CONVENE, CONNECT, COLLECT, AND CONVEYING: HBCUS AND TRIBAL COLLEGES BROADENING PARTICIPATION IN STEM

Major findings from the NSF INCLUDES Summit: A National Summit to Study and Stimulate Broadening Participation Research at Historically Black and Tribal Colleges/Universities. Washington, DC

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EXECUTIVE SUMMARY

Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs) are underrepresented in important areas of research and research-related national programs, particularly those related to science, technology, engineering, and mathematics (STEM). The Quality Education for Minorities Network (QEM) reports that the National Science Foundation (NSF) Broadening Participation Research Award does not have many representatives from HBCUs and TCUs with the 2016 portfolio, including only five projects by HBCUs and no TCU participation.

The "National Summit to Observe and Stimulate Broadening Participation Research at Historically Black and Tribal Colleges and Universities," focused on broadening participation (BP) in STEM for HBCU and TCU students. The primary goal of the Summit was to communicate the existing knowledge and promote future research on BP in STEM for HBCUs and TCUs. Objectives of the Summit used the Quad-C framework, which incorporated Convening and Connecting educational researchers from HBCUs and TCUs, Collecting data from them that is helpful in determining strategies on BP, and Conveying the results to the HBCU and TCU communities.

PARTICIPATION INSIGHTS

The Summit involved multiple activities, and they included different sessions. Discussion sessions involved attendees being assigned to groups or "tables" and taking part in discussions that covered questions. The first session involved discussion of effective metrics in evaluating HBCU and TCU success. NSF and other funding organizations might disadvantage HBCUs and TCUs by applying the same criteria to them and predominantly white colleges and universities. The use of the same metrics for different institutions appears to ignore the systematic inequalities, bias, and racism that HBCU and TCU researchers have to experience.

The first session involved discussion of effective metrics in evaluating HBCU and TCU success. It was pointed out that HBCUs and TCUs are diverse on their own. As a result, they proposed more tailored metrics that would consider the specifics of institutions as the most appropriate approach to measurement. NSF and other funding organizations might disadvantage HBCUs and TCUs by applying the same criteria to them and

predominantly white colleges and universities. The use of the same metrics for different institutions appears to ignore the systematic inequalities, bias, and racism that HBCU and TCU researchers have to experience.

The second session involved the discussion of resources, student body size, and the capacity of HBCUs and TCUs to perform STEM BP education and research. The key resources identified were connected to collaboration and funding (i.e. faculty, students, funding and learning materials). The student body size of TCUs puts them at a puts them at a disadvantage when funding agencies are concerned. Partnering with other, larger institutions would increase the numbers of students and their research capacity. Building capacity for BP research requires innovative approaches. The idea that STEM in TCUs should also have an entrepreneurial angle was also voiced; this approach was supposed to incorporate the translation of research to practice and forging important collaborations and partnerships.

The third session aimed to respond to key questions that were focused on collaboration. Ideas were shared on how cross-institutional collaborations, inter-institutional mindsets, and program collaborations around STEM BP research should be approached. It was suggested that federal agencies can promote collaboration between HBCUs, TCUs, and any other minority-serving institutions, specifically intending to increase BP understanding in them. Data mining could be used to determine the common interests among individual institutions which could be used for developing collaborations between HBCUs and TCUs. Participants suggested that HBCU-TCU collaboration should not be considered an option; rather, it should be viewed as a requirement for funding.

The fourth session was dedicated to cultural competence and ethics, and it was expected to involve responding to three topics. These topics included: 1) cultural competence and ethics in HBCU/TCU STEM research; 2) consideration of the ethics of educational research; and 3) creation of local networks to develop culturally appropriate BP research. Partnerships with first-generation students, and various organizations that were concerned with cultural minorities, were viewed as a solution. Collaborations with international, national, and other professionals and organizations were suggested. The dissemination of culturally relevant BP research was also considered as an opportunity.

The fifth session was concerned with the dissemination of the results of educational research. Consideration was given to the recipients of research information and how it could be distributed so that the results could also be used. Disseminating information to the parents of students and communicating to them that STEM fields should be important for the future of their children was described as an effective strategy. Also, considering

the mechanisms that would be required to show that the BP activities of individual institutions can apply to other institutions and other environments. The proposed solutions included piloting and replicating research, examining the factors that might affect the application of findings, involving more researchers and reviewers to test the findings, and developing the criteria of effectiveness that could apply to HBCUs or TCUs. Lastly, creative and social media approaches to dissemination were discussed. The use of Twitter, podcasts, Instagram, and other technological tools and platforms were suggested solutions.

KEY INSIGHTS AND CONCLUSIONS
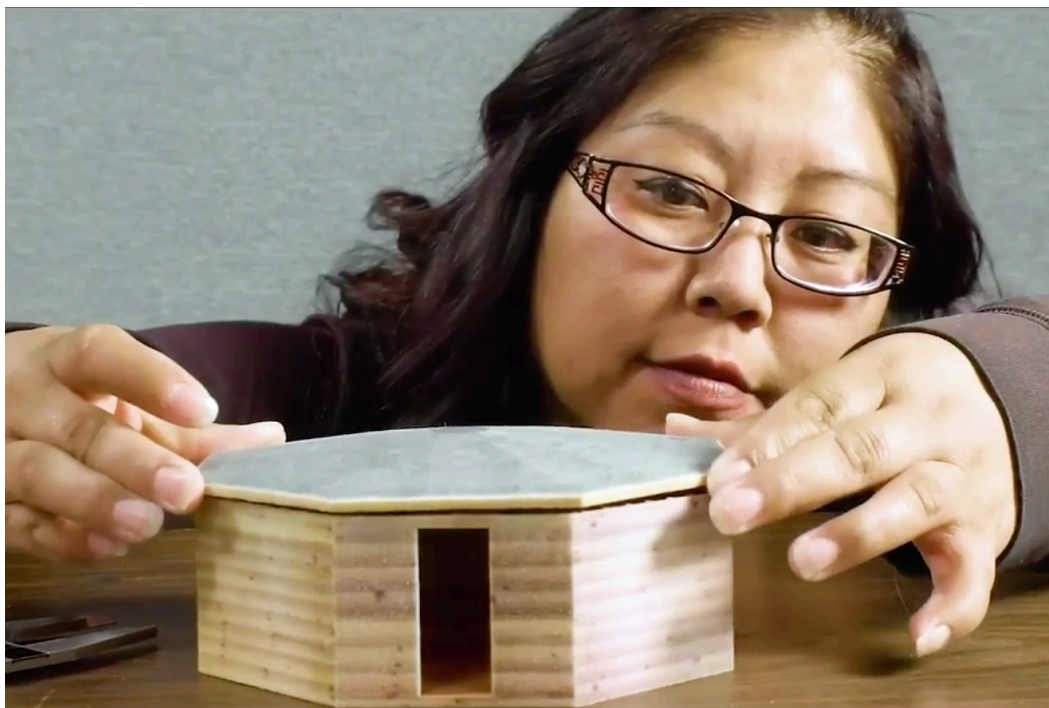
Courtesy: National Science Foundation

The five sessions of the Summit covered several important topics that are summarized in Table 1. Rather than narrating the ideas that were proposed during

individual sessions, here, the ideas are presented based on their links to specific crucial aspects of BP research as related to HBCUs and TCUs.

Table 1. Critical topics of discussion and proposed ideas to crucial aspects of BP research as related to HBCUs and TCUs.

TOPICAL AREAS DISCUSSED	ISSUES AND APPROACHES
Current Knowledge Base on BP in STEM at HBCUs and TCUs	• **Current Focus Areas of BP Research** • **Critical Gaps in STEM Education Research** • **The Roles of HBCUs and TCUs in Conducting and Building Capacity for STEM Education Research**
Building STEM Education Research Collaborations at HBCUs/TCUs	• **Identifying Potential Collaborators** • **Establishing the Collaboration**
Building Cultural Competence and Ethical Practices in STEM Education Research	• **Historical, Geographic, Political, and Ethical Factors** • **Transitioning to Practice, Replicating Success and Disseminating Results** • **Telling Our Story to Diverse Audiences** • **Collaborations for STEM Education Research Publications**

LESSONS LEARNED

The Summit had 55 participants from 28 HBCUs and TCUs. They varied in institutional position ranking and had anywhere from 0 to 25 or more years of experience in higher education. Overall the responses suggest that the absolute majority of the attendees expanded their knowledge with the help of the Summit.

SUMMARY OF KEY FINDINGS

This report investigated the results of the Summit's survey and the session notes that were made by some of its participants. The most valuable aspects of the Summit were its activities, cooperation and networking opportunities, and learning options. Even with time shortages, the Summit's five sessions considered BP research, TCU/HBCU role in it, cultural competence, ethics, potential for collaboration, findings dissemination, and challenges associated with all these topics. The sessions show that there are some gaps in the way HBCU and TCU STEM research is funded as compared to HWIs. HBCUs and TCUs have specific cultural features and face particular concerns, which is why they might require the metrics that focus on added value rather than simple performance. It appears that HBCUs and TCUs can become more effective, successful, and visible through collaboration and increased focus on research, especially in STEM fields.

The scarcity of resources at HBCUs and TCUs amplify the need for education on research, grants, and BP that would simultaneously promote awareness and stimulate interest in these topics. Education is also a tool for increasing cultural competence and ensuring ethical research. Finally, researchers might need some training on dissemination methods, especially on modern and innovative ones that use recently developed communication technologies and opportunities; an example is social media. In addition, the sessions also make several meaningful recommendations on the topic that will be discussed below.

Recommended Strategies for Advancing STEM Education Research at HBCUs/TCUs

> **HBCU and TCU Researchers and Administrators:**
> - Summit revealed notable gaps in BP and STEM research
> - Staff of HBCUs and TCUs are the primary resources to address gaps
> - Incorporate STEM research into the programs and agendas of institutions
> - Promote awareness of STEM and research opportunities
> - Contribute fair partnerships between HBCUs and TCUs, and HWIs

- Develop exchange programs for enhancing collaboration
- Financially contribute building the research capacity of HBCUs and TCUs

Program Officers and Federal Agencies:
- Research and review exclusionary existing policies and adjust them with a culturally awareness approach that facilitate HBCU and TCU collaboration
- Incentivize multi-institutional collaborative STEM research

STEM Advocates and Policymakers:
- Promote STEM, BP, and inequality awareness, and introducing incentives for institutional cooperation
- Advocates work with researchers to equip them to work with policymakers
- Policymakers also need to consider reviewing the existing value-added success metrics for HBCUs and TCUs
- Increase group collaboration with TCUs and HBCUs to improve visibility and build capacity of HBCU and TCU STEM education research

CONCLUSION/NEXT STEPS

The Summit was introduced to share some important information about BP and STEM educational research in HBCUs and TCUs, and it has achieved this outcome. The feedback received from attendees strongly supports that the Summit was a success. The participants discussed critical gaps in STEM educational research, especially those related to the lack of HBCU and TCU representation in it. They also proposed solutions to this problem with a focus on increasing the awareness of research opportunities, developing new partnerships with minority-serving institutions and HWIs, promoting culturally sensitive and ethical research, and increasing the focus on various approaches to information dissemination. Overall, the findings show that there are significant problems which prevent HBCUs and TCUs from becoming equally represented in research, but with a combined effort of HBCU and TCU staff, federal agencies, policymakers, and advocates, we can change this situation. The Summit only contributes some data on the existing issues and solutions. Thus, future summits and other methods of diagnosing issues and reporting solutions would become the next steps in promoting equal research participation of different minority institutions.

INTRODUCTION

Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs) are underrepresented in important areas of research, particularly those related to science, technology, engineering, and mathematics (STEM). They are not well represented in various research-related national programs, however inclusive networks such as the INCLUDES National Network, have better representation from these communities than Historically White Institutions (HWIs). The Quality Education for Minorities Network (QEM) reports that the National Science Foundation (NSF) Broadening Participation Research Award does not have many representatives from HBCUs and TCUs with the 2016 portfolio, including only five projects by HBCUs and no TCU participation.

The "National Summit to Observe and Stimulate Broadening Participation Research at Historically Black and Tribal Colleges and Universities," focused on broadening participation (BP) in STEM for HBCU and TCU students. The primary goal of the Summit was to communicate the existing knowledge and promote future research on BP in STEM for HBCUs and TCUs. Objectives of the Summit used the Quad-C framework, which incorporated **Convening** and **Connecting** educational researchers from HBCUs and TCUs, **Collecting** data from them that is helpful in determining strategies on BP, and **Conveying** the results to the HBCU and TCU communities.

The first three Cs from the Quad-C framework were covered by working with nationally recognized specialists in HBCU and TCU research. Specialists participated in focus groups and surveys, and they provided their expert advice and shared critical experiences and insights on the Summit's topics with QEM collecting and analyzing the resulting data. In addition, QEM investigated existing studies on the topic preceding the Summit. This investigation involved 23 articles published in journals, and reports and policy papers that discussed best practices for improving minority representation in STEM research. QEM found gaps in the studied research, and some crucial issues that became the focus of the Summit.

The final 'C' of the framework included launching the Summit and conveying the findings to the representatives of HBCUs and TCUs who visited it. The goal was to deliver this

information to the broader community and promote HBCU/TCU STEM research and cooperation with NSF. The Summit took two days in March 2019. Expected outcomes included developing STEM talents in HBCUs and TCUs and enhancing leadership in such institutions. The Summit also incorporated a self-assessment system that included a feedback survey.

"*Responses suggest that the absolute majority of the attendees expanded their knowledge with the help of the Summit.*"

The present report uses information from the Summit's proposal, its feedback surveys, and the notes of the session participants to provide details about the insights and lessons that one can extract from the event. Structure of the report is as follows: First, we summarize survey's findings, including the information about the attendees, their feedback concerning their experiences during the Summit, and their reported plans that the Summit influenced. Then, the session notes are reported and summarized to find important lessons that the participants learned from the Summit. Finally, conclusions are drawn, and we offer recommendations for different stakeholders who can promote STEM research in HBCUs and TCUs.

PARTICIPANT INSIGHTS

Participants of the Summit

The Summit involved multiple activities, and they included different sessions. Discussion sessions involved attendees being assigned to groups or "tables" and taking part in discussions that covered questions. During the latter, the participants made notes, which summarized the content of the information found during their discussions by their table. Having notes from several attendees, the present report will offer a review of the participants' insights. The names

of the individuals will not be stated to preserve their anonymity, but we will summarize the results for each session, and it will also provide the conclusions regarding the key areas of knowledge disseminated by the Summit.

SESSION 1 – BROADENING PARTICIPATION RESEARCH

The first session involved discussion of effective metrics in evaluating HBCU and TCU success. The first question that was covered by the first session was concerned with metrics for success and effectiveness of HBCUs and TCUs, especially when compared to HWIs. Responses included several suggestions. First, it was recognized that HBCUs, TCUs, and any other minority-serving institutions could need specific metrics, especially given the fact that minority students are typically very diverse and might encounter difficulties and challenges. Thus, it was proposed that we should acknowledge HBCU and TCU successes in specific ways with a broader understanding of what success means.

First, they offered a focus on research rather than graduation and retention; for example, a participant suggested that the highest-producing PhDs could be a good metric. Other performance-connected recommendations included the tracking of the number of institutions' publications, talks, presentations, and research conducted. Also, checking undergraduate research programs was offered as a metric. The latter suggestion appears to focus on assessing an institution's ability to promote research rather than research conducted. An assessment of the faculty's understanding of grant procedures was also suggested as another option.

One table discussed the idea that HBCUs and TCUs might need the recognition of the support that is provided to students. Thus, empowering students and graduates was considered a potential metric with direct feedback as a measurement approach. The growth of students since enrollment and until graduation was suggested. Finally, the continued monitoring of post-graduation successes of students was discussed as a possibility. Some factors that could be assessed included jobs, income, and other phenomena that could show social mobility.

It was eventually pointed out that HBCUs and TCUs are diverse on their own. As a result, they proposed more tailored metrics that would consider the specifics of institutions as the most appropriate approach. In the same vein, when considering the advantages and disadvantages of using the same metrics for different institutions, the participants appeared to see disadvantages. The only direct advantage that was proposed was simplicity; also, it was acknowledged that certain aspects of education have to be standardized, for instance, for the standards of education. However, it was pointed out

that different institutions have different concerns, resources, and possibilities with minority-serving institutions typically are disadvantaged. It was suggested that NSF and other funding organizations might disadvantage HBCUs and TCUs by applying the same criteria to them and predominantly white colleges and universities.

> *"NSF and other funding organizations might disadvantage HBCUs and TCUs by applying the same criteria to them and predominantly white colleges and universities."*

The use of the same metrics for different institutions appears to ignore the systematic inequalities, bias, and racism that HBCU and TCU researchers have to experience. It was not considered to be a fair approach when smaller institutions were concerned, and it was pointed out that the data on TCUs that would enable the creation of metrics meant for them were not very extensive. Basically, the existing metrics which used the data from HWIs were not suitable for HBCUs or TCUs. Finally, they noted that the metrics could be flawed in other ways, for example, in being focused on tests and graduation. Thus, it was agreed by all groups that individualized metrics for different institutions are important.

The participants also described how HBCUs and TCUs could be more successful than predominantly white institutions. They were supposed to focus on the factors that could make HBCUs and TCUs more successful. The attendees pointed out that HBCU/TCU students are best suited to respond to this question, which justified researching the topic with a greater sample. Still, the participants proposed some suggestions.

First, student support and empowerment were considered, which were especially impactful for minority students from the perspective of the participants. Second, that HBCUs and TCUs are usually smaller was used to suggest that the better student-to-faculty ratio could enable more personalized approaches to education. One participant stated that we could consider the mission of HBCUs "value added"; that means that HBCUs and other minority-serving institutions do their best to meet students wherever they are and ensure their progress. Third, that HBCUs and TCUs are usually supportive of their students' culture was brought up. As a result, the participants argued, HBCUs and TCUs could feel safer and less hostile than other environments where micro- and macroaggressions and cultural insensitivity could be a problem. Finally, HBCUs and TCUs

might focus on teaching and learning rather than research, which could make HBCUs and TCUs more popular with students but did not support engaging them in STEM research.

> *"The use of the same metrics for different institutions appears to ignore the systematic inequalities, bias, and racism that HBCU and TCU researchers have to experience."*

The attendees, however, noted that judging by the scores, HBCUs could be less successful than HWIs. They proposed that we required certain improvements to change that, including adequate funding, success-oriented faculty with a positive mindset, student support, and research culture. In addition, they pointed it out that outside factors such as cultural incompetence of federal agencies and the lack of research on HBCU/TCU students and settings were also significant. Thus, when discussing the success factors for HBCUs and TCUs, the participants considered both their strengths and challenges.

We asked the attendees to consider how they could incorporate BP research agenda into their institutions' strategic plan. The participants stated such an agenda would support STEM importance, improving students' preparedness for STEM research. The suggestion showed visible benefits. The attendees determined that to incorporate this agenda into strategic plans, it is necessary to prepare and educate future participants, including students and faculty, ensure goal alignment, come up with outcomes and metrics to determine success, develop evidence-based strategies, and formalize related terminology to articulate the plans. The participants of one table also insisted that BP needed to have a direct impact

Summit panelist

on the community, and community-related goals and outcomes required investigation. QEM support was mentioned as a factor that would enable BP research agenda

integration through the dissemination of information, and they viewed networking as a

> **"HBCUs and TCUs could be more successful than predominantly white institutions."**

major tool for BP research, and the promotion of student research.

In addition, the attendees posed questions for a better understanding of the BP activities that were implemented at their institutions. The opportunities for an improved understanding of how modern-day teaching innovations could be used in a STEM learning environment were also reviewed. The suggestions included workshops that would promote an understanding of innovations and encourage experimental educational approaches. Such workshops could also take the form of conferences, especially with NSF support and grants. It was also suggested that virtual workshops or labs could have greater accessibility. The participants appeared to be in favor of hands-on and workplace-simulating approaches, and the innovations that facilitated students' work and reduced their workload. One table also highlighted the lack of the recognition of such innovations in their institutions, pointing out the importance of their introduction.

The value of reviewing both effective and ineffective HBCUs and TCUs was shortly debated as well with the conclusion that experiences, and stories of success and failure could provide valuable lessons. HBCUs, TCUs and predominantly white institutions could learn from each other. However, one table explicitly articulated the frustration with HBCUs being unfairly compared to and expected to look up to HWIs, and the reluctance of the latter to approach HBCUs and TCUs. It was also pointed out that trust issues that resulted from centuries of inequality are a barrier in that they prevented people of color or women from sharing their stories with other groups, which prevented understanding. They considered the challenge of building trust through ensuring the creation of safe spaces for such discussion.

They also considered the question of TCU partnerships during this session. It was established that non-equitable relationships are unlikely to appeal to TCUs, and they were also described as insufficiently effective, strong, or helpful. However, it was stressed that TCUs needed to focus on forging partnerships with federal and local agencies while being loyal to their own goals and those of their students. The collaboration of TCUs with HWIs was also repeatedly noted as an effective approach to data dissemination. In addition, they noted that TCUs encounter multiple problems, including the lack of peer-

reviewed publications, and incentives to publish them or take part in conferences for TCU faculty. The participants suggested that HBCU and TCU faculty are commonly very innovative, but they might not have the time to because of large teaching loads and lack of other approaches to promoting research and innovation. Topics like effective approaches to data dissemination, TCU success, STEM in TCU, and STEM over-emphasizing were mostly touched upon in the second session.

SESSION 2- ROLE OF HBCUS AND TCUS IN STEM AND BP EDUCATION AND RESEARCH

The second session also involved discussing questions around HBCU and TCU roles in STEM and BP education and research. The first question required discussing the resources available at the participants' network for developing BP research and relevant skills and collaborations. Some ideas proposed by the participants included funds and particular structures, for example, research committees, which are required for the funds' successful allocation. Faculty, students, and other human resources, and their mindsets, willingness to particulate, and important skills and knowledge, were recognized as a resource. Advocates were considered as another human resource element. Potential for partnerships with local businesses, and strategic benefits, including, for example, mission and vision were listed as resources too. Thus, the key resources were connected to collaboration and funding, which were some primary topics of the Summit.

Literature and other learning materials that would promote the skills were also considered as significant resources. It was pointed out that the size of an institution could offer a benefit, in particular, when it was large and, therefore, more likely to host and attract resources. Institutional exchanges were viewed as a potential resource that could also foster both collaborations and relevant skills. Using recently developed technological platforms was discussed as a major opportunity, but also as a resource that required funds and maintenance. In summary, multiple potential resources were listed by the participants, and some of them could not be categorized.

When discussing resources, the participants also pointed out some challenges, including the little time available to educators and students, limited financial support, problems with the availability of advanced equipment and technology, and sustainability of innovative projects. Preparing students for research was also considered given that the procedure requires both collaboration and funding. Finally, the increasing of the research capacity of the facilities was viewed as a challenge because of the need for training and mentoring systems that would enable future research. When considering the resources

that were available specifically in their institutions, the participants could not help but notice their shortages and the factors that can lead to their shortage.

The second question focused on TCUs; it required discussing how TCUs, which are so small in numbers and likely to face significant difficulties, demonstrate success. The participants discussed how TCUs could build fair and successful collaborations. The participants stated that TCUs are not very large and have few students, which puts them at a disadvantage when funding agencies are concerned. As a result, TCUs should build partnerships with other, larger institutions to increase the numbers of students and research capacity. A comment on the mindset was made; they proposed that TCUs required an emphasis on research in order for students to become invested in it.

It was also pointed out that TCUs did not appear to produce a lot of PhDs, which was viewed as a hindrance to their visibility. Other approaches to making TCUs more visible included ensuring the monitoring and recording of successes, preparing students to make a change and have a social impact, and various approaches to empowering students. They also viewed the idea of telling the TCU story as a primary method of resolving the issue. Thus, in response to this question, the participants once again focused on existing problems and the means of resolving them.

The next question asked the participants to consider how they could assist their institutions in building capacity for BP research. It was also concerned with the skills necessary. The key skills for an educator that were mentioned throughout the session included pedagogical ones, and those related to leadership, research, and findings dissemination. Mentoring was discussed as a very important ability that could be augmented through the use of technology. The topic of technology and its use was brought up. Also, the participants pointed out some challenges they encountered as educators, including the shortages of time and resources. Given the fact that few administrators were involved, their role was discussed to a lesser extent, but the comments about leadership apply to them. The participants recognized the contribution of both groups to the building of research capacity.

The attendees were further asked how STEM could fit or be integrated into TCUs' academic program and mission. It was proposed that instead of measuring TCUs using absolute numbers, a focus on trends and change, and the "added value," could help. It was suggested that TCUs needed to consider how the education provided by TCUs benefited their students. In addition, developing a culture of collaboration, particularly with funding agencies and other institutions, including predominantly white ones, was listed as a major requirement for progress.

However, innovative solutions were viewed as complex, but a necessary way to achieve the desired outcome of STEM integration into TCUs programs. Thus, it was highlighted that student experiences and future challenges needed to be taken into account and introduced as a crucial element of their preparation for their future employment. The resulting "cocktail" of experiences include studying, researching, and internship, all of which would promote STEM integration. The idea that STEM in TCUs should also have an entrepreneurial angle was also voiced; this approach was supposed to incorporate the translation of research to practice and forging important collaborations and partnerships.

Certain additional questions were also considered. Thus, the most effective approaches to dissemination, which were named, included partnerships and other forms of interactions between HBCUs, TCUs, and other institutions. Conferences and meetings, interviews, blogs, relevant websites (for instance, Native Science Report website that focuses on TCU research), and teaching and learning opportunities were also viewed as dissemination opportunities. Finally, the session also asked if it was possible to theoretically over-emphasize STEM. The participants pointed out that different colleges and universities encountered different issues, which is why for particular types of HBCUs and TCUs, especially small ones, STEM could be overemphasized. Thus, the second session covered a wide variety of questions.

SESSION 3- FOSTERING COLLABORATIONS

Courtesy: National Science Foundation

The third session aimed to respond to three key questions that were concerned with collaboration. The first one focused on how federal agencies can promote collaboration between HBCUs, TCUs, and any other minority-serving institutions, specifically intending to increase BP understanding in them. Several strategies were identified during the session, and a multi-dimensional, complex solution was required. First, the participants recommended reviewing the existing collaborations between HBCUs and TCUs and ensure their monitoring, for example, through a list of such

connections. It was established that agencies need to recognize HBCUs and TCUs as important receivers of funds with the opportunities for large and mini grants. Also, it was pointed out that the awareness of existing inequalities was crucial for future improvements. This awareness might require evolving mindsets in case they do not reflect these problems both within the agencies and HBCUs or TCUs. An approach to changing mindsets comprised advocacy.

In addition, it was pointed out that the existing funding models were not targeting collaboration. As a result, plans for using particular collaboration models were proposed by one table. The existent model that was suggested was the National Nuclear Security Administration consortium model, which could apply to up to four minority-serving institutions and should strengthen collaboration between them. However, it was also implied that data mining techniques could determine opportunities for collaboration. According to the table's members, federal agencies would have access to the data, which made them capable of conducting this research. The results would prepare the models and databases that would facilitate matches and connections between the institutions that appeared to have similar interests. The emphasis was on ensuring productive, sustainable, and equitable collaborations that are positive and conducive to building capacity for BP research.

It was determined that the most obvious solution was HBCU- and TCU-targeting programs and incentives, although these are umbrella terms that incorporate multiple individual activities. One example that was discussed was awards provided by federal agencies to celebrate achievements in collaboration. Also, the participants noted that some NSF programs focused on collaboration and that an increase in their numbers could be the solution. It was further pointed out that HBCU and TCU research needed platforms and creating them can promote collaboration with available to agencies.

They considered the instruments that disseminate information, including workshops, dear-colleague letters, and calls for proposals, and meetings and summits like the one described in this report. Disseminating technical information was deemed as a crucial factor which could ensure that no grants are rejected because applicants turned out to be insufficiently aware of the relevant procedures. The need for the clarity of the provided information was also mentioned. Finally, the procedures needed to be reviewed to ensure that no significant and undue restrictions were in place that might restrict HBCU or TCU participation.   The participants highlighted the positive aspects of HBCU-TCU collaboration, pointing out that it is beneficial for both of them while also promoting change in other institutions, including those that do not serve minorities.

The discussion also considered the issues and challenges in the process of collaboration fostering. The session participants suggested that HBCU-TCU collaboration should not be considered an option; rather, it should be viewed as a requirement and treated as such by federal agencies. An example of how agencies could ensure this approach would involve requiring such collaborations for an institution to be eligible for funding. Also, adequate funding for collaborative opportunities and programs was proposed. The participants acknowledged significant barriers, in particular, geographical distances, but they suggested that the modern-day methods of communication mitigated the issue. The differences between institutions were recognized as a challenge that made individualized solutions more likely to be successful. However, the participants also realized that most minority-serving institutions had some very similar concerns, which made more standardized approaches workable to some extent. In addition, the attendees suggested paying attention to small institutions which could be considered particularly underfunded and lacking resources.

The second question of the session was concerned with the different approaches to cross-institutional collaborations; participants were encouraged to share their personal experiences and the best, most innovative practices of their institutions. The participants pointed out that little collaboration and few innovative approaches to ensuring they could observe it in their institutions. The examples included the STEM initiative between Jackson State University and Indiana University and the Minority Serving grants of the University of Pennsylvania. Also, some collaboration between local institutions was mentioned. The attendees noted that HBCUs rarely reached out to other institutions while HWIs entertained the possibility. Regardless, the participants recognized the need for both minority- and majority-serving institutions in benefiting from collaboration. Also, the session suggested that STEM could be considered a common interest for everyone involved. This finding was to be expected since the Summit focused on STEM research, but it is also promising because it implies that HBCUs and TCUs can be united through diverse STEM fields.

The suggestions for cooperation included collaborative programs and exchanges, especially graduate and post-doctorate student exchanges and full or partial faculty exchanges. Similarly, regular events, especially regional ones, were viewed as an opportunity for collaboration. Finally, educational experience programs with a focus on cultural and educational exchange achieved through temporary studying in TCUs was proposed. The participants highlighted the problems with funding associated with exchange solutions and suggested that grants aimed at such programs could be helpful.

In addition, summer research programs were mentioned, and the option of "affiliate faculty," which enables a faculty to co-advice students from other institutions. It was pointed out that the value of such programs comprises the opportunity to prepare and develop students and enhance the understanding of the systemic issues that cause minority students to be at a disadvantage. The participants also highlighted the importance of reviewing all the existing programs to make sure that existing gaps and deficits are known and addressed in a due manner. By updating the existing collaborations and programs, HBCUs and TCUs could address the concern of future collaborations.

One table proposed using data mining to determine the common interests among individual institutions which could be used for developing collaborations between HBCUs and TCUs. This solution focused on the role of federal agencies which could gain access to the relevant data. However, the investigation of proposals and abstracts published by HBCUs and TCUs could be conducted by other interested institutions, which was pointed out by two other tables. Their members proposed reaching out to the authors of relevant publications with collaboration proposals while focusing on younger contributors who might not reach out on their own.

The third question was dedicated to the participants' and their institutions' interests in STEM and BP education and research. The members of the tables were encouraged to consider how such interests could develop collaborations. Not all groups considered this issue because of the lack of time, but some conclusions can still be made. Thus, an important point that was made was that the interest in BP research needed to be fostered in HBCUs and TCUs, and individual researchers and administrators could assist by promoting it within their own institutions or, possibly, smaller units, for instance, departments.

In addition, the session involved pointing out that BP research is favored, especially by promotion committees. The participants suggested that this aspect could be viewed as a potential advantage. From this perspective, such committees could promote BP through various incentives, which was in line with the idea that bodies, including federal agencies, can and should promote BP research in HBCUs and TCUs.

An issue was mentioned as well: some participants stated that the level of instruction at HBCUs might be not very high-quality, which could become a constricting factor. In addition, HBCUs do not have many doctoral programs. It was, however, established that the problem was manageable through improved education and developing the staff of HBCUs and other minorities-serving institutions, especially on STEM research and related

topics. One note pointed out that the session was insightful, and some people commented that they learned more about TCUs during this session and the Summit than throughout the rest of their career. Therefore, the session was a successful in covering key questions and educating its participants.

SESSION 4- CULTURAL COMPETENCE AND ETHICS

The fourth session was dedicated to cultural competence and ethics, and it was expected to involve responding to three questions. Depending on the table that a participant attended, his or her fourth and fifth session may have been different. Specifically, the questions covered in them could be interchangeable or otherwise overlap. However, certain plans still existed, and they determined the questions that were covered by the two sessions.

Courtesy: National Science Foundation

First, the participants were invited to consider the topics related to cultural competence and ethics in HBCU/TCU STEM research. The responses were rather many, and it turned out that a lot of topics needed to be discussed. It was pointed out that culture appears to

affect how an institution functions. They reported predominantly white and predominantly minority institutions differ, for instance, in the latter's focus on the collective. Thus, one of the first ideas proposed by the Summit attendees described the urgency of informing and engaging students and faculty in discussions about BP research and its role.

They mentioned faculty competence and cultural sensitivity as a crucial component. It was pointed out that cultural competence could only be achieved through introducing the perspectives from underrepresented groups, including students who could provide some data on the cultural issues that their communities encounter. As a result, it was proposed that TCUs could relatively easily make propositions for what is required to ensure culturally competent research, but planning was deemed an important element of incorporating diverse historical perspectives and value systems.

It was further pointed out that cultural competence might require definition or redefinition in institutions in case it cannot demonstrate a broad spectrum of sociocultural phenomena. It was recognized that ethnicity and race were the primary components of cultural competence, but other sociocultural factors like the socioeconomic status also required consideration. The participants mentioned the ethical implementation of research as a very significant consideration. Additional ethical topics were well, including the level of accommodation that could be afforded by HBCU and TCU researchers, their right to keep to themselves if needed, and the upholding of particular cultural standards and values. Finally, the mechanisms for data-sharing and partnerships were discussed as challenging topics that required a review for their solution.

The second question invited the consideration of the ethics of educational research; basically, the participants determined what ethical educational research was. The response that was proposed comprised a combination of ethical practices that ensured the deliberation of the moral issues associated with each study, and the measures and steps taken to protect human subjects before, during, and after the relevant procedures. The key considerations included those related to privacy or confidentiality risks and health hazards. In connection to that, Institutional Review Boards were mentioned, and their reports that would be required for monitoring their activity.

The issues of equity in research and the underrepresentation of non-white research samples were pointed out. The participants suggested that HBCUs and TCUs might need their own theoretical models that would be critical of the norms which developed in predominantly or all-white communities. Rather, HBCU and TCU variances and the

recognition of the need for individual approaches with diverse populations were considered a basis of the knowledge that HBCU and TCU ethical, equity-based research required for their development. In connection to that, cultural competence and sensitivity were well.

The third question was concerned with the opportunities that the participants could see in their local networks as related to developing culturally appropriate BP research. First, it was established that it is necessary to understand the cultures and groups interested this effort. Second, it was determined that cultural competence and sensitivity were required for successfully developing of culturally appropriate research. It was pointed out that minority-serving institutions were not homogenous, and the recognition of their diversity was critical for ethical and culturally appropriate research.

The suggestion for contacting and enlisting the help of the individuals who research the topics of cultural, social, and educational aspects was proposed. Partnerships with first-generation students, and various organizations that were concerned with cultural minorities, were viewed as an option. Collaborations with international, national, and other professionals and organizations were suggested by different tables. The dissemination of culturally relevant BP research was also considered as an opportunity. The possibility of modifying culturally insensitive materials was framed very positively with the potential for change being highlighted and tied together with educating the faculty on cultural issues and appropriateness. Thus, while the participants required considering several issues while debating this question, the discussion kept its focus on the opportunities for improvement. The fourth session appeared a successful one due to its coverage of all the planned questions.

SESSION 5- DISSEMINATION OF EDUCATIONAL RESEARCH

As previously mentioned, the fourth and fifth sessions could overlap, but the fifth session was concerned with five questions dedicated to the dissemination of the results of educational research. As the first question of the session, the participants considered the recipients of research information and how it could be distributed so that the results could also be used. The consensus was that findings are important for those who can take part in future research, support it, or benefit from it. The participants noted that potential contributors and partners could be informed for the purpose of enlisting their help with future research. In a similar way, funders could be enticed through publications and presentations, and such an approach to dissemination would enable future research and build BP and STEM research capacity in HBCUs and TCUs.

It was pointed out that since students are technically future investigators, their interest in STEM could be enhanced when provided with research data through events and demonstrations dedicated to the relevant topics. An idea was also expressed that parents have a significant effect on the choices of their children. As a result, disseminating information to the parents of students and communicating it to them that STEM fields should be important for the future of their children was described as an effective strategy. All the stakeholders from politicians and advocates to students and their parents were described as the people who had the right to learn about research results. However, individual tables demonstrated a preference for particular groups. Thus, one table focused on the people who could directly benefit from research results understanding that the general population is more likely to be a part of that group. However, another table proposed considering policymakers and legislators as the people who needed to be informed the most because such an approach would invite them to promote and fund research and find the ways of further disseminating findings.

It was also pointed out that dissemination of data was not the only aspect of findings dissemination; rather, researchers needed to present both the results and how they could be used, especially in different contexts. The adaptability of research to individual circumstances is an important aspect of the research-to-practice transition. One table also highlighted the importance of disseminating information in ways that would be digestible; thus, it is reasonable to use understandable language and structure the findings in ways that facilitate their comprehension. Finally, researchers are not usually specifically trained on how to disseminate findings, especially when approaching legislators and policymakers. It was consequently proposed that teaching researchers the best ways of reaching diverse populations was needed.

The second question invited the participants to consider the mechanisms that would be required to show that the BP activities of individual institutions can apply to other institutions and other environments. It was acknowledged that multiple factors, including, for example, the size of institutions that served as settings for a particular project could impact the applicability of research. For instance, something that worked for a small college might not apply to a larger one. The proposed solutions included piloting and replicating research, examining the factors that might affect the application of findings, involving more researchers and reviewers to test the findings, and developing the criteria of effectiveness that could apply to HBCUs or TCUs. They especially emphasized the collaboration solution as a method for enabling all these interventions. It was also pointed out that for research to be replicable or transferable, the original studies should provide sufficient data on their design and method, which implies that educating HBCU and TCU

researchers on the intricacies of research reporting is even more important. It was suggested that this question was connected to dissemination since for a study to be replicated or reproduced, it needs to be sufficiently accessible.

QEM Network's Twitter Page

The third question was concerned with creative data dissemination approaches. Respondents focused on recent technology-assisted methods. At least one table pointed out that digital dissemination could be more accessible than traditional methods. As a suggestion, radio talk shows or other forms of broadcasts were mentioned. It was highlighted that modern technologies allow fairly creative dissemination methods, including social media, and other websites, and the use of Twitter or Instagram for mentorship. As a result, the fourth question, which asked the participants about the possibility of using social media to reach various audiences and disseminate findings to diverse populations, was answered with comments about social media being very suitable for data dissemination. Online or offline conferences and presentations were described as rather creative and reliable methods of disseminating findings.

Other than that, the creativity of a method depended on the needs of a population that it intended to reach. For instance, one table proposed that policymakers could benefit from research-to-practice translation guidelines, which could indeed disseminate findings. However, the same table also suggested that it would be important to avoid allowing a publication to become too engaging; from the perspective of the participants, it would be inappropriate to sway an audience. Rather, dissemination should be aim and accurate, which links the topic back to ethics in research.

The last question was concerned with the resources at the participants' institutions that could assist researchers with findings dissemination. The list of the suggestions included the public relations departments, grant funds, learning management systems, exchange programs, and various methods of communication, in particular, newsletters. The discussion of the dissemination methods was rather diverse and productive, making the fifth session a success.

KEY INSIGHTS AND CONCLUSIONS

T he above-summarized five sessions of the Summit covered several important topics that will structure this section of the report. Rather than narrating the ideas that were proposed during individual sessions, here, the ideas will be presented based on their links to specific crucial aspects of BP research as related to HBCUs and TCUs. This way of presenting information will facilitate making relevant conclusions on HBCU and TCU BP research.

CURRENT KNOWLEDGE BASE ON BP IN STEM AT HBCUS AND TCUS

Current Focus Areas of BP Research. The attendees show that BP is becoming increasingly significant and emphasized by diverse institutions, especially when STEM fields are concerned. It appears to be true for predominantly white colleges and universities. However, BP focus does not seem to incorporate minority-serving institutions to a sufficient extent.

Critical Gaps in STEM Education Research. The participants agree that modern BP and STEM research are not very inclusive. The research rarely samples HBCUs or TCUs, and it is also not often conducted by HBCUs and TCUs. This exclusion results in the limited visibility and representation of minority-serving institutions, and some problems with finding the data that could improve research and other aspects of the activities of HBCUs and TCUs. Therefore, the greater engagement of HBCUs and TCUs in BP and STEM research would help to cover these gaps.

The Roles of HBCUs and TCUs in Conducting and Building Capacity for STEM Education Research. The diverse findings of the five sessions show that HBCUs and especially TCUs are not sufficiently engaged in STEM research and are underrepresented within its fields. However, while some participants point out the possibility of over-emphasizing STEM, all of them also appear to agree that the situation can be changed. The key issues that are cited include the lack of resources, visibility, funding, and attention of federal agencies. The primary solutions include changes in the mindset, appropriate management of resources, education and advocacy, and collaboration.

BUILDING STEM EDUCATION RESEARCH COLLABORATIONS AT HBCUS/TCUS

Identifying Potential Collaborators. The participants show that HBCUs and TCUs need to search for potential collaborators based on their interests in STEM and BP. The search strategies include the monitoring of publications, the creation of databases of HBCU/TCU researchers, and developing HBCU/TCU networks for data dissemination. It is established that the matching of potential collaborators could be carried out by HBCUs and TCUs or various agencies. It is also recommended to keep considering collaborations with predominantly white institutions with a suggestion for federal agencies to promote such alliances. Also, for small institutions, it is apparently a reasonable choice to collaborate with bigger ones for a greater access to resources and funding possibilities.

Establishing the Collaboration. When considering how collaborations could be established, the participants appear to focus on the incentives that could be provided by federal agencies. Such incentives could include collaboration-focused programs or the requirements for collaboration in applications for certain grants. However, communication, advocacy, and information dissemination were also described as collaboration-building mechanisms. Regarding the specifics and quality of collaborations, the participants highlight equity and productivity.

BUILDING CULTURAL COMPETENCE AND ETHICAL PRACTICES IN STEM EDUCATION RESEARCH

Historical, Geographic, Political, and Ethical Factors. All the participants show some awareness of the varied factors that still affect HBCUs, TCUs, other minority institutions, and their students. They also suggest that different institutions have cultural specifics that affect their activities. As a result, the Summit recognizes the significance of ensuring cultural competence within the institutions and outside of them, and of promoting culturally competent and ethical research. The participants conclude that cultural competence is predominantly augmented through education and mindset change and that ethical research requires a complex of continuously used measures that affect research before, during, and after it is conducted.

Transitioning to Practice, Replicating Success and Disseminating Results. That STEM research carried out by HBCUs and TCUs needs to be practice- and often community-oriented is supported by many participants. The transitioning of research to practice was discussed in connection to results dissemination. Thus, the Summit's attendees believe that findings of studies need to be reported to anybody who can have a stake in them

with a focus on the people who benefit from the findings, implement them, or can support future research. It is acknowledged that the findings of any study might not be fully replicable in other settings, but that consideration only implies the need for careful reporting of all the details of a study's method and settings. This way, researchers can avoid making incorrect assumptions and can use the data to replicate or carry out similar investigations. When disseminating findings, researchers are encouraged to make an emphasis on their practical application and use the methods of communication are most likely to be used by the target audience.

Telling Our Story to Diverse Audiences. The participants directly highlight the importance of making minority-serving institutions, especially small TCUs, more visible. As a result, the varied methods of data dissemination are viewed as important for telling HBCU and TCU stories. The cultural competence and new technologies should enable the messages to reach diverse audiences, especially the stakeholders who might assist HBCUs and TCUs in building their research capacity. As for the methods of dissemination, the participants favor those that use communication technologies (for instance, social media) and those that enable communication and potential collaborations (for instance, conferences, including technology-assisted ones).

Collaborations for STEM Education Research Publications. That TCUs and HBCUs should collaborate for disseminating research findings was only briefly covered. However, it is apparent that the participants support minority-serving institutions uniting resources to enhance their ability to report the results of their research. This way, HBCUs

Courtesy: U.S. Department of Energy

and TCUs can build their research capacity, find new collaboration opportunities, and improve their visibility.

LESSONS LEARNED
INSTITUTIONS AND PARTICIPANTS: CHARACTERISTICS

Multiple-choice questions from the survey determined the characteristics of the Summit's participants. Fifty-five respondents from various HBCUs and TCUs responded to the survey (see Figure 1).

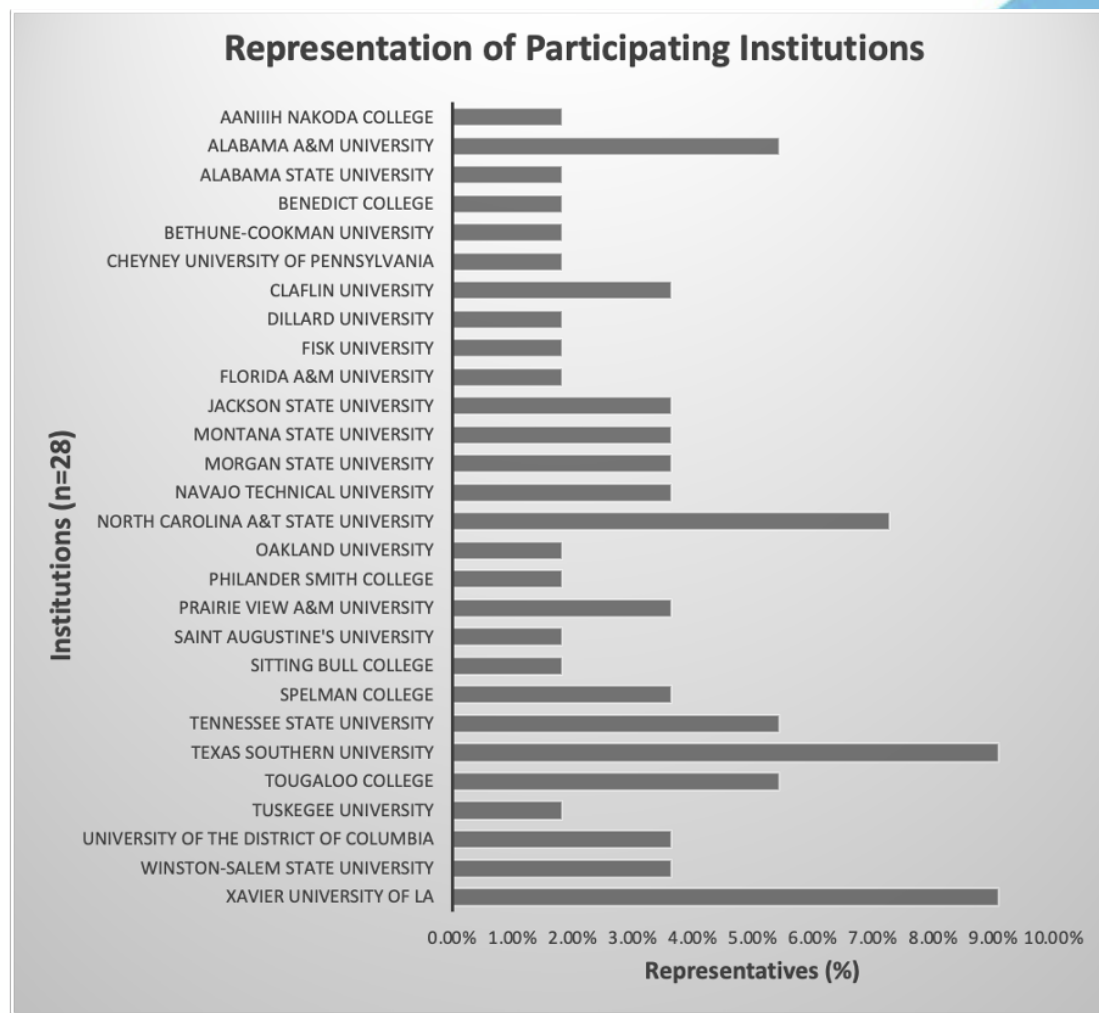**Fig. 1** Representation of the institutions participating in the Summit.

Figure 2 shows that the majority of the participants (n=40) were assistant, associate, or full professors. Compared to these numbers, few administrators attended the Summit, but they were still represented among the attendees. Additionally, there were staff, STEM educational improvement specialists, postdocs, and senior program officers in attendance.

Fig. 2 The professional positions of most participants (n=55) of the Summit.
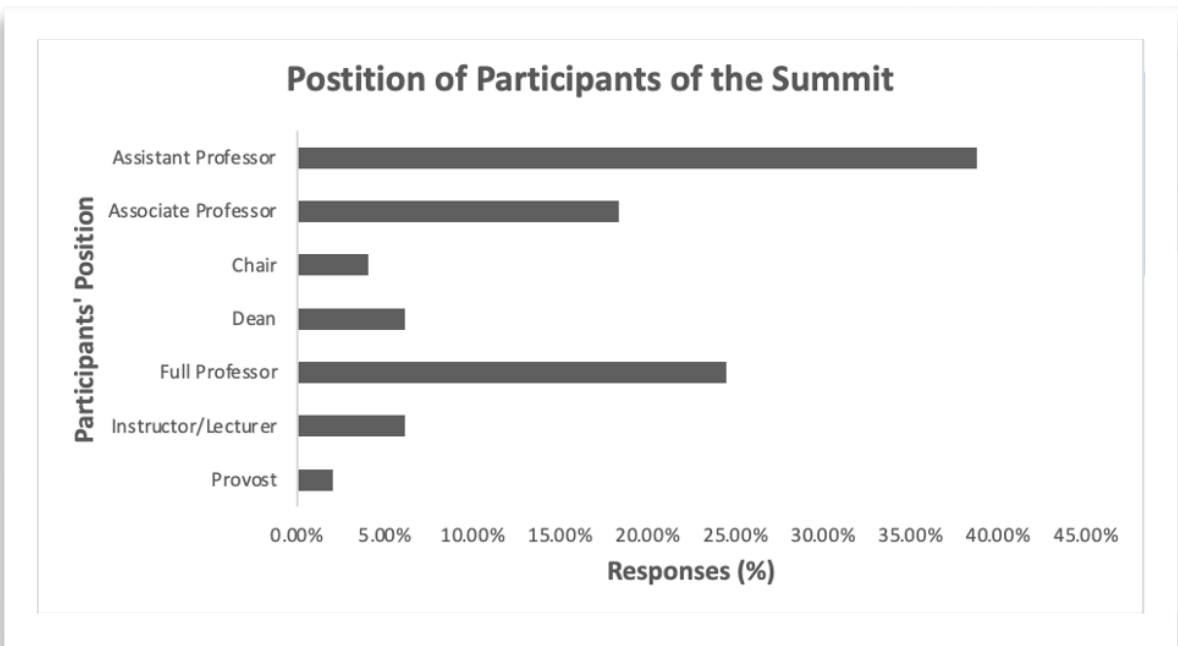
Participants had between 5 to 25+ years of experience at their academic institutions (Figure 3). Most of the participants had over five years of experience with their HBCU or TCU, which implies that they could understand the challenges and opportunities present for HBCUs and TCUs.

Fig. 3 Number of years participants (n=55) have spent working with their current institution.

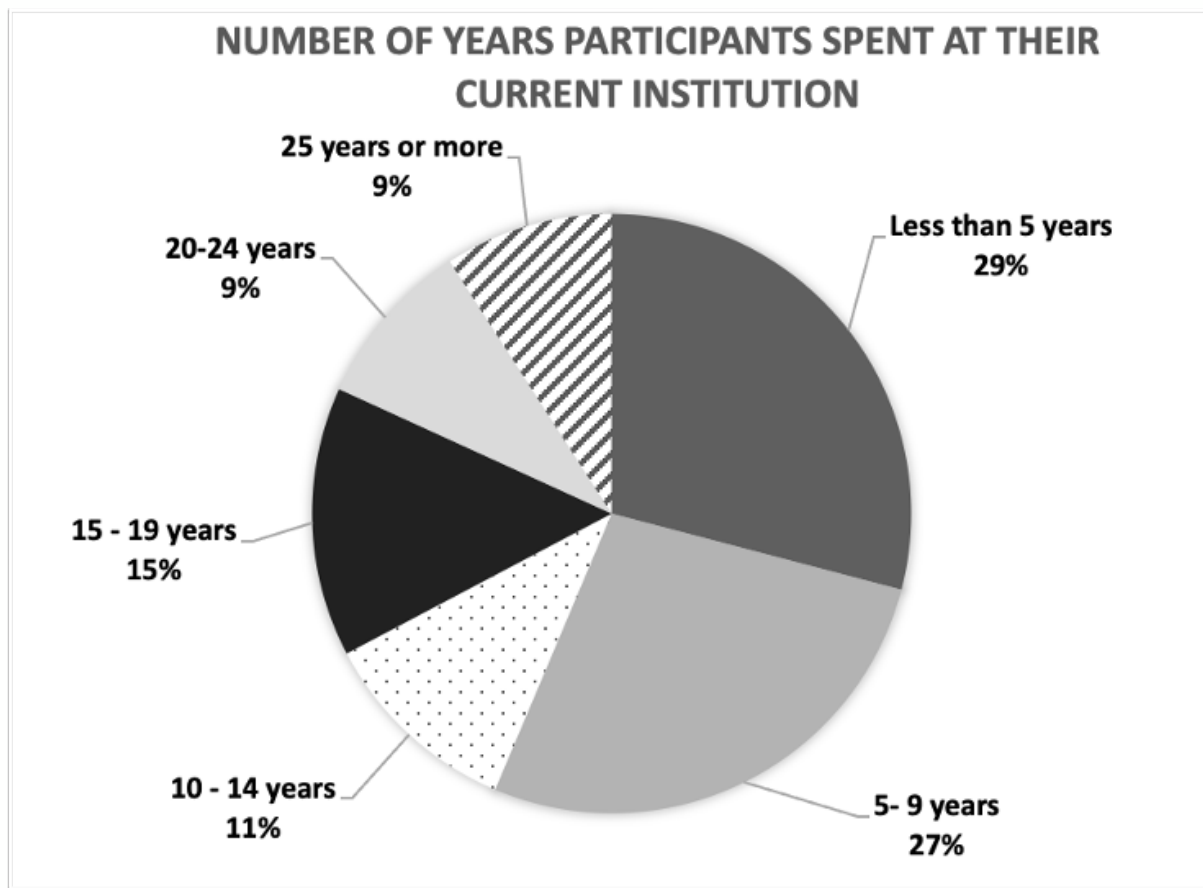NUMBER OF YEARS PARTICIPANTS SPENT AT THEIR CURRENT INSTITUTION

- 25 years or more 9%
- 20-24 years 9%
- 15 - 19 years 15%
- 10 - 14 years 11%
- Less than 5 years 29%
- 5- 9 years 27%

THE IMPRESSIONS OF THE PARTICIPANTS

Multiple questions from the survey determined the impressions that the participants had after the Summit. Mostly, the survey attempted to gather the data about the most and least successful elements of the event and find out what potential for improvement it had. Some participants did not respond to all questions, which may affect the percentages we report. However, in most cases, the Summit's attendees completed the survey.

Expanding Knowledge. The objective of the Summit was to gather the participants' opinions and present them with specific statements that they could agree or disagree

with using a Likert scale-based system. The system included five options: "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree." We will use this scale or similar ones in most of the following questions.

The Summit intended to expand the participants' knowledge regarding six particular areas. The first area focused on the current state of BP research at HBCUs and TCUs. The second area covered the data on gaps in STEM education research when HBCU and TCU students were concerned. The third area described the expansion of knowledge related to HBCU/TCU roles in STEM research, especially regarding conducting it and building the institutions' capacity for conducting it. The fourth area involved collaboration-building with a focus on STEM researchers that were affiliated with HBCUs or TCUs. The fifth area represented the knowledge regarding the translation of research findings into practice; the Summit also included the dissemination of findings into this option. The sixth and final area considered had a focus on telling HBCU/TCU stories to diverse audiences. Thus, the participants were asked to check these areas of knowledge and determine if the Summit had provided them with any additional information.

The responses suggest that the absolute majority of the attendees expanded their knowledge with the help of the Summit. Thus, 78% of the attendees strongly agreed with the idea that the Summit helped them to learn more about current BP research conducted at HBCUs and TCUs. Seventy-five percent of attendees felt the same way about the information on collaboration building between STEM researchers at HBCUs and TCUs. Seventy-two percent of people received similarly significant knowledge regarding HBCU and TCU roles in STEM education research.

> **"Responses suggest that the absolute majority of the attendees expanded their knowledge with the help of the Summit."**

Sixty-one percent of attendees strongly agreed with the idea that they learned a lot about telling their stories, 55% of people commented similarly about the gaps that existed in STEM education research regarding HBCUs and TCUs, and 54% of people felt that they learned a lot about translating research to practice. Slightly lesser approval was expressed by, 30% of people regarding STEM research gaps, 24% of people concerning

HBCU/TCU roles, 41% of people concerning findings translation to practice, and 31.48% of people regarding telling HBCU/TCU stories.

The summarized findings show the following. First, the Summit was successful in disseminating additional information among attendees. Most attendees either agreed or strongly agreed that the event expanded their knowledge. Few people disagreed or strongly disagreed with the statement regarding the information provided on current BP research; for the rest of the areas, only two people expressed disappointment with the provided data. Also, most attendees could assess their experience as either a positive or a negative one. The current BP research, HBCU/TCU roles, and collaboration elements appear to have been assessed positively especially often.

The Value of a Variety of Activities. The next question also used a Likert scale, and we applied it to different activities present throughout the Summit. We asked the respondents to assess them depending on their value. Thus, the scale comprised the following options: "extremely invaluable," "somewhat invaluable," "neither valuable nor invaluable," "somewhat valuable," and "extremely valuable." The activities included plenary, roundtable, and sampler sessions, and panel discussions held by NSF/INCLUDES grantees or funders. In addition, the questionnaire asked the participants to test the networking opportunities presented by the Summit, which was not exactly a direct activity but a part of the rest of the described opportunities.

The reception of the plenary sessions was overwhelmingly positive, with 93.3% of people viewing them as valuable. With sampler sessions, 83.63% of people considered them extremely valuable or somewhat valuable. However, 10.9% of attendees were unsure and could not decide whether they were valuable.

Both panel discussions received noticeable support, and those by NSF/INCLUDES grantees were especially favored. Seventy-four percent of participants described them as extremely useful, and 16.67% stated that they were somewhat valuable.

With funders' discussions, 63.64% of people were extremely satisfied and 18.18% were somewhat satisfied. The greatest number of people positively assessed the networking opportunities: 89.09% of attendees considered them to be extremely or somewhat valuable. However, 9.09% of people assessed them as nonvaluable.

To summarize, all activities received positive assessments by most attendees. Also, networking opportunities and discussions were more positively viewed than sessions, especially sampler sessions. Sampler sessions appeared to render most attendees

confused about how to assess them. Based on these responses, all activities appear to have been well chosen and suited the Summit and its goals.

Participants provided feedback on the roundtable sessions section. The respondents felt that the discussions were informative and provided possibilities for learning and discovering new perspectives. The participants commented on the opportunity for meeting, sharing, discussing, and cooperating as an advantage of the activity. Participants noted that the discussions followed the plenary sessions, which enabled interaction with the speakers.

The sampler sessions received 14 comments, which was the greatest number of comments dedicated to an activity. A third of the comments were positive with the participants praising the value of the sessions in that they provided important information about understanding grants, their potential weaknesses, and future possibilities. However, the rest of the participants focused on improvements. Some participants felt as if more time should have been dedicated to these sessions due to the amount of information shared. In order to provide a better since of organization a few of the participants suggested alternative methods of organization that would be built around a central theme or roundtable discussions instead.

> *"The sessions provided important information about understanding grants, their potential weaknesses, and future possibilities."*

The section for the panel discussions with grantees received the smallest number of comments. Participants provided positive feedback stating that it was informative and prompted them to apply for a grant and desire more opportunities for interacting with the grantees, especially in one-on-one discussions. Funders' discussions were commented on by seven attendees. People stated that an opportunity to talk to funders after the panel would have been beneficial. Also, including more diverse funding agencies and if any of the funders could apply to their institution was of interest to participants.

The networking opportunities received thirteen comments, which was a relatively large number. Nine of them were purely positive comments; attendees noted that the environment of the Summit was "conducive to establishing relationships." Four

respondents stated that the Summit helped them to meet new people, and two of them briefly described plans for future collaboration. One participant also pointed out that the atmosphere was informal, which was good for interaction. Four participants made suggestions for improvement. Two of them stated that most of the attendees mostly sat in specific groups that did not change over time; they proposed regularly moving the name tags to enable cooperation and interaction between more people.

"The environment of the Summit was 'conducive to establishing relationships.' "

To summarize, the open-ended part of the question provided additional insights, especially about the weaker aspects of the different activities. It might not have fully explained why certain individuals liked or disliked a particular activity since the questionnaire was anonymous, and the responses could not be matched. However, it showed that people were enthusiastic about the Summit and its opportunities, but not oblivious to its flaws. Other questions from the questionnaire provided more insights into the weaker parts of the Summit.

Overall Rating. The next question was aimed at determining the rating of different aspects of the Summit. A Likert scale used for that purpose comprised the following five options: "poor," "fair," "good," "very good," and "excellent." The aspects of the Summit that were assessed included the organization, goals, materials, and duration. Also, the participants were asked to provide the overall rating of the entire event (Figure 4). The feedback was positive, and only a few negative assessments were made.

The length of the Summit received the most negative feedback. Several attendees (16.36%) believed it to be good, 28.18% described it as very good, and the rest viewed it as excellent. Finally, the overall rating of the Summit was positive. Ninety-eight percent of attendees responded by describing it as very good or excellent. Therefore, the Summit was largely positively received. The organization and materials were described as especially well-prepared. Basically, the only aspect of the Summit that was problematic was its duration, which implies that the participants valued the information provided and are seeking more detailed instruction.

The Most Valuable Aspect of the Summit. Several open-ended questions should gather some more specific information about the participants' experiences. One of them asked

the attendees to state which aspect of the Summit proved to be the most valuable one to them. Almost every participant responded; 54 responses were collected. Some of them specified the activity that they considered to be the most useful one; such responses included sampler sessions (1 person), plenary sessions (2 people), and roundtable discussions (one person). Also, at least 5 people mentioned the opportunity to learn from grantees and funders, which can be viewed as a reference to the panels. In addition, the opportunities for discussion and collaboration were mentioned in direct or indirect ways in at least 40 responses. Since the questionnaire views networking as a separate activity, it can also be included in this section as the most valuable one for most of the participants. Several people considered the Summit's activities to be its most valuable aspect.

Fig. 4 The participants' rating of the summit organization, goals, and materials to capture the overall rating of the summit.
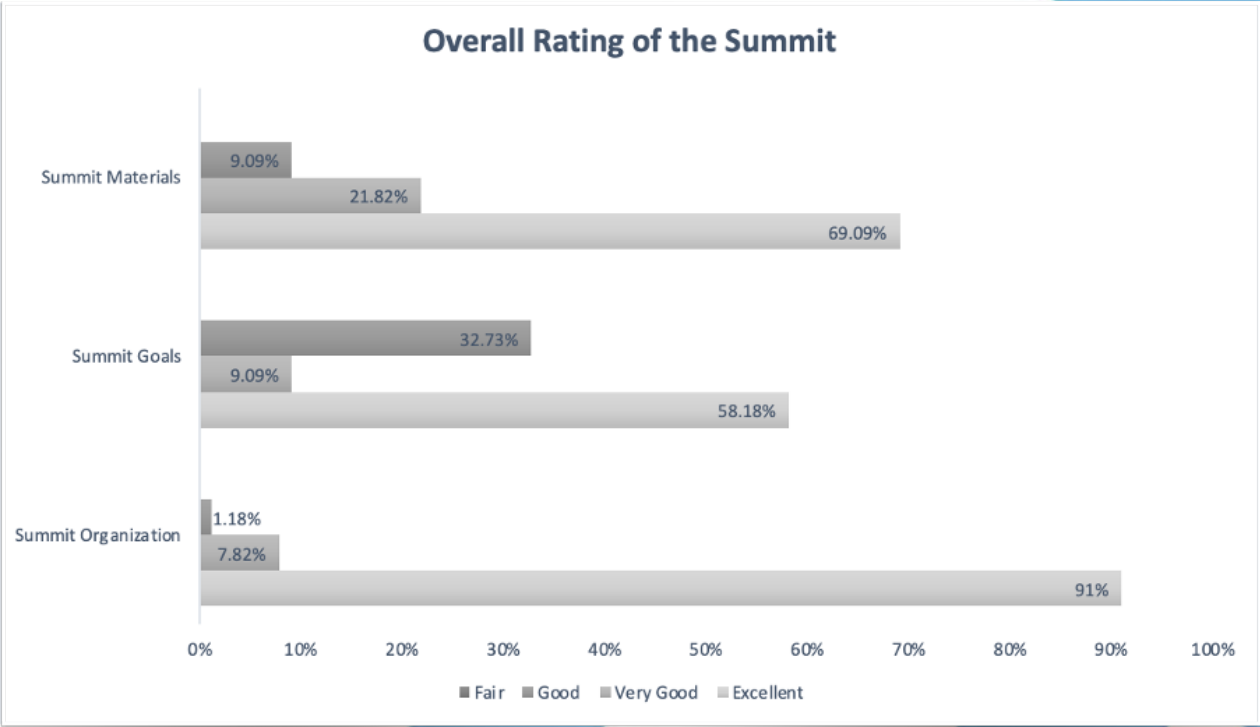
The participants considered the outcomes to be very valuable. As it was mentioned, 40 people commented on collaboration opportunities and some stated that they had seized those opportunities by forging relationships with potential contributors. Second, many participants commented on the informative nature of the Summit. At least half of the people directly stated that they learned something new, and this aspect of the Summit

became the most valuable one for them. The topics they discovered new things about included BP research, collaboration, funding opportunities, the roles of HBCUs and TCUs, and cultural factors in research. Thus, the participants viewed the Summit as valuable because of its activities, opportunities, and positive outcomes, which included collaboration and information dissemination.

The Least Valuable Aspect of the Summit. To determine potential routes for improvement, the Summit also inquired the participants about its least valuable aspect. Fifty-one percent of people either did not respond to this question or stated that they considered nothing about the Summit not valuable. Some people were apologetic about having to label an aspect as the least valuable one. Therefore, it can be suggested that some attendees might have been reluctant to provide their feedback in response to this question because it used a word with a negative connotation that implied the lack of value in something.

However, the rest of the attendees responded by specifying something that they did not like about the Summit. Here, it can be mentioned that some respondents did not focus on the least valuable element but stated a flaw or a disadvantage of the Summit. Thus, one person noted that the breakfast did not include any protein, which cannot be considered the least valuable element of the Summit. Similarly, two people stated that the Summit was overscheduled, and two more individuals suggested that more time was required, particularly for interaction. All these comments are important to consider, even though they do not respond to the stated question.

One more individual described personal narratives as insightful but not very valuable and proposed using more workshops. Sampler sessions were described by one person as not very valuable because it was "difficult to keep them straight." Also, some participants did not explain their choice and stated that specific activities (the sampler sessions, discussions on research design, and abstract presentations) were not valuable to them. Thus, many of the respondents felt the need to justify their criticisms by explaining why they considered something not valuable and making suggestions for improvement. This tendency further shows the participants' reluctance to answer a question with a negative descriptor in it. However, the responses showed that certain aspects of the Summit could be criticized and might be improved either through organizational changes or by altering the activities themselves.

Recommended Improvements. The next question required the participants to offer recommendations and propose improvements for future Summits by QEM. Fifty-two attendees responded, but fourteen of them stated that they did not want to improve

anything. Sometimes, they added motivational, positive comments describing the Summit as an "excellent event" and asking QEM to "keep up the good work." The rest of the responses contained some suggestions, however, and they will be summarized here.

Multiple comments were concerned with organizational aspects, and at least seventeen of them touched upon the time and scheduling issue. Specifically, the participants were dissatisfied with the duration of breaks, including those meant for meals, the tightly packed schedule, and the long days that lasted 10-12 hours. Suggestions for resolving the issue included restricting the schedule with more breaks and fewer activities or adding a day but keeping the same number of hours and activities. The participants pointed out that the Summit had very tiring and difficult days and recommended changing this aspect of it. Other organizational issues included changes in the menu (adding more protein), finding a better way of communicating the names of the speakers to the audience, and providing participants with some more detailed information about the schedules, and offering them more time to prepare for the Summit.

Opportunity suggestions were offered. Thus, at least fourteen people commented on the need for expanding communication and interaction opportunities. Several people commented on the need to engage HBCU and TCU representatives to a greater extent; one of them believed that we needed more administrators, and the other one considered it essential to involve younger people. They proposed collaboration and roundtable sessions.

Another commonly suggested opportunity, was to have participants engage with NSF representatives, grantees, and various regional organizations and institutions. One individual offered brainstorming activities, and another one stated that a "speed dating" networking activity could be introduced to foster communication. They also made a few suggestions about the removal of certain elements. Thus, one person proposed removing sampler sessions, and another one also suggested substituting them with poster-based ones. Finally, one person proposed adding poster sessions and a cocktail hour for the ending of the Summit or daily.

Additional Comments. The final question of the questionnaire offered the participants the opportunity to provide any other comments they might have had. The question explicitly pointed out that any additional ideas or suggestions were welcome in these responses. Forty-three people left comments, but 13 of them just stated that they had nothing else to say. Many attendees thanked QEM and once again commented on the positive qualities of the Summit. At least 8 comments were thankful, and 17 comments

included some positive feedback. The Summit was described as "excellent" and "wonderful," and QEM was commended for doing a "great job."

Some suggestions were made as well. One attendee praised QEM's approach to name tents, which made it easy to find particular participants and suggested that it was possible to include some information about their current projects for collaboration. Participants asked for more examples of funding and competition, more information about TCUs, more sessions with funding agencies, more opportunities for networking. and increased involvement of junior faculty.

Some participants also offered to explore additional topics, including quantitative and qualitative research, community improvement, and teaching process enhancement. Finally, one person shared their plans: they stated that they would like to cooperate with QEM in organizing a workshop. In summary, some attendees used this open-ended question to leave some more insightful suggestions.

POST-SUMMIT PLANS OF THE PARTICIPANTS

We designed two of the survey questions to find out if the Summit impacted participants. In particular, we geared them toward determining the plans of the attendees for future actions related to BP in STEM research. First, 96.36% of the respondents stated that the Summit resulted in them becoming interested in developing partnerships. The survey asked about more specific partnership plans; one open-ended question invited the attendees to name the institutions they wanted to recruit as a partner. Forty-eight people responded to this question, therefore 5 people who intended to develop partnerships did not wish to share their plans. Also, among the respondents, 3 stated that they could not decide on the specific institution, 1 reported that they would like to cooperate with all other institutions, and 4 merely responded that they wanted to work with TCUs or HBCUs.

Four participants pointed out that they intended to choose institutions that would fit their requirements. One of them highlighted the importance of having similar project ideas and "passion," and one focused on the distance issue, specifying the workable distance between their own institution and potential partners. Two more attendees discussed specific research interests and pointed out that they wanted to cooperate with institutions that supported them. Thus, at least some attendees explained the reasons for their attention to particular institutions. The rest, however named individual HBCUs or TCUs they planned to cooperate with. One participant commented that they have already exchanged business cards with the representatives of the institutions interested them.

Thus, the open-ended question helped to clarify the plans of some participants, showing their commitment to future cooperation and partnerships. In addition, it provided some data on the factors that HBCU and TCU representatives consider before forging relationships with other institutions. Apparently, they include similar research interests and ideas, and the circumstances that can facilitate or hinder cooperation. Both questions also showed that the Summit achieved some of its desired outcomes, including the promotion of STEM research in HBCUs and TCUs with the help of cooperation.

SUMMARY OF KEY FINDINGS

This section will present an overview of the findings that can summarize both the lessons and insights from the Summit. It will discuss the recommendations that can be made based on these lessons and insights. Thus, the current report investigated the results of the Summit's survey and the session notes that were made by some of its participants. The analysis of these two sources provides rather different conclusions, but they can be interconnected.

The survey aimed at determining what worked about the Summit and how to improve it. It showed that the Summit was an overall success. They linked the majority of the issues to its organization, especially scheduling, since many participants found the Summit exhausting and difficult to cope with because of its twelve-hour days. Other than that, suggestions were concerned with potential improvements for individual activities. However, the activities were mostly enjoyed; the only one of them that consistently received negative feedback was sampler sessions. Possibly, they could be replaced by poster sessions, but it should be pointed out that most of the attendees still liked them.

The most valuable aspects of the Summit were its activities, cooperation and networking opportunities, and learning options. This demonstrates that the Summit was generally successful in achieving its goals, but it also allows connecting the survey results to the session notes. The notes recorded the crucial insights experienced by the participants during discussion sessions. They do not cover all the information that the participants received, but they contain some of it while highlighting the participants' role in constructing the knowledge produced by the Summit.

The five sessions of the Summit were not tightly structured, and the time shortage affected them as well since, as the participants had admitted, they did not always cover all the planned questions. Still, the sessions considered BP research, TCU/HBCU role in it, cultural competence, ethics, potential for collaboration, findings dissemination, and challenges associated with all these topics. When responding to session questions, Summit attendees showed a noticeable preference for discussing the existing issues and challenges, but they also presented meaningful solutions and pointed out exciting opportunities.

Thus, the sessions show that there are some gaps in the way HBCU and TCU STEM research is funded as compared to HWIs. HBCUs and TCUs have specific cultural features and face particular concerns, which is why they might require the metrics that focus on added value rather than simple performance. It appears that HBCUs and TCUs can become more effective, successful, and visible through collaboration and increased focus on research, especially in STEM fields.

The resources at HBCUs and TCUs appear to be scarce based on the participants' responses. In addition, there may be a need for education on research, grants, and BP that would simultaneously promote awareness and stimulate interest in these topics. Education is also a tool for increasing cultural competence and ensuring ethical research. Finally, researchers might need some training on dissemination methods, especially on modern and innovative ones that use recently developed communication technologies and opportunities; an example is social media. In addition, the sessions also make several meaningful recommendations on the topic that will be discussed below.

RECOMMENDED STRATEGIES FOR ADVANCING STEM EDUCATION RESEARCH AT HBCUS/TCUS

HBCU and TCU Researchers and Administrators. Some findings contain relatively direct suggestions for various actors who might improve HBCU and TCU STEM research and BP. First, the Summit recognizes the significance of educators, researchers, and administrators, and their ability to influence their institutions. Thus, the Summit shows that there are notable gaps in BP and STEM research, and the staff of HBCUs and TCUs are the primary element of human resources that can be mobilized to address them. To achieve positive outcomes, researchers and administrators need to incorporate STEM research into the programs and agendas of their institutions, promote awareness of STEM and research opportunities, including grant-related ones, and contribute to meaningful, fair partnerships between HBCUs and TCUs, and HWIs. We should achieve the latter through the monitoring and communication between different institutions with a focus

on those that share similar research interests. Various exchange programs are also a viable option for enhancing collaboration.

Finally, researchers are the primary agents of findings dissemination, but they require funds and support from administrators. Thus, the collaboration between researchers and administrators is also a predictor for building the research capacity of HBCUs and TCUs. In addition, research dissemination is also an option for engaging other stakeholders, including federal agencies. Researchers' ability to reach them, using communication technology, conferences, and publications, is crucial for HBCU and TCU research.

Caption

Program Officers and Federal Agencies. The specific recommendations for federal agencies include researching and reviewing the existing policies and adjusting them in ways that facilitate collaboration and research in HBCUs and TCUs. The Summit's participants point out that the existing policies might be imperfect if not exclusionary. Their revision with a culturally aware approach could help to improve HBCU and TCU involvement in STEM. Then, the mechanisms of federal agencies' incentives could encourage different institutions to focus on STEM and enter collaborative research.

STEM Advocates and Policymakers. The participants recognized advocates and policymakers as stakeholders that can stimulate research, but they were not the focus of the Summit. Still, the recommendations for them include promoting STEM, BP, and inequality awareness, which is especially topical for advocates, and

introducing incentives for institutional cooperation, which especially applies to policymaker roles. In addition, one table found that researchers were often ill-equipped to work with policymakers, which is a problem that can be resolved with the help of advocates spreading information or acting as intermediaries. Policymakers also need to consider reviewing the existing success metrics for HBCUs and TCUs and check if ones based on added value could be introduced. Finally, advocates can help make TCUs and HBCUs more visible. we can achieve the building of HBCU and TCU STEM education research capacity through the collaboration of multiple groups of stakeholders.

CONCLUSION/ NEXT STEPS

The Summit was introduced to share some important information about BP and STEM educational research in HBCUs and TCUs, and it has achieved this outcome. After a review of the Summit's proposal, feedback questionnaire, and session notes, the following conclusions can be made. The majority of the participants learned additional information from the Summit that was related to the key topics that it covered. Certain issues were also encountered during the event, especially regarding time. Many participants suggested that more time was required, especially for covering all the questions included in every session. This information, and the rest of the attendees' feedback, can improve future summits.

The feedback received from attendees strongly supports that the Summit was a success. The participants discussed critical gaps in STEM educational research, especially those related to the lack of HBCU and TCU representation in it. They also proposed solutions to this problem with a focus on increasing the awareness of research opportunities, developing new partnerships with minority-serving institutions and HWIs, promoting culturally sensitive and ethical research, and increasing the focus on various approaches to information dissemination. Overall, the findings show that there are significant problems which prevent HBCUs and TCUs from becoming equally represented in research, but with a combined effort of HBCU and TCU staff, federal agencies, policymakers, and advocates, we can change this situation.

The presented analysis and recommendations suggest that further steps are required to advance BP and STEM research in HBCUs and TCUs. The presented Summit requires an

analysis and discussion, and the findings need to be disseminated. Some of them can help to improve future similar events, and others contain recommendations for different stakeholders or potential strategies. The Summit does not resolve the problem of HBCU and TCU underrepresentation in BP and STEM research. The Summit only contributes some data on the existing issues and solutions. The scientific testing of such solutions and their outcomes, and the continued monitoring of raising concerns and new interventions to rectify them, is required. Thus, future summits and other methods of diagnosing issues and reporting solutions would become the next steps in promoting equal research participation of different minority institutions.

APPENDIX A

QEM NSF INCLUDES: *A National Summit to Survey and Stimulate Broadening Participation Research (BPR) at Historically Black and Tribal Colleges/Universities*
March 7-9, 2019

Hilton Baltimore BWI Airport
1739 West Nursery Road, Linthicum Heights, MD

ALL SESSIONS WILL BE HELD IN SALON A

A G E N D A

THURSDAY, March 7 – Day One

PM
1:00   *Registration Opens*

3:00   **OPENING PLENARY SESSION**

     *-Welcome, Introductions, and Review of **Summit** Purpose*
     -Creating an Action Plan: Gathering Participants' Feedback and Input
          Ivory A. Toldson, President and CEO, QEM Network and PI, Summit Project
          Althea Burns, Associate, QEM Network and Summit Project Director

3:30   ***An Overview of the Current Knowledge Base on Broadening Participation (BP) in STEM at HBCUs and TCUs***

     Stephen Paul Boyer
     President, Boyer Associates
     Editor, *Native Science Report,* and *Summit* Consultant

     Odis Johnson, Jr.
     Associate Professor, Departments of Sociology and Education
         Director of Graduate Studies, Department of Education
     Washington University in St. Louis, and *Summit* Consultant

     Current Focus Areas of Broadening Participation Research, including the NSF BP Portfolio

     Leyte Winfield
     Associate Professor, Department of Chemistry & Biochemistry
         Chair, Division of Natural Sciences and Mathematics
     Spelman College, and *Summit* Consultant

     Critical Gaps in STEM Education Research about HBCU and TCU Students

     Patricia Campbell
     President, Campbell-Kibler, Inc. and *Summit* Consultant

4:30   Discussion One: *Participants' Input and Feedback on Presentations*

5:00   ***Summit Sampler Session 1***: *Briefings on Participants' Research Project Abstracts*

Moderators: Bruce Crawford, Lawson State Community College
and Scott Friskics, Aaniiih Nakoda College
SUMMIT Coordinating Committee Members

5:30   *Break*

6:00   DINNER PLENARY AND KEYNOTE PRESENTATION
The Roles of HBCUs in Conducting and Building
***   HBCU Capacity for STEM Education Research***

Introduction of Speaker: Eugene DeLoatch
Professor and Dean of Engineering (Emeritus)
Morgan State University

Keynote Speaker: Juliette Bell
Former President, University of Maryland Eastern Shore
and *SUMMIT* Coordinating Committee Member

7:00   ***Summit Sampler Session 2***: *Briefings on Participants' Research Project Abstracts*
Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

8:00   ***Adjournment, Day One***

FRIDAY, March 8 – Day Two

<u>AM</u>

8:30   *Continental Breakfast*

9:00   PLENARY AND KEYNOTE PRESENTATION
The Roles of TCUs in Conducting and Building
***   TCU Capacity for STEM Education Research***

Introduction of Speaker: Paul Boyer, *Summit Consultant*

Keynote Speaker: Leander R. McDonald
President, United Tribes Technical College
Enrolled member of the Spirit Lake Dakota Nation, and
QEM INCLUDES D&DLP Partner

9:45   <u>Discussion Two</u>: *Participants' Input and Feedback on both Keynote Presentations*

10:15   ***Summit Sampler Session 3***: *Briefings on Participants' Research Project Abstracts*
Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

10:45   *Break*

11:00   **Seminars: *Building STEM Education Research Capacity***
Seminar I – *A Primer on STEM Education Research (Fundamentals)*
    Patricia Campbell, *Summit Consultant*

Seminar II – *Enhancing Faculty/Staff STEM Education Research Skills*
    Leyte Winfield, *Summit Consultant*

*QEM NSF INCLUDES: **A National Summit** on Broadening Participation
Research (BPR) at Historically Black and Tribal Colleges/Universities*   **AGENDA -- Page 2**

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PM

12:30   LUNCHEON PLENARY SESSION

*Building STEM Education Research Collaborations at HBCUs/TCUs:
Identifying Potential Collaborators and Establishing the Collaboration*

Caesar R. Jackson
Professor of Physics, Department of Mathematics & Physics
North Carolina Central University, and INCLUDES *Summit Consultant*

1:45   Discussion Three: *Participants' Input and Feedback on Presentations*

2:15   **Summit Sampler Session 4**: *Briefings on Participants' Research Project Abstracts*
Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

2:45   *Break*

3:00   PANEL SESSION

*Opportunities for Research Collaborations with NSF INCLUDES D&DLPs /Alliances:
NSF Grantees Share Broadening Partcipation Research Goals and Strategies*

Moderator: Fay Cobb Payton, Program Director and
INCLUDES Implementation Team Member
Division of Computer and Network Systems (CNS)
Computer & Information Science & Engineering (CISE)
Directorate, National Science Foundation

Panelists:

– *The Alabama Alliance for an Inclusive Middle Grades
Computer Science Preparation through Makerspaces in the
Alabama Black Belt Region*

Shaik Jeelani, Principal Investigator and
Vice President for Research and Graduate Studies
Tuskegee University

– *Early STEM Engagement for Minority Males through a Network of MSIs*

Kelechi Nwachukwu, Project Staff and
Manager for the Data Engineering and Predictive Analytics Laboratory
Morgan State University

–*Increasing Minority Presence within Academia Through Continuous Training*

Kinnis Gosha, Co-Principal Investigator, Endowed Associate Professor
Computer Science and Director, Culturally Relevant Computing Laboratory
Morehouse College

– *QEM D&DLP Project in Partnership with HBCUs and TCUs*

Jeremy Guinn, Chair, Environmental Science Department and
Director, Tribal College REU Program
United Tribes Technical College

Scott Friskics, Director of Special Programs
Aaniiih Nakoda College

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Research (BPR) at Historically Black and Tribal Colleges/Universities*   **AGENDA -- Page 3**

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4:15   PANEL SESSION
         Funders' Roundtable: ***Funding for BPR STEM Education Research***

         Moderator: M. Brandon Jones, Program Director
                     Education and Diversity Programs
                     Office of the Assistant Director (OAD), Geosciences (GEO) Directorate
                     National Science Foundation

         Panelists:
         –National Science Foundation (NSF) Initiatives
                     Earnestine Easter, Program Director
                     Division of Graduate Education (DGE)
                     Education and Human Resources (EHR) Directorate

         –Leveraging Resources through External Collaborations with other Institutions
                     Peter Romine Professor and Head, Electrical Engineering
                     Navajo Technical University

                     Brian Grebliunas, Instructor, Environmental Science/Natural Resources
                     Aaniiih Nakoda College

         – A Look at Private Foundations
                     Dirk Butler, Senior Associate, National Community Strategies,
                     Annie E. Casey Foundation

                     Tomeka Hart, Senior Program Officer, U.S. Programs
                     Bill & Melinda Gates Foundation

5:15   ***Summit Sampler Session 5***: *Briefings on Participants' Research Project Abstracts*
         Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

5:45   *Break*

6:00   WORKING DINNER PLENARY
         Building Cultural Competence and Ethical Practices in STEM Education Research:
         Historical, Geographic, Political, and Ethical Factors to Guide Research

         Presenters:
         –Paul Boyer, S*UMMIT* Consultant

         –Odis Johnson, S*UMMIT* Consultant

7:30   Discussion Four: *Participants' Input and Feedback on Presentations*

         Adjournment – *Day Two*

SATURDAY, March 9 – Day Three

AM

8:00   *Continental Breakfast*

8:30   **Summit Sampler Session 6**: *Briefings on Participants' Research Project Abstracts*
Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

9:00   **PLENARY SESSION**: *Research to Practice*

–*Transitioning to Practice, Replicating Success. and Disseminating Results*
Patricia Campbell, INCLUDES *Summit Consultant*

9:45   Presentations:
-*Telling Our Story to Diverse Audiences*
-*Collaborations for STEM Education Research Publications*

–Paul Boyer and Odis Johnson, S*UMMIT* Consultants

10:30   Discussion Five: *Participants' Input and Feedback on Presentations*

11:00   **Summit Sampler Session 7**: *Briefings on Participants' Research Project Abstracts*
Moderators: Bruce Crawford and Scott Friskics, *SUMMIT* Coordinating Committee

11:30   *Break*

11:45   LUNCHEON AND CLOSING PLENARY SESSION
Next Steps:
–*Creating an Action Plan to Stimulate BP Research at HBCUs/TCUs*
–*Developing an HBCU/TCU BPR in STEM Education Research Community of Practice*

Discussion Leaders: Ivory Toldson, QEM Network, *Summit Consultants*, and
INCLUDES *Summit Coordinating Committee*

PM

12:45   *Participants' Feedback on the Summit*
Discussion Moderator: Caesar Jackson, *Summit Consultant*

1:15   *Closing Comments from Summit Leadership*
Facilitator: Ivory Toldson, Summit PI, QEM Network

1:30   *Participants Complete Online Evaluation of Summit*
Facilitator: Mercy Mugo, QEM Research Associate and *Summit Project Staff*

2:00   **SUMMIT ADJOURNMENT**

*QEM NSF INCLUDES: A National Summit on Broadening Participation
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Caption

The Quality Education for Minorities Network

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