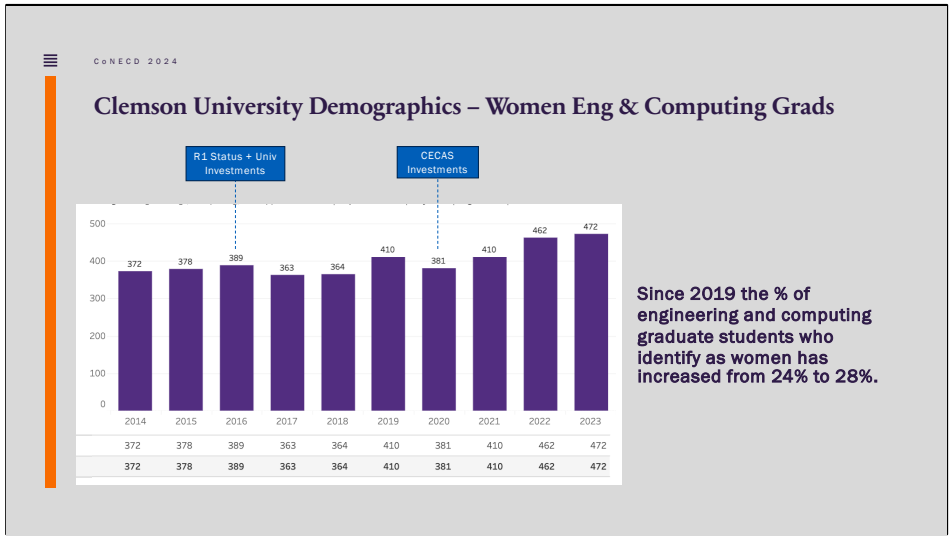
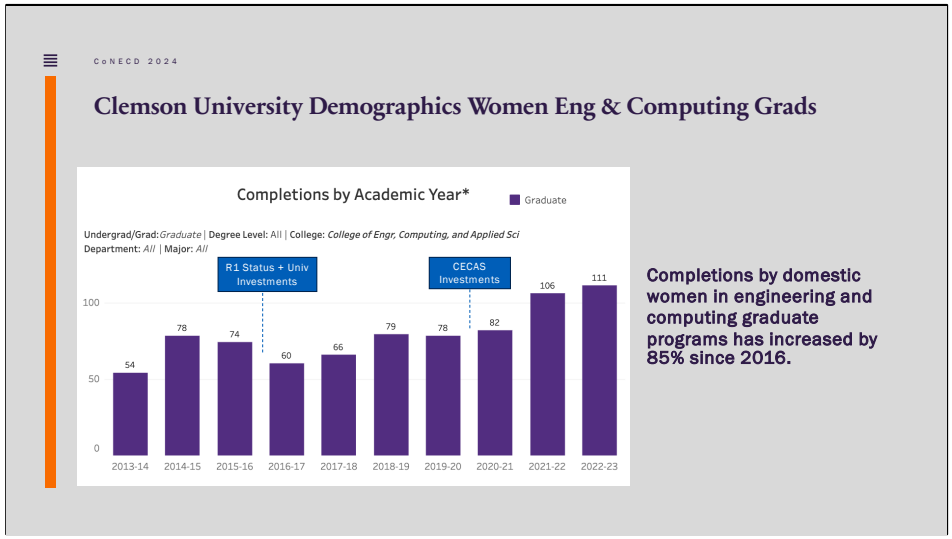


Presenters will talk about growth in women engineering and computing graduate enrollment both in count and overall representation among graduate students. More than 100 additional women graduate students since 2020, and the overall representation has increased from 24% to 28%. If accepted, we will update the graphic to show the percentage/share of women students each year to reflect the growth and fluctuations with transparency.



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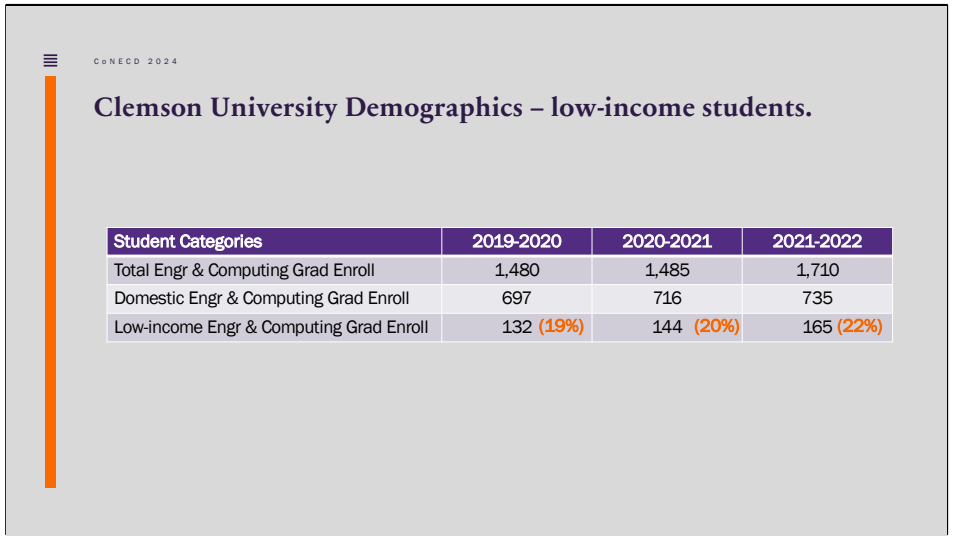
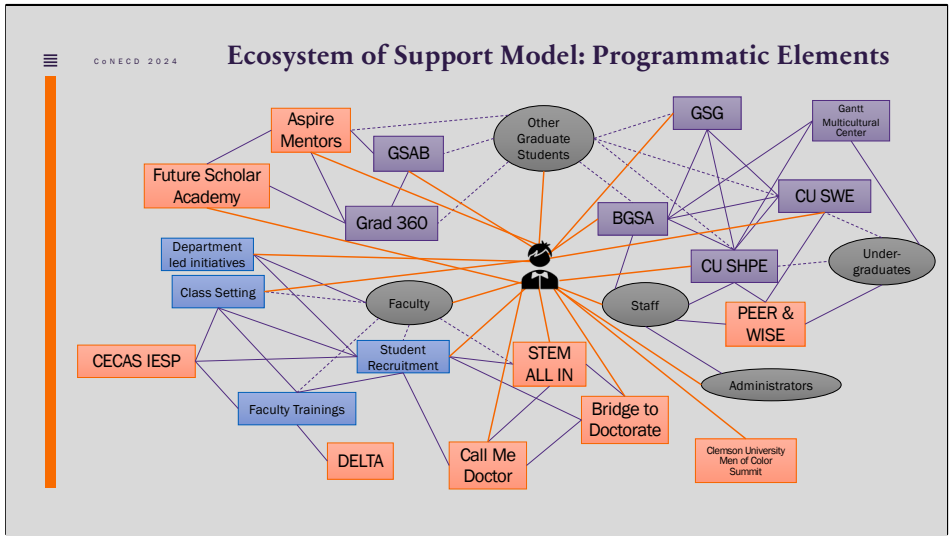
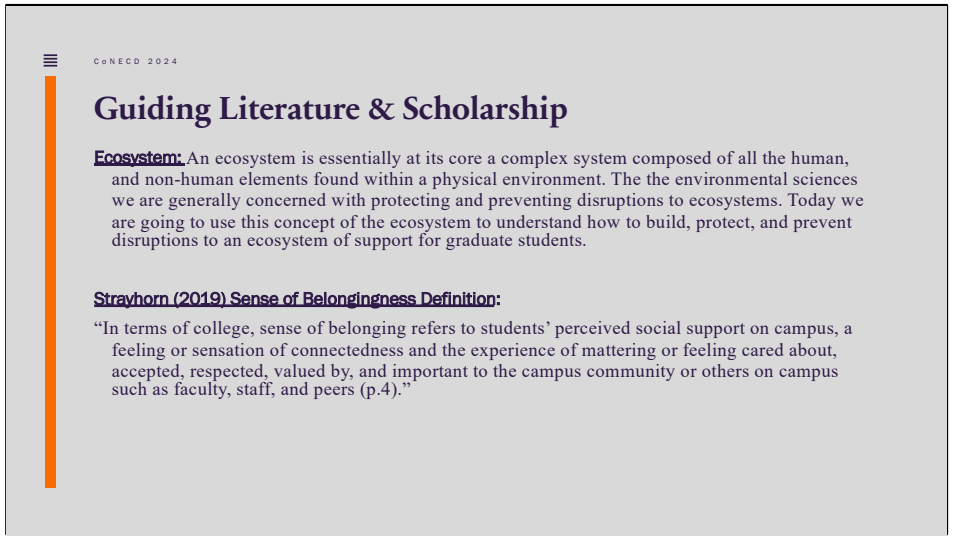


We are still waiting on 2022-2023 data from financial aid, but this data shows that approximately 20% of domestic engineering and computing graduate students have unmet financial needs. Since 2019-2020, the mean unmet need for students has increased from $11,058 to $15,212 annually. We anticipate that 2023-2024 data will be similar to 2021-2022 levels. This data will help participant understand that R1 institutions still struggle to meet the financial needs of their students, and recognize that supporting students is not just an interpersonal and professional development effort. Supporting students also means ensuring they can cover their basic living expenses without incurring levels of debt that make a graduate degree unfeasible.

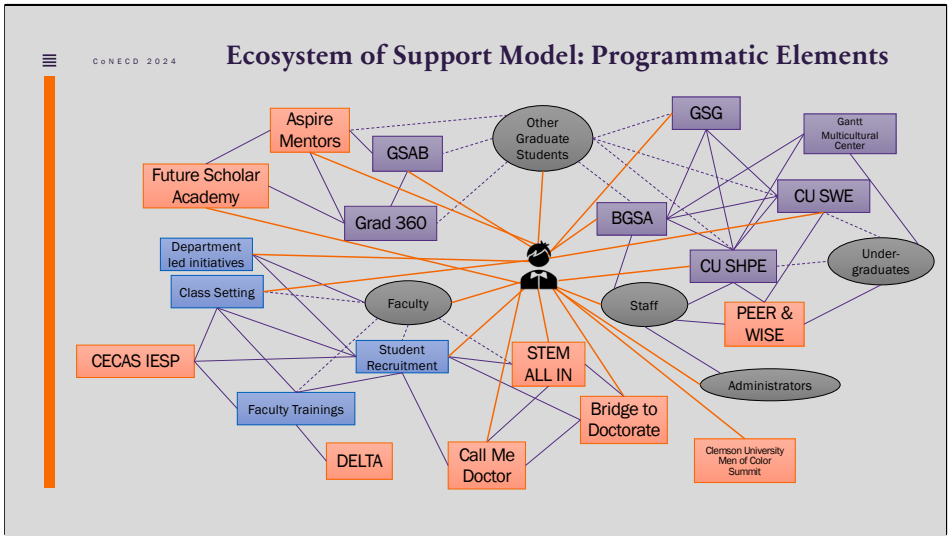


What is an Ecosystem? Ecosystems originated as a term to describe biological environments but now more commonly used to describe human organizations. An ecosystem is essentially at its core a complex system composed of all the human, and non-human elements found within a physical environment. The the environmental sciences we are generally concerned with protecting and preventing disruptions to ecosystems. Today we are going to use this concept of the ecosystem to understand how to build, protect, and prevent disruptions to an ecosystem of support for graduate students. This model will be introduced in phases starting with people, the introducing organizations and elements, ending with featured programs and initiatives. Phases will be brought in via PPT transitions to help participant make connections and sense of the model.

Add in actual transitions



Strayhorn's definition of Sense of Belonging will provide a common understanding of the concept for the purposes of this session and will serve as a gateway towards understanding the important elements of an effective ecosystem of support. Our ecosystem of support is assessed through qualitative assessment and mapping of resources, recruitment of students, and matriculation of students to graduation.



Presenters will make connections between the elements of the ecosystem and the scholarship/best practices for supporting graduate students.

Sense of Belongingness:

- Schlossberg (1990) – Foundational principles of student transition and belongingness[1]
- Hurtado & Carter (1997) – early examination of belongingness for BIPOC students[2]
- Hoffman et al. (2002) – development of framework and measures of belongingness[3]
- Sax et al. (2018) – sense of belongingness in women and BIPOC computing students[4]
- Strayhorn (2019) – sense of belongingness in graduate students[5]

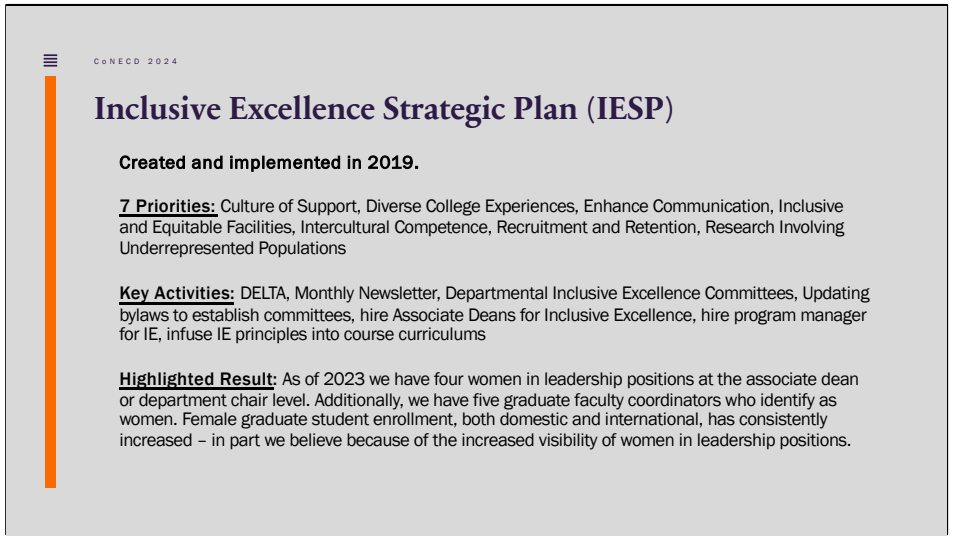
Graduate Student Needs and Support

- Knowles (1977); Hagen and Park (2016) – foundational needs of adult learners, validated by neuroscience[6]
- Curtin et al. (2013) – importance of advisor support for doctoral students[7]
- O'Meara et al. (2017); Pascale (2018) – graduate student relationships and networks impact on student experience and belongingness[8]

Here is how we got here…

- **An overview of significant event at the University-level**
  - **2016** – Tigers ADVANCE grant activities begin supporting women in STEM
  - **2016** – Clemson achieves R1 status
  - **2016** – Clemson hires first Chief Diversity Officer (CDO) and special assistant to the president for inclusive excellence
  - **2018** – University implements Grad 360 curriculum
  - **2023** – New VP Diversity and Inclusive Excellence (Dr. Felicia Benton-Johnson)
- **An overview of significant events within CECAS that directly impacted engineering and computing students**
  - **2018** – IESP development process and position descriptions for Inclusive Excellence ADs initiated
  - 2018 – STEM ALL IN is implemented
  - **2020-2022** – Inclusive Excellence ADs are hired and staffing up around graduate student support and inclusive excellence.
  - **2020** – ASPIRE Mentoring program implemented
  - **2020** – CECAS Graduate Student Advisory Board formed
  - **2022** – Bridge to the Doctorate cohort arrive on campus in Fall semester

In this section presenters will introduce cornerstone programs and initiatives within the ecosystem, explain their relevance and contributions to the ecosystem, and help participants understand how they can transfer these concepts and adopt similar strategies their own institutions. The highlighted programs are all run at the college-level, so participants can reasonably develop similar initiatives at their own institutions without requiring full university-wide buy-in/support.



On this slide/slides the presenters will discuss the development of the college's inclusive excellence strategic plan, management of the plan toward achieving targets, key activities, and spotlight results. Challenges and successes will be shared along with advice for those developing or initializing their own strategic plans related to strategic plans that include diversity, equity, and inclusion priorities.

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STEM ALL IN

For the last 6-years CECAS has partnered with our STEM-peers at Clemson University to promote graduate degrees in STEM and support domestic and underrepresented students in the process of applying to graduate school.

STEM ALL IN participants spend 2.5 days on an R1 PWI campus meeting with students, faculty, and alumni. While on campus students tour lab facilities, attend educational sessions, and engage in professional networking. All of this is at no cost to the students and supported by external funding.

Presenters will discuss one of the cornerstone programs in the ecosystem of support – STEM ALL IN. The development and evolution of the program will be covered along with specific connections to how the program has created pathways for domestic, women, and BIPOC students to pursue a graduate degree.

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STEM ALL IN

STEM ALL IN Overview

STEM ALL IN Graduates

As time allows these videos will give attendees a deeper understanding of the STEM ALL IN program and its successes. Videos include testimonials from students and a celebration of participants graduation.

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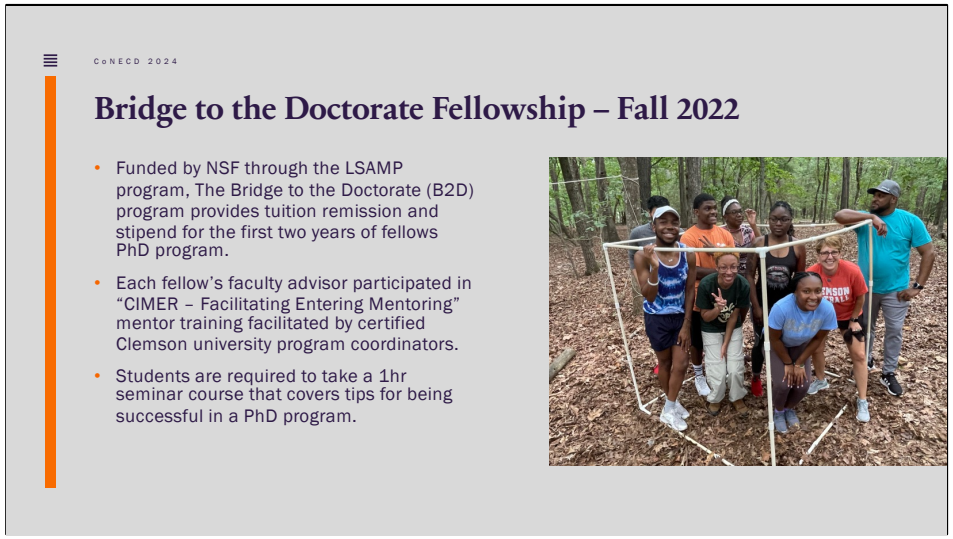
STEM ALL IN

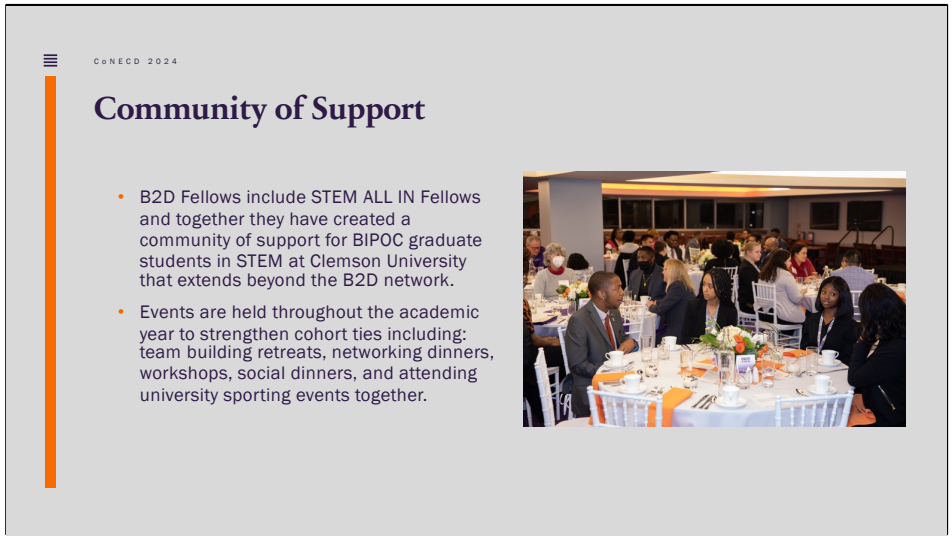
More than 100 students have participated and XX% ultimately enrolled in graduate programs. STEM ALL IN is a centerpiece of our domestic student recruitment apparatus. It helps us fill internal and external fellowship opportunities for domestic students. STEM ALL IN participants form a bond and ties to former participants that create informal mentoring and support networks for other domestic, women, and BIPOC students.

Year	Participated	Applied	Accepted	Enrolled
2018	24	8	7	2
2019	34	4	4	0
2021*	4	1	1	1
2022	20	9	8	8
2023	17	7	7	6
5 -year total	**99**	**29**	**27**	**17**
2024	*TBD*	*TBD*	*TBD*	*TBD*

Presenters will share qualitative and quantitative assessments of the programs success. The table will be updated in January after the 2024 event. Personal narratives of two of the students featured in this photo will also be shared as qualitative programmatic data. Presenters will discuss the evolution of the program, clarify that not all participants are eligible to apply to graduate school (we include Juniors and 1st year MS students). The effective yield rates since 2021 can be accounted for by several factors: a) fully in-person events, b) additional funding to enhance the on-campus experience for students, c) b2D students responsible for 2022 bump, d) b2D students created a strong community that was visible to 2023 participants, f) more of our stakeholders and departments have worked with a STEM ALL IN participant now – and therefore are more likely to admit and offer funding to those students.



The B2D program at Clemson University is an example of how additional external funding can follow and contribute to a foundation of support for domestic, BIPOC, and women graduate students. B2D fellows now comprise a formal and informal network of student support and mentorship across STEM disciplines and graduate programs. Presenters will share successes, challenges and best practices. B2D Fellows include STEM ALL IN Fellows and together they have created a community of support for BIPOC graduate students in STEM at Clemson University that extends beyond the B2D network. Events are held throughout the academic year to strengthen cohort ties including: team building retreats, networking dinners, workshops, social dinners, and attending university sporting events together. Additionally, students are required to take a 1hr seminar course that covers tips for being successful in a PhD program.



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Font on slide is small and wordy. Perhaps shorten with bullets and verbally tell the information the information shown on the slide. Again, data on what makes it successful or how it is integrated into the ecosystem could be helpful.

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ASPIRE Peer Mentors

- We offer Peer to Peer mentoring for all incoming graduate students and use a group mentoring model that matches mentors to mentees using a 1:3 ratio.
- We incentivize mentors to participate with a $500 stipend. Mentors meet with mentees informally throughout the year and at larger ASPIRE mentor events each semester. ASPIRE mentors and mentees also correlate pursue other volunteer and leadership opportunities across the college and campus.

The ASPIRE Peer Mentor program is one example of graduate student support programs that support students through their transition to and through their graduate studies. Presenters will provide insights on programs operation, success, and participation rates. Success is measure by the retention of mentors, conversion of mentees to mentors, and annual surveys completed by participants.

The FSA is a new initiative which evolved out of several iterations of support for graduate students designed to prepare students to secure external fellowships. The FSA is sponsored by the college with support from leadership and other campus stakeholders. The development of this program is also linked to engagement with the NSF STEM PLUS INCLUDES Alliance. The inaugural year of this program begins in Spring 2024 and formative assessments of the programs' success and challenges will be shared with attendees. Piloted versions of this program offered in 2021 and 2022 have assisted students in successfully securing external funding to top-off their existing support and support their persistence to graduation.

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Graduate Student Advisory Board

- CECAS GSAB was organized formed in 2020 to provide advocate for graduate students and provide input to administration. An outgrowth of the college student advisory board this group focuses its attention solely on the needs of graduate students – a growing but traditionally overlooked population on Clemson's campus.
- The CECAS GSAB Mission Statement: Encourage and advocate for graduate students and their well-being while being a bridge of communication to administration at Clemson. GSAB promotes diversity and inclusivity as they help incorporate students into the Clemson Family.

Presenters will discuss how GSAB exists to both inform the ecosystem of support – but also contribute to it actively by supporting graduate students. Now a formally recognized student organization GSAB not only advocates for graduate students – but has grown to meet the needs of graduate students. GSAB links graduate students across our innovation campuses and main campus through social and professional programing.

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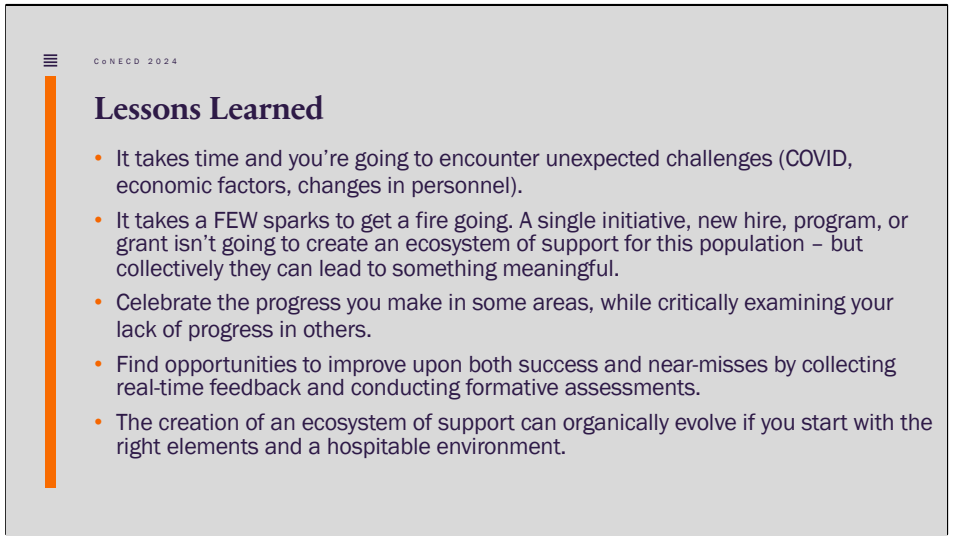
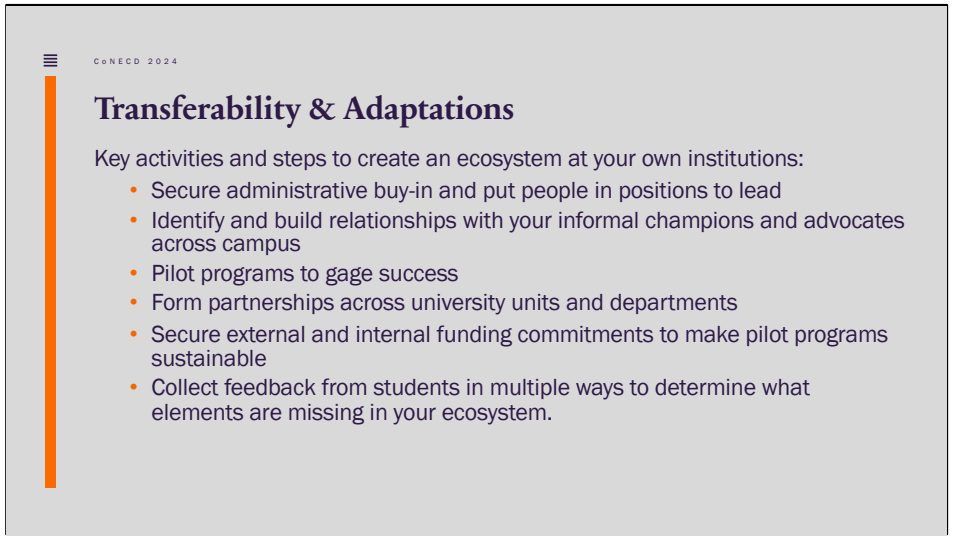
Transferability and Next Steps



Presenters will end the lecture portion of the session with Lessons Learned and Next Steps. Connections will be made to some of the best practices and programs described previously for context.



Presenters will recap connections and opportunities to transfer lessons and strategies to participants own institutions by highlight key activities and steps at Clemson University.

What we're working on next

- We are continuing to seek external funding to provide funds to students and support initiatives. NSF INCLUDES, NSF S-STEMs, and non-profit opportunities are all targets. These efforts will target domestic students broadly but include approaches that will ensure BIPOC and women continue to have access to STEM graduate programs.
- The Future Scholar is an emphasis this year as we aim to provide an additional layer of support to our current students and assist them in securing external fellowships and/or publications – both key in degree progress for PhD students.
- Additional IESP priorities are launching this year. This tiered approach to pursuing action items and priorities in the CECAS IESP has been effective. With the core building blocks in place (leadership, staff, committees, and cornerstone programs) we can pursue some of the the plans more ambitious goals.

Discussion

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References

[1] N. K. Schlossberg, "Marginality and mattering: Key issues in building community," *New Directions for Student Services*, 48, pp. 5–15, 1989.

[2] S. Hurtado, and D. F. Carter, "Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging," *Sociology of Education*, 70(4), pp. 324-345, 1997.

[3] M. Hoffman, J. Richmond, J. Morrow, and K. Salomone, "Investigating 'sense of belonging' in first-year college students," *Journal of College Student Retention: Research, Theory & Practice*, 4(3), pp. 227-256, 2002.

[4] L. J. Sax, J. M. Blaney, J. K. Lehman, S. L. Rodriguez, K. L. George, and C. Zavala. "Sense of belonging in computing: The role of introductory courses for women and underrepresented minority students," *Social Sciences*, 7(8), pp. 122, 2018.

[5] T. L. Strayhorn, *College Students' Sense of Belonging*. Routledge Press, 2019.

[6] M. Knowles, "Adult learning processes: Pedagogy and andragogy," *Religious Education*, 72(2), pp. 202-211, 1977.

[7] M. Hagen, and S. Park, "We knew it all along! Using cognitive science to explain how andragogy works," *European Journal of Training and Development*, 40(3), pp. 171-190, 2016.

[8] N. Curtin, A. J. Stewart, and J. M. Ostrove, "Fostering academic self-concept: Advisor support and sense of belonging among international and domestic graduate students," *American Educational Research Journal*, 50(1), pp. 108-137, 2013.

[9] K. O'Meara, K. A. Griffin, A. Kuvaeva, G. Nyunt, and T. N. Robinson, "Sense of belonging and its contributing factors in graduate education," *International Journal of Doctoral Studies*, 12, pp. 251-279, 2017.

[10] A. B. Pascale, "'Co-existing lives': Understanding and facilitating graduate student sense of belonging," *Journal of Student Affairs Research and Practice*, 55(4), pp. 399-411, 2018.