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Guest editorial

Ramon B. Goings Donald Mitchell Jr Adriel A. Hilton

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Embracing a multicultural perspective in science, technology, engineering, and mathematics (STEM) higher education: from talk to action

Research on science, technology, engineering and mathematics (STEM) education has garnered particular interest from colleges and universities, policymakers and industry professionals. Given the USA' changing demographics, a growing body of literature has emerged that highlights the ways institutions of higher education can nurture a more diverse STEM workforce. Building a more diverse workforce is a targeted concern as the STEM workforce and STEM faculty positions are held mainly by white men [National Science Foundation (NSF), 2013].

As a result of the lack of diversity in STEM, diversifying STEM fields and STEM education have been the subjects of several conferences, reports, books and scholarly publications. For instance, the Association of American Medical Colleges (AAMC) (2015) report – *Altering the Course: Black Males in Medicine* – provided explanations for the lack of black males in the medical school pipeline, while also showcasing how black males succeed in medical school. Moreover, in 2015, *USA News and World Report* sponsored the “STEM Solutions National Conference” to tackle how to best ensure women and minorities are represented in STEM employment. Additionally, the book by Palmer *et al.* (2013), *Fostering Success of Ethnic and Racial Minorities in STEM: The Role of Minority Serving Institutions*, explored the ways in which minority-serving institutions (MSIs) contribute to diversifying the STEM workforce. Still, multiculturalism within the STEM context warrants attention because the STEM pipeline remains leaky.

As conversations continue on how to best ensure that diverse students are adequately prepared to succeed in the STEM disciplines in college, this special issue seeks to not only add to the discourse but also broaden the scope of discussion. In particular, when scholars, policymakers and other concerned stakeholders advocate for a diverse STEM pipeline, there are some essential questions that must be asked. For instance, what are the experiences of underrepresented students in their pursuit of STEM degrees? How are colleges and universities implementing programs and policies that target diversifying the STEM pipeline at the community college, undergraduate and graduate levels? What lessons can be learned from MSIs on how to nurture and support a diverse STEM student population? In this special issue, the authors address some of these pressing questions and propose new questions that must be explored when examining the intersection of multiculturalism and STEM education.

Overview of the special issue

In this special issue, scholars have sought to broaden our understanding of how higher education might think differently about diversifying the STEM education pipeline, including looking to the work being done at MSIs (e.g. historically black colleges and universities [HBCUs], Hispanic-serving institutions). In “A Metasynthesis of Academic and Social Characteristic Studies: First-Generation and Other College Students in STEM Disciplines at HBCUs”, Hicks and Wood conducted an integrative review of scholarship over a 42-year time period to explore findings about how

first-generation college students enrolled in STEM disciplines at HBCUs adjust academically and socially to their college campus. The scholars found that first-generation students at HBCUs face challenges because they are the first in their families to pursue their degree; however, they point to the ability of HBCU faculty and staff to provide mentorship to help the first-generation college students adapt academically and socially to being a college student.

Gipson, in “Predicting Academic Success for Student of Color with STEM Majors”, uses quantitative methods to explore the pre-college characteristics that could predict college success for students of color majoring in STEM disciplines. He found that high school core grade point average (GPA), advanced placement courses taken and standardized test scores served as a predictor of college student success in STEM.

Pichon in “Descubrimiento Mi Lugar: Understanding Sense of Belonging and Community of Black STEM-H Students Enrolled at a Hispanic Serving Institution”, using a quantitative design, explored how black students majoring in STEM and health (STEM-H) and those not majoring in STEM-H developed a sense of belonging and community at a Hispanic-serving institution (HSI). Although she found no overall differences in the sense of belonging between the two groups, the author did find that black STEM-H students were more likely than their black non-STEM-H peers to believe that their faculty were sympathetic to their needs when they were upset. In addition, the black STEM-H students were more likely to describe that they felt they could be part of the community for a long time compared to their black non-STEM-H peers.

Leon and Charleston’s contribution, “Constructing Self-Efficacy in STEM Graduate Education”, explores the lived experiences of 23 African–American graduate students and faculty members in computer science. They found that self-efficacy for students needed to be reaffirmed at each stage in their academic careers (i.e. undergraduate, masters and doctoral) and that participants’ peers, family mentors and counselors had a strong influence on their decision to persist in their degree programs.

In “The Motivation of PhD Attainment in Black Engineering Doctoral Students: Passion Plus Purpose”, McGee and colleagues investigate, using qualitative methods, what intrinsic and extrinsic motivations drive black students ($n = 40$) to pursue PhDs in engineering. Several intrinsic motivators, including having a strong interest in engineering, a desire to make an impact in the field and the ability to use their engineering PhD to serve others, drove the participants in this study. Additionally, the participants were driven to obtain their PhD by extrinsic motivation factors, such as being provided extensive funding to complete their PhD, inspiration from mentors and family.

In “Enlisting Voices: Methods for Studying STEM Education at Historically Black Colleges and Universities”, Gasman and Nguyen discuss an ongoing research project that explored successful practices for student success in STEM at HBCUs. For instance, the authors argue that it is critical for HBCUs to collaborate together when looking to highlight the impactful work HBCUs have done in STEM. Working with 10 HBCUs selected through a competitive process for inclusion in this research project, Gasman and Nguyen provide insight into how the larger project will make an impact in research policy, and they practice on how HBCUs can develop models of success for their students in STEM.

In “Managing Transitions, Building Bridges: An Evaluation of a Summer Bridge Program for African American Scientists and Engineers”, using student journals, focus

group interviews and evaluation reports, Johnson explores how a summer bridge program supported the transition of 14 African–American college students majoring in STEM. The authors conclude that students’ prior academic success and previous exposure to STEM-related activities aided the students’ transition into college. Moreover, the program provided a venue for students to develop a positive science identity even when students experienced challenges adapting to college life.

Newman, in “Minority Engineering Programs at a Crossroads: A Multiple Case Study of Two Predominately White Public Research Universities”, examines two historically white public research universities and finds that “multicultural” and “minority” engineering programs offer financial and communal incentives for participants.

Lastly, in “More Than A Intervention: Strategies for Increasing Diversity and Inclusion in STEM”, using a multiple-case study approach, Jones explores the strategies used by leaders of graduate school preparation programs affiliated with the NSF’s Alliances for Graduate Education and the Professoriate program (AGEP) to prepare, recruit and retain graduate students of color in STEM disciplines. Jones found that several beneficial strategies were used including navigating the political terrain, networking inside and outside of the institution, coalition building and developing allies and engaging in purposeful strategic planning. This study, as well as others in this special issue, not only explores multicultural perspectives in STEM but also provides timely recommendations for scholars and practitioners to take action and support the development of a diverse STEM pipeline.

Taking action

As higher education continues to grapple with how to ensure a diverse STEM workforce, the article provides impactful insights into ways to close the STEM gap. Moreover, authors in this issue investigate developing a multicultural STEM workforce from all vantage points of the educational experience, including exploring the STEM education literature, investigating pre-collegiate factors for STEM success, transitioning from college for STEM majors, exploring the undergraduate and graduate STEM experience from the student and programmatic lens and checking how universities can collaborate and leverage each other’s resources to share successful stories of students of color in STEM. It is our hope that STEM educators, administrators and policy makers use these studies to not only engage in dialogue about the ways to support a diverse STEM pipeline but also use these findings and implications as a foundation to foster change. As the authors in this issue have urged, we must not just talk – we must act.

Ramon B. Goings

*Department of Education Specialties, Loyola University Maryland, Baltimore,
Maryland, USA*

Donald Mitchell, Jr

*College of Education, Grand Valley State University, Grand Rapids,
Michigan, USA, and*

Adriel A. Hilton

Grambling State University, Grambling, Louisiana, USA

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About the Guest Editors

Ramon B. Goings is an Assistant Professor of Educational Leadership at Loyola University Maryland. Previously, he served as a Program Coordinator for the Sherman STEM Teacher Scholars Program at the University of Maryland, Baltimore County. His research interests are centered on disrupting deficit narratives about African-American males throughout the educational pipeline. Specifically, his scholarship explores the experiences of high-achieving black males PK-PhD and the development and experiences of black male teachers and leaders. His scholarship has been featured in academic and popular press outlets, including the *Journal of African American Males in Education*, *Adult Learning*, *Inside Higher Ed*, *Education Week*, and *Diverse: Issues in Higher Education*. Goings is a recipient of the 2016 College Board Professional Fellowship and an Asa G. Hilliard III and Barbara A. Sizemore Research Institute on African Americans and Education Fellow held at the 2015 American Educational Research Association annual conference. He currently serves as the Managing Editor of the *Journal of African American Males in Education*. Prior to working in higher education, Goings was a music education and special education teacher and intern with the White House Initiative on Educational Excellence for African Americans. He earned his Doctor of Education degree in urban educational leadership from Morgan State University, Master of Science in human services from Post University and Bachelor of Arts in music education from Lynchburg College.

Donald Mitchell, Jr is an Assistant Professor of higher education at Grand Valley State University. His research and scholarship focus on issues of diversity, equity and inclusion in higher education contexts, primarily using qualitative methodologies. More specifically, his work theoretically and empirically explores the effects of race, gender and identity intersections within higher education contexts. He is recipient of the American College Personnel Association's 2015 Emerging Scholar Award and the Multicultural/Multiethnic Education Special Interest Group of the American Educational Research Association's 2014 Dr Carlos J. Vallejo Memorial Award for Emerging Scholarship, among other awards. Mitchell earned a Bachelor of Science in chemistry from Shaw University, the first historically Black institution in the South, a Master of Science in educational leadership from Minnesota State University, Mankato and a PhD in educational policy and administration with a concentration in higher education from the University of Minnesota – Twin Cities. Donald Mitchell, Jr is the corresponding author and can be contacted at: mitchedo@gvsu.edu

Adriel A. Hilton is Chief of Staff and Executive Assistant to the President at Grambling State University. He previously served as an Assistant Professor and Director of the Higher Education Student Affairs program at Western Carolina University. A noted author and presenter, Hilton's research is published in refereed journals such as *Teachers College Record*, *Journal of College Student Development*, *Community College Review*, *Community College Journal of Research and Practice*, *Journal of Applied Research in the Community College* and the *Journal of the*

Professoriate. Hilton's distinguished career includes many honors and awards – notably, the 2016 Harry Canon Outstanding Professional Award by the ACPA Coalition on Men & Masculinities; the 2016 Newly Published Research Award by NASPA's Men and Masculinities Knowledge Community; the 2015 Outstanding Professional Contribution & Distinguished Scholar Award by the North Carolina College Personnel Association and the 2010 Dr Carlos J. Vallejo Memorial Award for Exemplary Scholarship by the American Educational Research Association Multicultural/Multiethnic Special Interest Group. Hilton holds a bachelor's degree in business administration (finance) from Morehouse College; a master's of applied social science (public administration emphasis) from Florida A&M University; and a PhD in higher education (administration) from Morgan State University.