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HBCUs as a Strategic Resource to Advance Diversity in STEM Multiplex Monthly Theme, July 2020 Synthesis

Historically, opportunities for STEM learning and STEM professions have disproportionately been denied to Black students and STEM professionals, as well as others of color. This under-representation results as well in the impoverishment of scientific inquiry and STEM education, because these voices and perspectives have been missing from these fields — and we have all been the poorer because of the frequent invisibility of research and development contributions of Black men and women — through inadequate dissemination of research results, too little access to professional positions, and other inhibitors to full participation for Black scholars and educators in STEM at all levels.

The HBCUs (Historically Black Colleges and Universities) have a strong track record in STEM research and student mentorship and education in STEM fields, and with their current active programs across the country they represent an important, unique resource for advancing diversity in STEM fields. The July Theme of the Month focused on the strategic importance of HBCUs to equity in STEM fields and STEM education.

Prof. Ivory Toldson framed three strategic activities by which the HBCUs contribute to STEM research and career development: Innovation, Focus, and Agency (IFA). The video playlist, the resources, and the expert panel provided rich examples of each.

1. Innovation. Dr. Toldson framed his first strategy in this way: "Innovation will come from employing cutting-edge strategies, such as convergence, data science, artificial intelligence, blockchain and technological augmentation" to create opportunities to advance a more equitable society. For example, Dr. Kinnis Gosha of Morehouse College and director of the nationally recognized Culturally Relevant Computing Lab has been studying the effectiveness of conversational agents — chat bots — as virtual mentors. The large knowledge-base of the chatbots is drawn from the expertise of many experienced mentors, and in this way the conversational agents can engage students in flexible, targeted, and authentic exchanges with the wisdom of all these mentors. The technological innovation is one part of a broad effort to build students' capacity and sense of their own agency, and STEM identity.

2. Focus. Dr. Toldson's second strategy, Focus, derives " from being problem-focused and agenda-driven. The social issues of today demand more than what traditionally white institutions (TWIs) have the capacity to deliver...HBCUs need to elevate and expand the meaning of good research." For example, Dr Ann Podleski of Harris-Stowe State University, described the founding of an on-campus center for agricultural research, which involved students in the design and building of the facilities and the program from inception. The commitment to collaboration continues with students' participation in research, and faculty fostering students' publications or student authorship in research articles, and in mentoring of high school students and teachers from area schools. Thus, the center along with its many collaborators/allies in the St. Louis region, contributes both to the STEM research enterprise and in educating future Black STEM leaders.

For another example, Dr. Sarah Krejci of Bethune-Cookman University described a research program drawing on learning sciences research to research social-scientific argumentation skills in students from communities under-represented in STEM. The current pandemic shows that social-scientific argumentation can engage students in social justice conversations, as they learn to evaluate and make critical use of the massive flow of information (often contradictory) of science and pseudo-science that is emerging. As society grapples with the disease, its social effects are a central part of the challenge, as the inequalities in community responses to COVID-19, and its severe impact on communities of color, have become evident. Thus, social-scientific argumentation can help sort through the information, and understand social factors at work in impacts on different populations. In an urgent, dynamic situation, social-scientific argumentation skills can give students a framework within which to receive information, process it, and make a more informed decision, as they reason through the scientific data and information they encounter.

3. Agency. Dr. Toldson suggested that Agency comes "from controlling our means of dissemination. HBCUs can no longer allow White-owned and operated publications and media outlets to be gatekeepers of research from a Black perspective. We need to use the social media and the digital revolution to broaden access and visibility of HBCU research." For example, in response to the question "How did you cultivate such a distinctive style of research, that harnesses the creative and compassionate genius that's endemic to Black creed and culture?" Dr. Celeste M Brown of Tennessee State University's Center of Excellence for Learning Sciences, spoke to innovative research on learning environments for children and adults, which takes as foundational the importance of culture in how people learn. The work takes a community-focused approach to broaden participation, seeing students, teachers, and STEM researchers as part of a whole. A key element is the building of STEM identity and self-efficacy in students, helping create good images of STEM in kids of color. Imagination and growth in skills are authentically situated in learning challenges that focus on areas where action is needed, and help people get the skills they need: in engineering, in computer science, in biomedical learning and NASA programs in earth and space science. Teachers and scientists grow in their ability to help students with the barriers and systemic inequities they are facing. and to take childhood trauma in to account, thus increasing the community's economic and research knowledge base. Everybody in a learning community — adults and kids, K-20 students and teachers — benefit from mentoring and coaching in this holistic understanding of STEM learning.

Finally, one of the key ways that HBCUs are strategic resources for broadening participation is their role as active scholarly communities, and this was enacted in the discussion during and after the expert panel webinar. Experts and participants took the occasion to actively network with each other, sharing resources and contacts, and putting the principles into practice. To contribute to the continuing vitality and broader dissemination of the STEM and learning sciences research being conducted at the HBCUs, participants agreed that attention must be paid to mentoring undergraduates and graduates in these fields through collaboration on research and internship programs. In addition, participants noted that the Web and social media offer many new tools for dissemination of ideas, results, and opportunities, in parallel with the more traditional peer-reviewed journals. Imaginative use of these channels can build awareness within the STEM communities — and the community at large — about the many resources for STEM research and workforce development that the HBCUs offer, and continue to expand.

Recommendations for researchers

- The HBCUs are innovating and experimenting with distinctive approaches to STEM learning — for example in mentoring strategies, in new technologies, in the design of learning environments, and in community-based (and intergenerational) STEM learning. These are core areas of learning sciences research, and offer the possibility of creative research collaboration across institutions.
- A constructive and effective way to build relationships with students and researchers at HBCUs is to partner with the schools. Such partnerships should be informed by best practices for developing and maintaining the collaborations. Most important, the partners should think about - and discuss — how the various strengths of the collaborating institutions contribute to the project's work and goals, and how they complement each other. This also means articulating the benefits that each hope to derive from the collaboration, as well as the responsibilities each partner carries for the whole project. Remember, too, that it takes time to build such respectful collaborations. In the joint development of a grant proposal, for example, the partnership formation should begin early in the process. Indeed, a strong partnership is a valuable outcome in itself.
- The research and educational innovations of the HBCUs encounter, in particular forms, some limitations of the traditional scholarly processes of peer-review and dissemination that are being noted in many fields. How can researchers use new tools and media, to more effectively and quickly disseminate research findings within the disciplinary communities, and beyond? What innovations in peer-review or other quality-control methods need to be developed?

Recommendations for policy-makers and administrators

- Policy and programs in traditionally white institutions need to recognize the importance of building equity in the fields of STEM research and education. One key strategy for this work is to actively seek to become informed about the resources that HBCUs offer and are continuing to develop. This includes sustained effort to learn about the research and innovation coming out of the HBCUs, as well as the exploration of productive collaborations with scholars in the HBCUs.



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