

29 Feb – 01 Mar
2024 2024

Alexandria, VA



Advancing Innovations
in Graduate Education:

IGE Principal Investigators' Meeting





NO_3^- Nitrate ion

MnO_4^- Permanganate ion

ClO_2^- Chlorite ion

ClO Hypochlorite ion

HCO_3^- Hydrogencarbonat ion

HSO_4^- Hydrogensulfat ion

HSO_3^- Hydrogensulfidion

H_2PO_4^-

CH_3^-

CrO_4^{2-} Chromat ion

$\text{Cr}_2\text{O}_7^{2-}$ Dichromat ion

O_2^{2-} Peroxid ion



Welcome

to Washington, D.C.

On behalf of the National Science Foundation Division of Graduate Education (NSF DGE), we would like to welcome you to the 2024 Innovations in Graduate Education (IGE) Principal Investigators' Annual Meeting with the theme of "Advancing Innovation in Graduate Education." During the meeting, you will engage with leading graduate education researchers, IGE PIs, and NSF staff who each have their own unique expertise.

The IGE Program is a critical component of DGE's goal to advance innovation in US graduate education in STEM. The outcomes from NSF-supported IGE projects shared at this conference and through broader dissemination add to the knowledge base about graduate education and pave the way for identification of best practices.

Please take a moment during the meeting to thank the Council of Graduate Schools (CGS). As the leaders of the IGE Innovation Acceleration Hub, CGS has been a committed partner with NSF in working with the IGE community to document the program's role in knowledge

generation and in catalyzing advances in US STEM graduate education. CGS was the logical choice to lead this year's Annual Meeting and has generously contributed their ideas and time to make this conference a worthwhile and engaging experience. We look forward to the exchange of ideas in the coming days including on ways that NSF, and DGE in collaboration with CGS, can foster and support this community to advance research on graduate education innovations and catalyze rapid advances in STEM graduate education.

We hope you will take advantage of the many opportunities to engage and network during the conference as your contributions will enhance the experience for everyone and help shape directions for the IGE program.

Sincerely,

**Daniel Denecke, Karen McNeal,
Elizabeth Webber, Dorian Davis**

IGE Program Directors
NSF Division of
Graduate Education



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Agenda at-a-Glance

Day 1: Thursday, February 29, 2024

All Day 1 events will be held at the Westin Alexandria Old Town.

3:30–3:45 p.m. Welcome and Overview of Meeting—*Virtual Option*

3:45–5:00 p.m. Opening Keynote—*Virtual Option*

5:30–7:00 p.m. Networking Reception and Poster Hall

Day 2: Friday, March 1, 2024

All Day 2 events will be held at the NSF Headquarters,
0.4 miles from the Westin Alexandria.

9:00 a.m. Welcome from NSF and CGS—*Virtual Option*

9:15–10:30 a.m. Elevating, Evaluating and Scaling IGE Projects: Innovative Solutions to Persistent Challenges in STEM Graduate Education—*Virtual Option*

10:30–10:45 a.m. Coffee Break

10:45–11:45 a.m. Advancing Innovation in Common Research Areas

11:45 a.m.–12:15 p.m. Takeaways and Recommendations—*Virtual Option*

12:15–1:30 p.m. Networking Lunch

1:30–2:30 p.m. Cross-Cutting Issues in IGE Research: Concurrent Session A

2:30–2:45 p.m. Coffee break

2:45–3:45 p.m. Cross-Cutting Issues in IGE Research: Concurrent Session B

3:45–4:15 p.m. Takeaways and Recommendations—*Virtual Option*

4:15–4:30 p.m. Concluding Remarks and Next Steps—*Virtual Option*

About the **IGE HUB**



Goals of the **IGE Hub**

- 01** Foster learning and collaboration among IGE awardees and provide broader dissemination of information and opportunities across the STEM graduate community.

- 02** Support a network where IGE teams can learn about broader themes, challenges, and innovations in STEM graduate education.

- 03** Help IGE grantees overcome challenges that hinder broader adoption of their innovations.

- 04** Share innovations across grantee institutions and with the STEM graduate community.

- 05** Encourage and support the development of IGE proposals from Minority Serving Institutions (MSI's).

About **CGS**

For six decades, the Council of Graduate Schools (CGS) has been the national voice for the graduate dean community. CGS is the only national organization in the United States that is dedicated solely to the advancement of graduate education and research.

CGS accomplishes its mission through advocacy in the policy arena, innovative research, and the development and dissemination of best practices. CGS also acts as a convening authority, organizing major events that bring together graduate deans and other stakeholders to discuss and take action on a broad range of issues affecting graduate education today.

Meeting Goals and Policies

Code of Conduct

Adapted from the in-person conduct policy of the Societies Consortium on Sexual Harassment in STEM:

- 01 Demonstrate respect and consideration for all people.**
- 02 Make room for a diversity of voices** in group discussions.
- 03 Demonstrate that differing perspectives are valued**—critique ideas, not people.
- 04 Be aware of and do not enter others' personal space.**
- 05 Report conduct concerns to a CGS staff member** so that concerns can be addressed as quickly as possible.

CGS strives to host inclusive, accessible events that enable all individuals, including individuals with disabilities, to engage fully. Please contact Allison Robert (arobert@cgs.nche.edu) or any member of the CGS staff if you need additional support to participate.

Meeting Goals

- 01** Support awareness and learning about broader themes, challenges and innovations in STEM graduate education.
- 02** Provide a forum where IGE grantees can discuss both challenges and evidence-based practices with their colleagues.
- 03** Promote broader dissemination of IGE innovations to the STEM graduate education community.

By the Numbers

50 Attendees
representing IGE project teams

29
Posters

40
Current IGE Projects
Represented

Locations

Day 1

Westin Alexandria Old Town

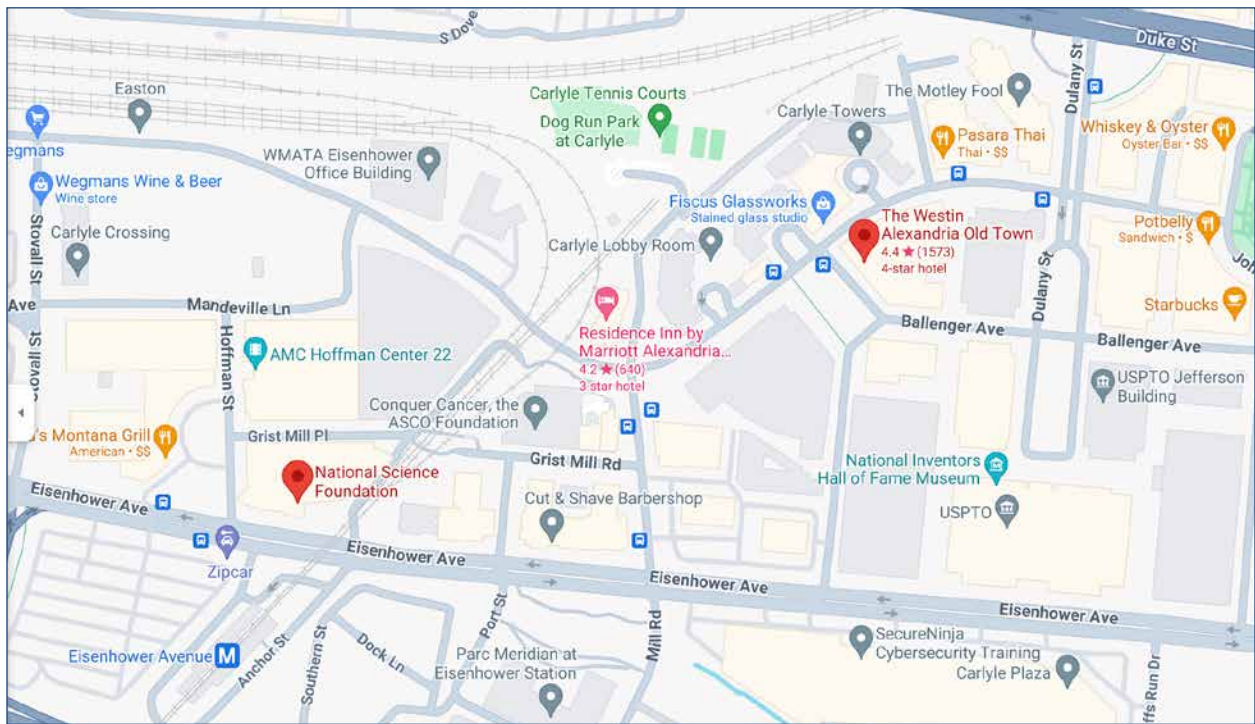
400 Courthouse Square
Alexandria, VA 22314

Day 2

National Science Foundation

Headquarters (0.4 miles from Westin)
2415 Eisenhower Avenue
Alexandria, Virginia 22314

NSF is located across the street from the Eisenhower Avenue Washington Metropolitan Area Transit Authority station.



Accessing the NSF building

Visitors must enter through the building's visitor center entrance, which is adjacent to the south building entrance on Eisenhower Avenue. A government-issued ID is required to enter the building.

Please plan to arrive at least 30 minutes before the event begins (by 8:30 a.m.) to allow time to pass through security and obtain your visitor pass.

Keynote Speaker



Dr. Keivan Stassun
Stevenson Professor of
Physics & Astronomy
Vanderbilt University

Stassun holds the Stevenson chair in Physics & Astronomy at Vanderbilt University, where he was previously the recipient of an NSF CAREER award, a Cottrell Scholar award from the Research Corporation for Science Advancement, an HHMI Professor award from the Howard Hughes Medical Institute, and a Ford Foundation Diversity Fellowship from the National Academies. Stassun is a co-investigator for NASA's Transiting Exoplanet Survey Satellite (TESS) mission, chairs the executive committee of the Sloan Digital Sky Survey, and recently served on the National Academy of Science's Decadal Steering Committee for Astronomy & Astrophysics. An elected Fellow of the American Physical Society, the American Astronomical Society, the American Association for the Advancement of Science, and the American Academy of Arts & Sciences, his research on stars and exoplanets has appeared in more than 500 peer-reviewed journal articles, with an emphasis on developing new data-driven methods for making precise measurements of the fundamental physical properties of stars and planets. From 2004 to 2015, he served as founding director of the Fisk-Vanderbilt Masters-to-PhD Bridge Program, which has become one of the nation's top producers of PhDs to underrepresented minorities in the physical sciences. Having trained more than 50 PhD students and postdoctoral scholars from diverse backgrounds, Stassun is a leader and advocate for broadening participation in STEM, especially of underrepresented minorities and persons with disabilities. He has served on NSF's Committee for Equal Opportunity in Science and Engineering, chaired the American Astronomical Society's Committee on Minorities, is a recipient of the American Physical Society's Nicholson Medal for Human Outreach, has been named Mentor of the Year by the American Association for the Advancement of Science, and has been honored with a Presidential Award for Excellence in Science Mathematics and Engineering Mentoring. Stassun currently serves as founding director of the Frist Center for Autism & Innovation in Vanderbilt's School of Engineering, focused on advancing science and engineering through the engagement and workforce development of autistic individuals and those with other forms of neurodiversity. In 2023, Stassun was appointed to a six-year term on the National Science Board by President Joseph R. Biden.

Detailed Agenda

Advancing Innovation in Graduate Education: Innovations in Graduate Education (IGE) Principal Investigators' Meeting

Day 1: Thursday, February 29

All Day 1 events will be held at the [Westin Alexandria Old Town](#).

1:00–3:00 p.m.

Edison EFG Foyer

Arrival and Registration

Collect badge and materials; poster set-up.

Please plan to arrive during the 1:00-3:00 p.m. period to get settled at the hotel. (Those traveling longer distances may need to arrive the day before). If an early check-in is not available, you may store your bags with the hotel staff.

3:30–3:45 p.m.

Edison EFG

Welcome and Overview of Meeting— *Virtual Option*

- **Dr. James Moore**, Assistant Director, Directorate for STEM Education, NSF
- **Dr. Suzanne T. Ortega**, President, Council of Graduate Schools

3:45–5:00 p.m.

Edison EFG

Opening Keynote—*Virtual Option*

Dr. Keivan Stassun, Stevenson Professor of Physics and Astronomy, Vanderbilt University

Day 1: Thursday, February 29: continued

5:30–7:00 p.m.

*Edison EFG Foyer &
Wright and Banneker*

Networking Reception and Poster Hall

A buffet and cash bar will be available in Edison EFG Foyer. The poster hall will take place in adjacent Wright and Banneker. Poster presenters are assigned to one of two sessions within the networking period.

Session A (6:00-6:30 p.m.)

Session B (6:30-7:00 p.m.)

7:00–7:30 p.m.

Wright and Banneker

Poster Hall Breakdown

Presenters take down posters.

All participants submit suggestions for lunch group discussion topics.

Day 2: Friday, March 1

All Day 2 events will be held at the [NSF Headquarters](#), 0.4 miles from the Westin Alexandria.

7:00–8:30 a.m.

Breakfast on your own

Travel to NSF for security check-in.

Please note that a government-issued ID is required for entry into the NSF headquarters. Please plan to arrive by 8:30 a.m. so that you have ample time to check in and get settled for the opening session. Please also note that suitcases should be stored at the hotel; NSF does not have the ability to store bags during the meeting.

9:00 a.m.

Multipurpose Room

Welcome from NSF and CGS—Virtual Option

- **Dr. Daniel Denecke**, IGE Lead Program Officer, NSF
- **Dr. Julia Kent**, Vice President, Best Practices and Strategic Initiatives, Council of Graduate Schools

Day 2: Friday, March 1: continued

9:15–10:30 a.m.

Multipurpose Room

Elevating, Evaluating and Scaling IGE Projects: Innovative Solutions to Persistent Challenges in STEM Graduate Education—*Virtual Option*

Speakers:

- **Dr. Arash Esmaili Zaghi**, Professor of Engineering, University of Connecticut. Project: Encouraging the Participation of Neurodiverse Students in STEM Graduate Programs to Radically Enhance the Creativity of the Professional Workforce
- **Dr. Peter Harries**, Professor of Marine, Earth and Atmospheric Sciences, Dean of the Graduate School, North Carolina State University. Project: Accelerate to Industry (A2i)
- **Dr. Colette Patt**, Assistant Dean for Diversity, Equity, Inclusion and Access in the Mathematical & Physical Sciences Division, University of California at Berkeley. Project: IGE: Innovations in Graduate Education: Identity, Structure and Belonging (IGE-ISB)
- **Dr. Thandi Sulé**, Associate Professor of Higher Education, Oakland University. Project: Mentoring for Life: Enhancing STEM Graduate Student Well-being

Facilitator: **Dr. Janice Daniel**, AAAS Science and Technology Policy Fellow, Division of Graduate Education, NSF

10:30–10:45 a.m.

Coffee break

10:45–11:45 a.m.

Advancing Innovation in Common Research Areas

The goal of the morning breakouts is to discuss challenges, solutions to overcoming them, and emerging or established practices that support success in a common research area. Please choose the session you find most relevant to your project. This session is guided by Activity Sheet #1.

Room W-2170

Professional Development and Professional Identity-Formation

Facilitators:

- **Dr. Himanshu Jain**, Lehigh University
- **Dr. Yusuf Mehta**, Rowan University

Day 2: Friday, March 1: continued

Room W-2180

Preparing STEM Graduate Students for Interdisciplinary Learning and Research

Facilitators:

- Dr. Gundula Bosch, Johns Hopkins University
- Dr. Hua Li, Texas A&M University Kingsville

Room W-2240

Supporting Environments of Diversity, Equity, Inclusion, Accessibility, and Belonging

Facilitators:

- Dr. Valerie J. McKenzie, University of Colorado, Boulder
- Dr. Krishna Pakala, Boise State University

Room W-2250

Evidence-based Practices to Support Mentoring and Wellbeing

Facilitators:

- Dr. Cynthia Furse, University of Utah
- Dr. Barbara Sarnecka, University of California, Irvine

11:45 a.m.–12:15 p.m.

Multipurpose Room

Takeaways and Recommendations—*Virtual Option*

Facilitators will present a summary of the answers to session questions (3-5 minutes of presentation per group), with opportunities for participants to add reflections that may have been missed in the summaries.

12:15–1:30 p.m.

Multipurpose Room

Networking Lunch

Ideas for discussion topics will be gathered on Day 1.

1:30–2:30 p.m.

Cross-Cutting Issues in IGE Research: Concurrent Session A

Please choose the session that best supports your project needs and goals. This session is guided by Activity Sheet #2.

Room W-2170

Strategies for Engaging Faculty Through Evidence of Good Practice and Improved Program Outcomes

Brief Presentations:

- Dr. Dax Ovid, University of Georgia
 - Dr. Mesbah Uddin, University of North Carolina at Charlotte
- Facilitator: Dr. Jill Huerta, University of North Carolina Charlotte

Day 2: Friday, March 1: continued

Room W-2180

Recruiting and Engaging Diverse Groups of STEM Graduate Students

Brief Presentations:

- Dr. Carmen Lilley, University of Illinois at Chicago
- Dr. Russell Mailen, Auburn University

Facilitator: Dr. Mark Moritz, Ohio State University

Room W-2240

Developing and Improving Rigorous Assessment and Evaluation Strategies

Brief Presentations:

- Dr. Elizabeth King, University of Georgia
- Dr. Kavitha Chandra, University of Massachusetts Lowell

Facilitator: Dr. Lu Liu, Iowa State University

Room W-2250

Strategies for Expanding and Scaling Impact Within and Across Institutions

Brief Presentations:

- Dr. Pablo Gomez, California State University, San Bernadino
- Dr. Ashby Kinch, University of Montana

Facilitator: Dr. Nathan Jackson, University of New Mexico

2:30–2:45 p.m.

Coffee break

2:45–3:45 p.m.

Cross-Cutting Issues in IGE Research: Concurrent Session B

Please choose a second session that best supports your project needs and goals. This session is guided by Activity Sheet #3.

Room W-2170

Strategies for Engaging Faculty Through Evidence of Good Practice and Improved Program Outcomes

Brief Presentations:

- Dr. Jessica Alzen, University of Colorado at Boulder
- Dr. Mark Garrison, Morgan State University

Facilitator: Dr. Misha Chertkov, University of Arizona

Day 2: Friday, March 1: continued

Room W-2180

Recruiting and Engaging Diverse Groups of STEM Graduate Students

Brief Presentations:

- **Dr. Megan Donahue**, University of Hawaii
- **Dr. Shan Jiang**, Iowa State University

Facilitator: **Dr. Susan Fullerton**, University of Pittsburgh

Room W-2240

Developing and Improving Rigorous Assessment and Evaluation Strategies

Brief Presentations:

- **Dr. Janis Bush**, University of Texas at San Antonio
- **Dr. Beverly Hartline**, Montana Technological University

Facilitator: **Dr. Sasha Goldman**, Boston University

Room W-2250

Strategies for Expanding and Scaling Impact Within and Across Institutions

Brief Presentations:

- **Dr. Fraser Fleming**, Drexel University
- **Dr. Angela Potochnik**, University of Cincinnati

Facilitator: **Dr. Allison Traylor**, Clemson University

3:45–4:15 p.m.

Multipurpose Room

Takeaways and Recommendations—*Virtual Option*

Facilitators will present a summary of the answers to session questions (3-5 minutes of presentation per group), with opportunities for participants to add reflections that may have been missed in the summaries.

4:15–4:30 p.m.

Multipurpose Room

Concluding Remarks and Next Steps—*Virtual Option*

- **Dr. Suzanne T. Ortega**, President, CGS
- **Dr. Julia Kent**, Vice President, Best Practices and Strategic Initiatives, CGS

Poster Abstracts

2024 IGE PI MEETING – Poster Hall

Posters in Session A

PRESENTER

Jessica Alzen

Project title: IGE: Transforming the Education and Training of Interdisciplinary Data Scientists (TETRIDS)

NSF Award Number: 1955109

Poster title: Transforming the Education and Training of Interdisciplinary Data Scientists (TETRIDS)

PI: Eric Vance

Abstract: The nation needs to educate and train more students with deep technical skills in data science and broad interdisciplinary collaboration skills to work with researchers, businesses, and policy makers to convert data into benefits for society. In our project, we study one approach to teaching statistics and data science collaboration at the Laboratory for Interdisciplinary Statistical Analysis (LISA) at University of Colorado Boulder. We seek to identify the extent to which participating in LISA prepares students to be effective statistical collaborators. Additionally, we identify effective and reproducible elements of the LISA approach to teaching interdisciplinary statistical collaboration. Our results show that LISA collaborators can perform relatively similarly to advanced statistical collaborators and that outside experts find high satisfaction with LISA collaboration projects. Further, the LISA approach to progressive project roles, integrated community of practice, and training with specific tools are useful for student confidence and effective collaborations.

PRESENTER

Gundula Bosch (PI)

Project title: R³ISE across the disciplines

NSF Award Number: 1955062

Poster title: Exploring Questionable Research Practices across the STEM Disciplines

Abstract: Much has been published on the pedagogy of research ethics education. However, many courses focus on contrasting flawless ethical practices with cases of misconduct or fraud. The poorly defined grey zone in between, the so-called “questionable research practices”, are rarely taught formally. Yet, they play an important role for ethical decision making in scientific practice. Our project aims to fill that gap by producing and evaluating the educational module “R³ISE across the disciplines” (Research Integrity training supporting Rigorous, Responsible and Reproducible Practice in Science and Engineering). It uses an error analysis approach and produces an openly accessible library of case scenarios. The goal of this project comprises assessing the learning outcomes of the R³ISE module in a student population spanning the life and social sciences, as well as engineering and technology. We appraise students’ critical thinking and communication skills around analyzing scientific errors in general, and questionable research practices in particular.

PRESENTER

Janis Bush (PI)

Project title: Advancing and Strengthening Science Identity through Systematic Training (ASSIST)

NSF Award Number: 1806323

Poster title: Advancing and Strengthening Science Identity through Systematic Training (ASSIST)

Abstract: Developing science leaders from underrepresented minority (URM) graduate students remains a national priority. Minority-serving institutions are uniquely poised to foster diverse science leaders, but they also require a systematic, integrated, program-wide approach geared toward nurturing and validating students’ identities as scientists. Using our master’s degree program in Environmental Science, we designed a series of graduate courses, professional workshops, and community-based activities to foster and validate underrepresented minority students’ science identity through holistic mentoring, writing to learn, and science communication. Interventions positively contribute to science identity, but we need more long-term data and statistical power (i.e., multiple cohorts after graduation). Cultivating a culture of writing within departments and colleges requires commitment, infrastructure, and strong relationships. We aim to continue to build support for culturally responsive pedagogy as a validation component for our students.

PRESENTER

Michael Chertkov (PI)

Project title: Integrating Data Science into the Applied Mathematics PhD: Generalized Skills for Non-Academic Careers

NSF Award Number: 2325446

Poster title: Integrating Data Science into the Applied Mathematics PhD: Generalized Skills for Non-Academic Careers

Abstract: The “IGE: Integrating Data Science into the Applied Mathematics PhD” project at the University of Arizona aims to revolutionize the AM curriculum by infusing it with data science and AI, preparing a new generation for non-academic STEM careers. This initiative will establish collaborations between PhD students, university advisors, and lab co-advisors to foster long-term research opportunities. It seeks to diversify the AM field, linking academic study with industrial and government sectors, thereby creating a model replicable across the nation. The project addresses the demand for PhD graduates skilled in both traditional AM and AI, focusing on preparing them for the interdisciplinary and multi-sectoral workforce.

PRESENTER

Susan Fullerton (PI)

Project title: A Personalized Learning Model for STEM Graduate Education

NSF Award Number: 2325599

Poster title: A Personalized Learning Model for STEM Graduate Education: A Pilot in Chemical Engineering

Abstract: Guided by the principles of personalized learning, this innovation at the University of Pittsburgh will prepare engineering graduate students for their target career by providing a customized education in which faculty and students work collaboratively to achieve a competency-based engineering education. To achieve this aim, we will pilot, test, and validate a Personalized Learning Model (PLM) for STEM Graduate Education in which personalized learning is implemented both within the classroom and in professional development activities. This student-centered approach to graduate education will create an inclusive environment by meeting students at their current skill levels, allowing them to customize their educational experience to their career goals.

PRESENTER

Cynthia Furse (PI)

Project title: The Lean Canvas for Invention (LCI): A Team Based Framework for Research Development and Mentoring

NSF Award Number: 2105489

Poster title: Research Development, Matrix Mentoring, and Career Development Training

Abstract: We have developed a graduate course (online and “zoom” in person) for helping students with Research Development, Matrix Mentoring, and Career Development. Students use a Lean Canvas approach to review traditional scientific literature as well as patent literature and business reviews in a research area of their choosing. They develop an individual career development plan (IDP), and identify key career development goals, skills, and milestones. This includes the development of a mentoring network. Students will begin personal interactions with key stakeholders in their area for support in innovation, career development, and mentoring. Students will leave the class with a formal framework for research, career, and mentor development. Materials for this course are available for sharing via Canvas.

PRESENTER

Fraser Fleming (PI)

Project title: IGE: Creative Interdisciplinary Research in Graduate Education (CIRGE)

NSF Award Number: 1855925

Poster title: Interdisciplinary Team-Oriented Creativity (ITOC)

Abstract: The NSF-funded CIRGE (Creative Interdisciplinary Research in Graduate Education) program initiated a project to inject creative thinking, problem solving, and interdisciplinary teamwork, through the development of a new graduate minor: **Interdisciplinary Team-Oriented Creativity (ITOC)**. ITOC trains students from disparate disciplines to be creative, innovative problem solvers through four courses, two core courses in creativity and two electives; at least one elective must be outside the home department. The core course *Creative Interdisciplinary Team Research: Principles and Practice* provides fluency with the foundational principles in cognitive research that demonstrably enhance creative practice and problem-solving skills. Students learn of recent advances in creativity research and practice and also gain practice developing these skills in team-based projects that address societal problems. The second core course, *Enhancing the Creativity of a Research Project*, is designed to infuse greater creativity into a student's research project.

PRESENTER

Sasha Goldman

Project title: PhD Progression: Creating Workforce-Driven Flexible Credentials for Doctoral Students

NSF Award Number: 2224988

Poster title: PhD Progression: Creating Workforce-Driven Flexible Credentials for Doctoral Students

PI: Sarah Hokanson

Abstract: To better support PhD students in building and communicating about their professional skills, we designed a micro-credentialing program called PhD Progression that would allow them to choose and complete self-paced and accessible modules whenever needed, and be rewarded for investing time in their professional development. PhD Progression: Creating Workforce-Driven Flexible Credentials for Doctoral Students is a three stage project to expand our extant micro-credentialing platform in order to better serve trainees in the sciences at Boston University and beyond. In the first stage, we partnered with Biomedical companies to integrate workforce knowledge directly into our credentials. For the second stage, PhD students will apply the knowledge learned in the workforce-driven credentials to funded internships with industry partners. Finally, we will build a multi-institutional consortium of Universities with badging programs, to share content and edify our respective credentialing systems.

PRESENTER

Kevin Han (PI)

Project title: IGE: Learning the Entire Pipeline: Analyzing and Improving Graduate Engineering Education through Communities of Practice

NSF Award Number: 2105555

Poster title: Learning the Entire Pipeline: Analyzing and Improving Graduate Engineering Education through Communities of Practice

Abstract: This project attempts to understand how graduate students in critical Engineering domains learn to put academic knowledge into practice while working in diverse, interdisciplinary teams. To prepare students to transfer their classroom experiences to professional practice, engineering education needs to improve students' ability to work in multidisciplinary teams, deal with diverse opinions, ideas, and backgrounds, and broaden their education to understand the impact of engineering solutions in a global context. This project adopts a highly developed theoretical framework called "communities of practice" (CoP) and applies, researches, and further extends CoP theory in graduate classes across Civil Engineering, Computer Science, and Electrical Engineering. This approach has a strong emphasis on collaboration, teamwork, knowledge as doing, and communication across disciplinary and cultural backgrounds. The proposed approach can help to bridge the gap between theory and practice, facilitating the development of a workforce that can work within and across teams, projects, and domains.

PRESENTER

Peter Harries (PI)

Project title: Accelerate to Industry (A2i)

NSF Award Number: 1855978

Poster title: Accelerate to Industry (A2i): Preparing Graduate Students for a Career in Industry

Abstract: Accelerate to Industry (A2i) is a program initiated and developed in the Graduate School at NC State University. It is a structured set of components designed to more effectively prepare those students interested in industry careers for that pathway. The backbone of A2i consists of six different modules: Industry Insights, Job Search Strategies, Company Visits, Internships, Team Practica, and Immersion Week. The thrust of our project was to build a network of 30+ university partners that used our A2i framework to provide similar content at their institutions. The modular nature allows programs to customize it to the needs of their graduate students as well as their strengths and workforce realities. The project, through our external evaluator, has also collected a range of data related to how effective the programming is in increasing various industry-oriented competencies of our participants and also to evaluate our partner network.

PRESENTERS

Beverly K. Hartline and Ashby Kinch (PIs)

Project title: Mental Health Opportunities for Professional Empowerment in STEM (M-HOPES)

NSF Award Numbers: 2105221, 2105251, 2105254

Poster title: Strategies for Supporting Graduate Student Wellbeing: Insights from M-HOPES

PIs: Beverly K. Hartline, Sarah Keller, and Ashby Kinch

Abstract: STEM graduate students face significant mental and emotional stressors and challenges: conducting innovative research, completing advanced coursework, teaching, low stipends, and career uncertainty. It is even tougher for women, minority, and international students; veterans; students with disabilities; and students from disadvantaged backgrounds. M-HOPES is designing, piloting, and evaluating an innovative model for fostering life-long skills for mental health and wellbeing. Project components include:

- annual surveys of students and faculty;
- activities for students to develop resilience and coping strategies (peer support groups, CBT skills workshops, eudaimonic happiness workshops); and
- workshops to help faculty improve support for mental health and wellbeing of students from diverse cultural and socio-economic backgrounds.

We seek to empower STEM graduate students to manage the stresses of their research; overcome stigma, impostor syndrome, and social isolation; and promote help-seeking and belonging—especially where counseling resources are limited and/or geared to undergraduates. Scale-up to four partner campuses is underway.

PRESENTERS

Jill Huerta and Aura Young (PIs)

Project title: Applying Cognitive Theories of Learning to Improve Graduate Training in STEM Communication

NSF award number: 2325453

Poster title: Applying Cognitive Theories of Learning to Improve Graduate Training in STEM Communication

Abstract: As graduate STEM education strives to meet workforce and societal needs, students must be trained in effective, clear, and culturally sensitive science communication, which is still too rare among STEM programs. We hypothesize that exposing theories of human cognition to students will provide them a foundational understanding of why certain communication tactics are successful and will allow students to better adapt their practices for different audiences and contexts. We will test if a student group exposed to cognitive science theories shows a deeper understanding and mastery of learning outcomes in a series of STEM communication mini courses than a group of students who receive the same STEM communication training without the cognitive science component. Findings will lead to a STEM Communication graduate certificate program, with materials and results made publicly accessible in order to allow other institutions to replicate this approach to STEM graduate education.

PRESENTER

Himanshu Jain (PI)

Project title: Partnership with Researchers in Industry for Doctoral Education (PRIDE)

NSF Award Number: DGE 1806904

Poster title: Perspectives of STEM Faculty on Their Role in the Training of Doctoral Students

Abstract: Lehigh University launched an innovative program called Pasteur Partners PhD (P3) for the training of STEM doctoral students. It is a student-centered training program based on use-inspired research in partnership with industry. Its preliminary evaluation revealed that students benefited significantly from gaining practical skills through industry involvement such as co-advising, resulting in a clearer understanding of how the industry operates, which, in turn, enhanced their employability in the industry. The University administration also provided significant support for the program. However, a broader implementation of P3 encountered hesitancy from faculty members. To examine the challenges and obstacles that the faculty members feel, we conducted a survey to assess their perspectives on three specific aspects: (i) faculty members' roles and responsibilities, (ii) perceived challenges and resources needed to serve their roles, and (iii) the skills and training needed for student centered doctoral training. The key outcomes of their responses are discussed.

Additional credits to: Zilong Pan, Anand Jagota, and Volkmar Dierolf.

PRESENTER

Shan Jiang (PI)

Project title: IGE: Learning Communities of Graduates for Advancing Professional Skills (GAPS): Integrate Professional Skill Training with Thesis Research

NSF Award Number: 1954946

Poster title: GAPS (Graduates for Advancing Professional Skills) Program: Train Project Management Skills with Thesis Research

Abstract: Science, Technology, Engineering, Mathematics (STEM) graduate education traditionally has focused on developing technical skills while leaving professional skills to post-graduate training. A significant portion of students lack the critical professional skills, such as project management (PM), that are needed to be more effective after graduation. We sought to address the lack of PM training in graduate education through our Graduates for Advancing Professional Skills (GAPS) program. The program has been offered since Fall, 2020 with a total enrollment of ~90 students with different specializations. Students learn PM skills and then applied these skills directly to their current research projects (thesis). We suggest that making improvements to bridging the GAPS in graduate education can not only aid graduate students to successfully complete their thesis research but also contribute to strengthening the future STEM workforce.

PRESENTER

Kyle Johnsen

Project title: IGE: Toward an interdisciplinary blueprint for Open Science Graduate Education

NSF Award Number: 1955049

Poster title: Towards a Cultural Shift: Understanding and Fostering Open Science Adoption Among Graduate Students

PI: Shannon Quinn

Abstract: Our project is studying how to catalyze a cultural shift towards increasing understanding and adoption of the practices of Open Science among graduate students and graduate educators. Our methods have included broad interviews and surveys to reveal current levels of knowledge and interest, incentives to apply Open Science in research, seminars and workshops to train Open Science skills, and an Open Science Fellows program to forge a network of Open Science influencers and ambassadors. Our poster focuses on our survey of graduate students at the University of Georgia and Pennsylvania State University. Results showcase that, while the majority of graduate students were aware of Open Science, the knowledge they had was more likely to be self-taught, learned from peers, or learned from faculty other than their advisors.

Posters in Session B

PRESENTER

Elizabeth King

Project title: IGE: Enhancing Imaginative and Collaborative STEM Capacity through Creative Inquiry

NSF Award title: 1856302

Poster title: IGE: Applying Creative Inquiry to Enhance Imaginative and Collaborative Capacity in STEM

PI: Nathan Nibbelink

Abstract: Advanced scientific training is insufficient to position future leaders to solve the complex problems we face. They must also think creatively, collaborate across disciplines, and work effectively with people having different perspectives, knowledge, and values. Creativity training can stimulate both scientific creativity and skills for interdisciplinary collaboration. To date, its benefits for STEM graduate education are largely anecdotal, but clearly merit research. We bring together diverse STEM and arts graduate students in a six-stage program that uses training methods from the arts to build students' imaginative and collaborative capacities. We are evaluating a range of students' experiences and perceived effects of the creativity-based training, including effects on their abilities to frame problems in new ways, and solve complex problems in diverse teams. If this mode of training generates desired outcomes, widespread adoption of these methods will contribute to equipping STEM graduates with communication and collaboration skills, and ultimately increase creative and innovative solutions to complex global environmental challenges.

PRESENTERS

Hua Li (PI) and Ari Sherris

Project title: NSF IGE: Transdisciplinary Research in Graduate Engineering Education

NSF Award Number: 2225109

Poster title: Transdisciplinary Encounters and Rapid Ethnographic Lenses

Abstract: This poster shows the rapid ethnographic assessment results of six workshops on intercultural competence, community-engaged practice, and qualitative and quantitative mixed research methods, which were designed for and offered to graduate students from different academic backgrounds. The workshops intend to foster transdisciplinary education that leads to stronger solution-seeking processes in the face of intensifying climate change and efforts to sustain and enhance life on Earth. Participants in the first cohort included master's and doctoral students from psychology, counseling, mathematics, environmental engineering, industrial engineering, mechanical engineering, and sustainable energy engineering. Student participants enacted several dynamic simulations and role plays as future transdisciplinary environmental

professionals facing unprecedented challenges. Workshop elements included mapping your cultural orientation, positioning values along a spectrum, theorizing plateaus of adult and organizational development, analyzing interactions, identifying principles of community-engaged practice, completing community engagement plan components, building qualitative research tools including interviewing and coding, and analyzing qualitative data.

PRESENTER

Lu Liu

Project title: Social justice training in graduate engineering education through critical civic engagement

NSF Award Number: 2325593

Poster title: Innovation in Graduate Education—Social justice training in graduate engineering education through critical civic engagement

PI: Cristina Poleacovschi

Abstract: The proposal focuses on integrating social justice training in graduate engineering education through critical civic engagement. It addresses the gap in engineering education, which often overlooks social justice, despite the significant societal impact of engineering decisions. The project aims to educate engineers to prioritize social justice in their decision-making. A novel Critical Civic Engagement (CCE) model is proposed, emphasizing community-driven collaboration and learning with marginalized communities. This model integrates social justice and civic engagement curricula, aiming to bridge the gap between universities and communities. The project will be implemented in four graduate courses at Iowa State University, involving partnerships with local civic organizations. The objective is to produce more ethically aware and engaged engineers equipped to tackle social inequalities through their professional roles. The project includes modules in three civil and systems engineering classes and diverse assessments of student outcomes to ensure the effectiveness of the curriculum in fostering social justice competencies.

PRESENTER

Russell Mailen (PI)

Project title: The Writing SySTEM: A Systematic Approach to Graduate Writing Instruction and Intervention

NSF Award Number: 2224967

Poster title: Preview of The Writing SySTEM: A Systematic Approach to Graduate Writing Instruction and Intervention

Abstract: Research in graduate student development identifies self-efficacy as a central factor in writing ability and related outcomes. Typical ad-hoc approaches to STEM writing support lack the four factors proven to develop self-efficacy: previous successful experiences, the ability to compare others to self, positive and negative feedback from the community, and the ability to use healthy emotional and psychological strategies to approach new challenges. We seek to determine the relations among self-efficacy, self-regulation of writing, and writing ability in the context of engineering graduate education that includes systemic writing instruction and intervention structures. Our approach utilizes four components: workshops to teach writing skills, discipline-specific graduate writing courses, peer writing groups, and writing resources hosted on a publicly available Open Educational Resource (OER). Success is informed by the insights gained into the relationships across self-efficacy, self-regulation, and writing performance as determined through validated quantitative and qualitative instruments for measuring each factor.

PRESENTERS

Valerie McKenzie (PI) and Scott Taylor

Project title: FIRED UP: An immersive early field experience program to build community, support inclusivity, and foster large-scale research ideas

NSF Award Number: 2105635

Poster title: Shared challenges, program components, and opportunities to collaborate in the field can foster sense of community in incoming graduate students.

Abstract: Successful collaborations are especially significant in fields where scientists work across large scales on multi-faceted problems and they require perspectives from diverse individuals. The field of ecology and evolutionary biology (EEB) can significantly benefit from partnerships between diverse scientists, however, many EEB graduate programs in the US have lacked diversity, due to barriers to recruitment and students from underrepresented groups experiencing a reduced sense of belonging. Typically, EEB programs rarely focus on intentional formation of a sense of community that leads to psycho-social supports and retention of diverse individuals. Drawing from self-determination and self-efficacy theories, this study presents findings from the evaluation of a graduate education model entitled Field Intensive Research Emphasizing Diversity Up in the alpine (FiredUp) that seeks to build autonomy and competence in field skills, enhance relatedness among incoming BIO graduate students, and foster big picture science thinking in the earliest stages of graduate training.

PRESENTER

Yusuf Mehta (PI)

Project title: Transforming Graduate Education in Transportation Engineering: Applying Cognitive Apprenticeship to Translate Doctoral Student Skills from Research-to-Practice

NSF Award Number: 2224724

Poster title: Applying a Research-to-Practice Model in Graduate Civil Engineering Programs

Abstract: Civil engineering graduate programs are often designed with the underlying assumption that graduating students will be taking on academic research careers. However, with limited numbers of available academic positions, it is necessary for these graduating students to be prepared to take on positions in either industry or government. This project applies a research-to-practice model based upon cognitive apprenticeship within the civil engineering graduate curriculum. The revised model allows for students to still benefit from learning through research, as with traditional graduate programs, but also gain non-academic experience through mentorship by industry and government professionals. Specifically, the project provides for skill building in four key areas: technical competency, business and communication skills, leadership and team building, and networking. Program assessment will be done through the determination of changes in students' professional identity and motivation towards degree completion as well as their perception of the cognitive apprenticeship experience.

PRESENTER

Mark Moritz (PI)

Project title: Training Scientists to Tackle Grand Challenge Societal Problems through Convergent Action in Transdisciplinary Teams

NSF Award Number: 2224769

Poster title: Graduate Interdisciplinary Specialization in Wicked Science

Abstract: The poster provides an overview of the Graduate Interdisciplinary Specialization in Wicked Science at the Ohio State University. The training program is open to graduate and professional students from across the university. The GIS prepares students for a wide range of careers in and outside of academia. The goal of the program is to train students to become wicked scientists—researchers with the skills and attitudes to tackle wicked problems.

PRESENTER

Dax Ovid

Project title: IGE: Graduate Opportunities to Learn Data Science (GOLD): Empowering female and underrepresented graduate students through inclusive data science training

NSF Award Number: 1856394

Poster title: Biology Graduate Student Conceptions of Identity and Social Justice in Data Science Through a Novel Assessment Tool

PI: Pleuni Pennings

Abstract: To elucidate perceptions of biology and biochemistry graduate students from backgrounds excluded from data science careers, our study designed and gathered evidence for validity of novel assessment prompts. Guided by theoretical frameworks of graduate student professional socialization (Weidman et al., 2001) and Goal Congruity Theory (Diekman et al., 2020), our team investigated two research questions: (RQ1) To what extent did graduate students provide evidence that data science was aligned (or not) with their professional and/or personal identity? (RQ2) In what ways did graduate students see data science as a tool for social justice? For our study, we conducted focus groups and collected pre-post assessments from entry and advanced programming courses. We conducted a systematic qualitative analysis on graduate students' responses to the following challenge statements: (RQ1) "People like me do data science," and (RQ2) "I see data science as a tool for social justice."

PRESENTER

Krishna Pakala (PI)

Project title: Collaborative Research: Scalable Storytelling Interventions to Support Graduate Student Success in STEM

NSF Award Number: 2325041

Poster title: Empowering STEM Voices: A Storytelling Approach to Enhancing Professional Identity and Belonging in Graduate Education

PIs: Krishna Pakala and Angela Minichiello

Abstract: The project seeks to enhance the professional identity, sense of belonging, and combat impostorism among STEM graduate students. To address the prevailing emphasis on content expertise, a cohort-based program is introduced. This initiative involves students learning and applying storytelling techniques through personal narratives. Grounded in theories of narrative identity, reflection, and cognitive consistency, the project builds on prior pilot work to establish proof of concept. Following Self-Determination Theory, it focuses on fulfilling basic human needs of autonomy (identity), relatedness (belongingness), and competence (imposter feelings). Collaboration with The Story Collider, a national nonprofit, aligns with the IGE mission for transformative STEM graduate education. Through storytelling performances, students delve into themes of discovery, fitting in, and overcoming doubt in STEM. The project aims to develop, implement, and assess the impact of a storytelling curriculum, contributing to broader dissemination and fostering positive changes in STEM graduate education.

PRESENTERS

Angela Potochnik (PI) and Melissa Jacquart

Project title: Engaging Science: Transforming Graduate Education through Public Engagement with Science

NSF Award Number: 2224857

Poster title: Interdisciplinary Curriculum on Public Engagement with Science

Abstract: Academic scientists are increasingly called upon to engage in public outreach, and an ever-increasing number of graduate degree-holders are finding employment in roles related to public outreach. Graduate programs across the sciences have the potential to address this need, but most programs focus almost exclusively on research. Our team is developing a three-part curriculum at the University of Cincinnati to provide interdisciplinary instruction in public engagement with science. The curriculum incorporates extensive community partnership, interdisciplinary collaboration, and methods from philosophy of science, and it enrolls students from across the physical, biological, behavioral, and social sciences. In this poster, we describe the three components of the curriculum—workshop, semester-long seminar, and summer fellowship; indicate some initial observations about participation; and summarize the research our team is conducting on this curriculum’s transformative potential to equip graduate students to engage public audiences in a more meaningful, robust way; to encourage collaboration across disciplines; and to advance diversity and inclusion in STEM graduate education.

PRESENTER

Barbara Sarnecka (PI)

Project title: IGE: Enhancing Doctoral Research Training through Cascading Mentorship (Anteater Huddles)

NSF Award Number: 2105661

Poster title: When bad things happen to good programs: Lessons from a failing scale-up

Abstract: Educational interventions are famously difficult to scale up. What works for one dedicated program developer with a small number of carefully chosen and highly motivated students often does not work for a broader group of leaders and students. Although the IGE program discussed in this poster is still underway, there are early indications that it will not show the hoped-for effects. The poster identifies some likely reasons for the failure including speed of scale-up, intrinsic vs. extrinsic motivation in students, and a pervasive climate of mistrust between grad students and university administrators at the time of the project.

PRESENTER

Allison Traylor (PI)

Project title: TRIAGE: Techniques for Resolving Intragroup Conflict to Advance Graduate Education

NSF Award Number: 2325521

Poster title: Needs Assessment Results from TRIAGE: Techniques for Resolving Intragroup Conflict to Advance Graduate Education

Abstract: Drawing from proven science on conflict management, this project focuses on developing a set of tools aimed at helping graduate students develop conflict management skills, assess conflict in their teams, and identify interventions to help their teams navigate conflict. This presentation captures the first phase of our research: a needs assessment focused on how and when graduate students engage in conflict in their research teams. This poster presentation will summarize results from the needs assessment including the knowledge, skills, and abilities required for graduate students to effectively engage in conflict. Finally, the poster will provide an overview of next steps for this project, including development of a day-long training program focused on constructive controversy, an approach aimed at improving teams' ability to generate constructive, task-focused conflict.

PRESENTER

Mesbah Uddin

Project title: Reimagining the STEM Doctorate: The Pathways to Entrepreneurship (PAteNT)

NSF Award Number: 1954978

Poster title: Pathways to Entrepreneurship (PAteNT) Program: Alternative Doctoral Capstone Degree Requirements

PI: Praveen K. Ramaprabhu

Abstract: PAteNT (Pathways to Entrepreneurship) is a pilot program that offers a new pathway for doctoral candidates in STEM programs at UNC Charlotte to fulfill their capstone degree requirements by applying for patents. This model program aims to bring greater alignment between doctoral degrees and the rapidly changing employment landscape. The program has the potential to modernize the STEM Ph.D. by introducing programmatic and curricular innovations necessary to create flexible pathways to doctoral degrees, thus encouraging innovations that align more closely with the dynamic workforce. The specific goals of the project include: (a) development of an alternative roadmap for STEM doctoral students with the objective of increasing entrepreneurship rates among graduates, (b) investigation of doctoral educational strategies that broaden participation of traditionally marginalized groups in society, and (c) scaling and propagating effective pedagogical strategies.

PRESENTER

Arash Esmaili Zaghi (PI)

Project title: Encouraging the Participation of Neurodiverse Students in STEM Graduate Programs to Radically Enhance the Creativity of the Professional Workforce

NSF Award Number: 2105721

Poster title: Experiences of Neurodivergent Students in Graduate STEM Programs

Abstract: This qualitative study examines the underrepresentation and challenges of neurodivergent students in STEM graduate programs, focusing on the experiences of 18 neurodivergent students at a research-intensive university. Through thematic analysis of 10 focus group sessions, the study identifies common experiences that intersect with the invisibility of neurological diversity, presenting unique challenges. A novel model for understanding these experiences highlights the pressures neurodivergent students face to conform to neurotypical norms, the tendency to self-silence to preserve advisor-advisee relationships, and the cognitive and emotional toll of navigating stigma and disclosure. Despite facing significant mental health challenges and burnout, participants also view their neurodivergence as a strength. The findings suggest implications for graduate students, advisors, and program administrators, emphasizing the need for awareness and policy adjustments to support the wellbeing and productivity of neurodivergent students in STEM fields.

2024

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