Board 354: Organizational Partnerships S-STEM Research Hub

Dr. David B Knight, Virginia Tech

David Knight is an associate professor in the Department of Engineering Education at Virginia Tech. He also serves as Special Assistant to the Dean for Strategic Plan Implementation and Director of Research of the Academy of Global Engineering. His research tends to be at the macro-scale, focused on a systems-level perspective of how engineering education can become more effective, efficient, and inclusive, and considers the intersection between policy and organizational contexts.

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Watford is Professor of Engineering Education, Associate Dean for Academic Affairs and Executive Director of the Center for the Enhancement of Engineering Diversity.

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Dr. Walter Lee is an associate professor in the Department of Engineering Education and the director for research at the Center for the Enhancement of Engineering Diversity (CEED), both at Virginia Tech.

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Jacob Grohs is an Assistant Professor in Engineering Education at Virginia Tech with Affiliate Faculty status in Biomedical Engineering and Mechanics and the Learning Sciences and Technologies at Virginia Tech. He holds degrees in Engineering Mechanics (

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Teri K. Reed is the inaugural Director of the OU Polytechnic Institute and Professor and George Kaiser Family Foundation Chair at OU-Tulsa.

Dr. P.K. Imbrie, University of Cincinnati

P.K. Imbrie is the Head and Professor of the Department of Engineering Education and a Professor in the Department of Aerospace Engineering and Engineering Mechanics University of Cincinnati. He received his B.S., M.S. and Ph.D. degrees in Aerospace Engineering from Texas A&M University. He is an advocate for research-based approaches to engineering education, curricular reform, and student retention. Imbrie conducts both traditional, as well as educational research in experimental mechanics, piezospectroscopic techniques, epistemologies, assessment, and modeling of student learning, student success, student team effectiveness, and global competencies He helped establish the scholarly foundation for engineering education as an academic discipline through lead authorship of the landmark 2006 JEE special reports "The National Engineering Education Research Colloquies" and "The Research Agenda for the New Discipline of Engineering Education." He has a passion for designing state-of-the-art learning spaces. While at Purdue University, Imbrie co-led the creation of the First-Year Engineering Program's Ideas to Innovation (i2i) Learning Laboratory, a design-oriented facility that engages students in team-based, socially relevant projects. While at Texas A&M University Imbrie co-led the design of a 525,000 square foot state-of-the-art engineering education focused facility; the largest educational building in the state. His expertise in educational pedagogy, student learning, and teaching has impacted thousands of students at the universities for which he has been associated. Imbrie is nationally recognized for his work in active/collaborative learning pedagogies, teaming and student success modeling. His engineering education leadership has produced fundamental changes in the way students are educated around the world.

Imbrie has been a member of ASEE since 2000 and has been actively involved with the Society in various capacities. He has served in multiple leadership roles in the ERM and FPD divisions, including: ERM board of directors (2002-2004), program chair for ERM (2005 and 2009), ERM program chair for Frontiers in Education (FIE) (2004), FIE Steering Committee ERM representative (2003-2009), as well as program chair (2016) and division chair (2016-17) for FPD. He has also served on two ASEE advisory committees.

Dustin Grote, Weber State University

Dustin currently serves as an Assistant Professor in Teacher Education at Weber State University and leads the higher education leadership program. He holds a PhD from Virginia Tech in Higher Education. His interdisciplinary research agenda includes graduate funding in STEM, transdisciplinary, experiential and adaptive lifelong learning, undergraduate education policies, systems thinking, organizational change, broadening participation in engineering, improving community college transfer pathways in engineering, curricular complexity in engineering, and assessment and evaluation in higher education contexts. Prior to pursuing a Ph.D., Dustin served as a Postdoctoral Research Associate in Engineering Education at Virginia Tech, Director of Admissions at Community College of Denver, and in Outreach and Access Initiatives for the Colorado Department of Higher Education.

Mrs. Amy Richardson, Virginia Tech

Amy Richardson is a Graduate Research Assistant at Virginia Tech in the Department of Engineering Education along with an Assistant Professor of Engineering at Northern Virginia Community College. She has been teaching math and engineering courses at com

Dr. Michelle D. Klopfer, Virginia Tech
Dr. Saundra Johnson Austin, Virginia Tech

Dr. Saundra Johnson Austin has dedicated her career to promoting diversity, equity, inclusion, and belonging of elementary, middle, and high school students in science, technology, engineering, and mathematics (STEM) education and careers. Her research is grounded in the effective implementation of STEM curricula in urban middle schools. She has published and presented on STEM education and organizational change. Dr. Johnson Austin earned a Bachelor of Science in Civil Engineering from The Pennsylvania State University, a Master's in Business Administration from the University of Notre Dame, and Doctor of Education in Organizational Change and Leadership from the University of Southern California.

At the University of South Florida (USF) she leads the project coordination for the National Science Foundation Florida Alliance for Graduate Education and the Professoriate (FL-AGEP), a $2.4M award to Florida A&M University (with a subaward to USF and Virginia Tech), Bethune-Cookman University, Florida International, and Florida Memorial University. Also, Dr. Johnson Austin is the project coordinator and Co-Principal Investigator for the USF Project Racism In School Exclusionary Suspensions (RISES), a $30k grant awarded to explore the suspensions of African American middle and high school students in Hillsborough and Pinellas County Florida.

Dr. Johnson Austin held positions as: math faculty at Academy Prep Center of Tampa; executive director of Curated PathwaysTM to Innovation; senior vice president for operations at the National Action Council for Minorities in Engineering, Inc.; president and CEO of St. Michael's High School; executive vice president of the Community Partnership for Lifelong Learning; executive director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science; and Minority Engineering Program director at The Pennsylvania State University. She began her career as a cost engineering at Bechtel Power Corporation. In 2007 she founded Charis Consulting Group, LLC.

Dr. Johnson Austin was recognized by numerous organizations for her work in promoting equity and access to STEM education. Her most notable award is the 2015 Outstanding Engineering Alumnus in Civil and Environmental Engineering from The Pennsylvania State University. In addition, she was awarded the 2004-2005 Selected Professions Fellowship by the American Association of University Women (AAUW). Dr. Johnson Austin was awarded in 2007 the Strengthening Our Communities Inaugural Community Educational Leadership Award at the 2nd Annual Celebrate Literacy Conference. In 1998, she was recognized with the National Society of Black Engineers' (NSBE) Inaugural Golden Torch Award for Minority Engineering Program Director of the Year and the Outstanding Contribution by a Minority Engineering Program Administrator Award by the National Association of Multicultural Engineering Program Advocates (NAMEPA).

She is a member of various STEM organizations including the United States White House endorsed initiative under the Obama Administration, Algebra by 7th Grade, and advisory committee member for

the Smithsonian Science Education Center's 'Zero Barriers in STEM Education.' Dr. Johnson Austin is currently the President of the American Association of University Women Tampa, Inc., consultant to the board for the Caribbean Community Association of Tampa, and Treasurer for the Northeast STEM Starter Academy of Mount Vernon, NY.

Dr. Johnson Austin is a member of the editorial review board for the Caribbean Educational Research Journal (CERJ). She also served as a reviewer for the National Science Foundation's CS for All Pathways, HBCU-Up, INCLUDES Conference and INCLUDES Launch Pilot.

She enjoys doing yoga, spending time on the beach, and mentoring young girls and women in STEM studies and careers.

Dr. Bruk T. Berhane, Florida International University

Dr. Bruk T. Berhane received his bachelor's degree in electrical engineering from the University of Maryland in 2003. He holds an M.S. in engineering management from the George Washington University and a Ph.D. in minority and urban education from the University of Maryland. In 2003, Bruk was hired by the Johns Hopkins University Applied Physics Laboratory (JHUAPL), where he worked on nanotechnology and microsystems. In 2005 he left JHUAPL for a fellowship with the National Academies and researched methods of increasing the number of women in engineering. Later that year, he briefly served as a mathematics instructor in Baltimore City High Schools.

From 2005 through 2018, Dr. Berhane directed engineering recruitment and scholarship programs for the University of Maryland. He oversaw an increase in the admission of students of color and women during his tenure and supported initiatives that reduce the time to degree for transfers from Maryland community colleges. The broader implications of his research are informed by his comprehensive experiences as a college administrator. His areas of scholarly interest include: 1) Broadening participation in engineering through community college pathways and 2) Experiences of first and second-generation African diasporic Americans in engineering undergraduate programs.

Research on Organizational Partnerships in Education and STEM (ROPES) Hub

The objective of the Research on Organizational Partnerships in Education and STEM (ROPES) Hub is to advance understanding of organizational partnerships that support academic pathways for domestic low-income engineering students. Partnerships across the education system are essential for improving STEM; achieving the systematic, structural, or sustainable change desired by programs such as NSF's Scholarships for STEM Students (S-STEM) program is seldom achieved by individual isolated units and often requires partnerships across silos within an academic institution (i.e., intra-institution partnerships) and across institutions (i.e., inter-institution partnerships). However, how such partnerships are built, designed, and sustained remains a great challenge facing the field. This Hub, led by a collaborative team from Virginia Tech, Weber State University, Northern Virginia Community College, and the University of Cincinnati, is working to organize groups to conduct research focused on supporting low-income undergraduate engineering, computer science, and computing students in ways that are congruent with the institutional context and resources while going beyond the direct impact on S-STEM Scholars to impact departments and institutions involved. It is often difficult to design such research within a single S-STEM program; thus, the Hub structure that asks these questions across S-STEM programs is important. We are zooming in on the institutional infrastructure and collaborative work between researchers, administrators and practitioners, and policymakers.

The overarching research question guiding the hub is: How can intra- and inter-institutional partnerships be designed, built, and sustained to systematically support low-income engineering student success? Answering this question requires a research hub because understanding different models of organizational partnerships—and linking such research to student outcomes across a variety of institutional contexts—requires a focus across S-STEM programs that is only enabled by a research hub approach; it cannot happen in a single S-STEM program. An important contribution of this work will be to characterize aspects of problems in which collaboration and partnerships can be most helpful—supporting low-income engineering students who want to earn a bachelor's degree fits these conditions. It requires a complex system of interacting, interdependent stakeholders with differing expertise and with no systematic organization of stakeholders to support such students. There are few formal structures for stakeholders to regularly communicate with one another, and the net result is a system in which students ultimately suffer from poor partner coordination. The Hub's rationale is grounded in a conceptualization of a process-focused theory of collaboration that highlights how interorganizational relationships are dynamic, emergent, and mutable and embraces the ways in which coalitions of stakeholders form and change, as well as the ways in which collective action can, at least temporarily, bring together diverse interests [1], [2].

Our poster will report on findings to date in three distinct areas: 1) characteristics of engineering and computer science programs receiving S-STEM funding, 2) introduction of the Hub's first cohort of accelerator grant teams, and 3) preliminary findings of the centralized Hub research.

Characteristics of Engineering and Computer Science Programs with S-STEM Funding

To understand the landscape of S-STEM funding within engineering and computer science programs, we compiled a list of all current S-STEM projects that focus on engineering or computer science, identifying the primary institution for each project. We then completed an analysis of multiple large-scale archival data sets by linking together program characteristics with the Integrated Postsecondary Educational Data System (IPEDS) for all active not-for-profit U.S. institutions. When compared to the relative proportion of institutions in each category, S-STEM awards were awarded more frequently to public four-year institutions; four-year schools received more than 60% of S-STEM awards in engineering or computer science, although they comprise approximately 20% of U.S. institutions. Similarly, land grant schools and doctoral-level research institutions received proportionally larger funding amounts and number of awards than did smaller institutions.

Although the IPEDS data for each institution contains information on the percentage of undergraduate students who are eligible for a Pell Grant (and are therefore classified as "low income"), such information was not available for engineering students specifically. Therefore, we contacted institutions directly and compiled data on the percentage of engineering students who are Pell eligible. When comparing these percentages with the institution-wide rates of low-income students, we see significant underrepresentation of low-income students in engineering programs.

In addition to analyzing institution level data across institutions with S-STEM awards, we wanted to better understand institutions leading S-STEM projects and where they fit within their organizational context. Searching through S-STEM project websites, institutional websites, and LinkedIn, we identified the job title and department of all S-STEM award PIs and Co-PIs and have completed descriptive analyses looking across S-STEM projects that our poster will display.

Introduction of the Hub's First Cohort of Accelerator Grant Teams

An important objective of the Hub is to build and support cohorts of S-STEM teams through an accelerator grant program. We launched a request for proposals for the first cohort of research accelerator grant recipients ($15,000 each). Our goal was to recruit 10 teams for this first cohort, and we met that goal. Ten proposals, representing 11 different institutions, were received, vetted following NSF practices (e.g., teams responded to clarifying questions to ensure alignment with the Hub goals), and selected. We met our overarching objectives of having a set of grant recipients that reflect the S-STEM program diversity. Recipients include small private institutions, large research institutions, minority-serving institutions, community colleges, and regionally focused institutions that represent a wide geographic footprint. Campus-specific projects being advanced by this budding community of practice focus on how to recruit low-income students from different institutional contexts, topics with a community college element, student support programming and processes, and within-institution partnerships that require coordination across a range of campus offices. Our poster will highlight some of the early activities of those projects and highlight some of the cross-Hub findings to date. Table 1 displays the teams comprising this cohort as well as the major topic areas of their projects.

Table 1. First cohort of accelerator grant recipients.

Focus of Local Project	**Institution**
Recruitment partnerships across different institutional types	Barry University
	Pennsylvania State University-University Park
Building partnerships that have a community college component	Moreno Valley College
	Tennessee State University
	University of Washington Tacoma
Building partnerships that have a student programming element	Pennsylvania State University-Berks
	Texas A&M University-San Antonio
	University of Missouri-Columbia
Building partnerships across different offices within a university environment	University of South Florida/Fordham University
	West Virginia University Institute of Technology

Preliminary Research of Hub's Centralized Activities

In addition to supporting the activities of each of the grant teams and working toward developing those individual campus projects into scholarly products that can be broadly accessible by the community, the Hub leadership team is also spearheading centralized research activities. The poster will highlight preliminary findings from the following efforts:

- **Case study research.** We are conducting case studies of S-STEM programs from the first cohort of 10 accelerator grant recipients. Interview protocols include the following topics: approach to change, engaging in partnerships, leveraging resources, perspectives on serving domestic low-income students.
- **Cross-site data collection.** In consultation with NSF program officers and PIs during the S-STEM annual PI meeting in 2022, developing a new framework and data ecosystem that is research-informed that could be applied across the S-STEM portfolio is one of the new objectives of the Hub. Initial discussion identifies needs for both program level data (e.g., types of partnerships, types of programming, staffing & resourcing) as well as student level data (e.g., activities with the program, academic and career outcomes, latent variable measures such as economic hardship or financial need) that allows for individual and contextual nuance while also being able to be aggregated to understand cross-cutting influences and best-practices.
- **Systematic literature review.** We are completing a systematic literature review of research produced by S-STEM programs and similar narrative literature reviews on

organizational partnerships and low-income students. Preliminary findings from those efforts will also be included on the poster.

Conclusion

In conclusion, the ROPES Hub will advance understanding of organizational partnerships that support academic pathways for domestic low-income engineering students. The Hub is generating new knowledge regarding the kinds of partnership processes and collaborations that colleges and universities may want to institutionalize to best support low-income engineering students. This Hub will also reframe many challenges associated with successful bachelor's degree attainment in engineering for low-income students to be "organizational" challenges as opposed to "student-related" challenges. Such a reframing can be especially powerful for making the complex web of student supports work better for students. Additionally, this Hub is working on reframing the notion that bachelor's in engineering programs start once students matriculate in a four-year institution—rather, the Hub is encouraging a transfer receptive mindset [3] that builds inter-institutional partnerships that consider students' paths far prior to when students transfer to best support student success. With much investment and federal policy focused on the community college pathway to broaden STEM participation, this Hub will inform those efforts seeking more cost-effective ways for students to earn a bachelor's degree.

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