

## Meeting of the Directorate for STEM Education (EDU) Advisory Committee

Wednesday, May 18<sup>th</sup> and Thursday, May 19<sup>th</sup>, 2022

Location: Virtual

**Advisory Committee Members Present:** Stephanie Adams, Tom Brock, Melissa Collins, Kaye Husbands Fealing, Okhee Lee, David Monk, Ada Monzón, Becky Wai-Ling Packard, Jeremy Rochelle, Nicole Smith, James Spillane, Laurel Vermillion, Marilyn Strutchens (Chair)

**Designated Federal Officer:** Sylvia Butterfield; **Executive Secretary:** Bonnie A. Green

**Day 1 – May 18, 2022, noon – 5 pm**

**Theme:** Promoting Organizational Level Transformation in STEM Education and Workforce Development

**Noon – 12:45 Welcome Remarks** from AC Chair and Acting Assistant Director

Dr. Marilyn Strutchens, chair of EHR's AC, opened the meeting highlighting the importance of social justice and how it can benefit the country. She stressed that while we have made strides related to education and equity, we still have a long way to go in making educational opportunities equitable for all students. She introduced the overall theme for the next two days: sustainability. Dr. Strutchens introduced new AC members Juan Gilbert and Lorelle Espinosa.

Dr. Butterfield, EHR Acting Assistant Director, provided agency updates about the EHR Assistant Director search and the establishment of the new Technology, Innovations and Partnership (TIP) Directorate. Dr. Butterfield also discussed EHR progress on recommendations from prior AC meetings, especially progress in paying attention to the broadening participation language used in solicitations and EHR documents. She also gave some budget and program updates. Budget updates included the Directorate's name change to the Directorate for STEM Education, and the Division of Human Resource Development (HRD) to the Division of Equity for Excellence in STEM which will take effect on October 1<sup>st</sup>, 2022. Dr. Butterfield closed by thanking the AC members for their continued dedication and advice about STEM education and workforce development.

**12:45 – 1:50 pm Session 1-1 – Through the Lens of Equity and Access: Improving Implementation of Evidence-Based Practices for Organizational Change**

**Moderator:** Jermelina Tupas, Deputy Division Director (DDD) for HRD.

**Common Intellectual Experience:** Dr. Geoffrey Cohen (EHR PI)

Dr. Cohen provided an overview of his research on belongingness. This included the processes that shape sense of belonging and implications for social problems. He discussed two interventions from his research, fostering a positive narrative for adversity and simple values affirmation. Findings showed that three "T"s are important: targeted at people who needed them, tailored to specific psychological needs, and timing. Cohen ended by stating, translational research draws from decades of foundational research in the context of practitioner understanding. This can have positive results. His book, *Belonging: The Science of Creating Connection and Bridging Divides*, is based on NSF funded research and will be published in September 2022.

**AC Discussion Session 1-1**

The Advisory Committee discussed Dr. Cohen's presentation and made some suggestions about how researchers can successfully move research insights into policy and practice. The committee recognized that Dr. Cohen's interventions have been replicated, are easy to implement, and inexpensive, yet consideration needs to be given about what prevents implementation at a wider scale. More research is needed to understand how to introduce promising interventions effectively.

AC members recommended more Intentional research on factors limiting/facilitating scale in education. They discussed how even powerful interventions, with data and research behind them, have limited potential for scale in different contexts. Context, timing, and audience are crucial to determining when scale can happen in education, and all of these need more research. EHR could aid the field in better understanding the science underlying educational initiatives with the potential to impact change, especially the impact of context on outcomes.

## **2:00 – 3:30 pm Session 1 -2 – Understanding and Addressing Structural Barriers to Organizational Level Transformation**

**Moderator:** Ellen Carpenter, Acting DDD for DUE

**Common Intellectual Experiences:** Drs. Bryan Brayboy and Sandra Laursen (EHR PIs)

**Dr. Bryan Brayboy** from Arizona State University shared his research involving American Indian/Native American students, who often do not think their heritages are respected or seen at Institutions of Higher Education (IHEs). Dr. Brayboy discussed how his institution has developed interventions that enhance student experiences, address the lack of native faculty, and bring tribes to campus for conversations. Those actions helped contribute to increased retention of AI/NA students and have led to an increase in the number of indigenous faculty from 2013 to 2022.

**Dr. Sandra Laursen** explained that education is localized, solutions should be contextualized, and problems are interconnected. Multiple frames are needed when viewing organizations: structural, human resources, political, and symbolic. Strategies for organizational level transformation need to use resources based on the setting. Solutions are not always top down. Thinking organizationally is hard and requires educating leaders as they make structural changes.

### **AC Discussion Session 1-2**

AC members recognized the importance of Intentionality in organizational change, especially when IHEs are trying to foster a sense of belonging that is grounded in the environment (system). They saw huge opportunities to use technology to understand the virtual experiences for students and teachers. AC members also indicated that much of the research and interventions have been focused on individuals (teachers, students), while the organizational context appears to not have had the same emphasis in EHR investments and EHR research.

Commitment to diversifying the academy requires addressing issues at multiple levels and disrupting the status quo. Institutional transformation is under researched. AC members praised EHR for expanding the types of research and institutions that are doing this work. However, there may still be groups that are left behind after interventions are implemented. Lastly, there appears to be tension between researchers and practitioners, particularly in the K-12 educational space. Such tension needs to be addressed.

AC members felt the field would benefit from initiatives that encourage the integration of multiple approaches such as systems thinking and DEIA-focused research. An emphasis on investing in organizational level research and how organizations have contributed to inequities is needed. For example, EHR could capitalize on the changes taking place within the directorate to look for an intersection between DEIA and institutional and community

transformation focused issues. EHR should consider what programs, funding opportunities, other forms of outreach or support are available to advance an organizational lens (systems approach) to DEIA. In addition, EHR might consider more intentionally focusing some research at the K-12 STEM level on the role of organizations and systems in student success. Understanding how to make available that information in a “usable” manner for overstretched educators would be key.

### **3:20 – 3:50 pm Session 1 -3 - Cultivating Partnerships to Promote Sustainable Organizational Level Transformation**

**Moderator:** Lee Zia, Acting DD for DGE

**Common Intellectual Experience:** Erwin Gianchandani, Assistant Director for the Directorate for Technology Innovations and Partnerships (TIP)

Dr. Gianchandani shared that Dr. Butterfield, Dr. Heit, and other EHR senior leaders have worked carefully with TIP leadership to create a matrix that maps the opportunity spaces for EHR collaboration with TIP. In addition, he discussed TIP’s emphasis on experiential and entrepreneurial experiences for students and faculty. TIP is working to determine what partnerships need to be catalyzed so that students receive practical experiences that allow application to what they are learning in the classrooms with real world scenarios, whether it be for industry, state and local governments, tribal governments, or schools and universities. The goal is not to train people to become PhD scientists and engineers exclusively, and instead to give individuals a grounding in STEM that allows them to be successful. TIP understands that success can be defined in different ways for different people. TIP is working with EHR to partner with other organizations that can catalyze work at the K-12 level through topics such as data science. Dr. Gianchandani also introduced the Regional Innovation Engines (RIE) [agency announcement](#). There were a several listening sessions that helped with the design for that agency announcement to try to introduce more equity into the system. These RIEs will bring to scale innovation and technological ecosystems across the country particularly in regions that do not have emerging technologies.

### **AC Discussion Session 1-3**

The AC members commended TIP for looking beyond the usual pipeline models for workforce development. TIP could also consider Incorporating significantly more K-12 engagement, providing retraining and upskilling opportunities to adult learners, and exploring more pathways or on-ramps and end points to engage a broader audience in STEM workforce needs.

The AC members noted that much of the discussion centered on how to make NSF opportunities accessible to underrepresented PIs and Institutions in funding decisions. Some ideas might include engaging institutions with well-established relationships with EHR in the new Regional Innovation Engines, especially Minority Serving Institutions that have a level of trust built up with EHR. Also, structuring competitions through a tiered system may assure more equitable comparison and might help broaden the pool of institutions involved.

AC members advised that while partnerships are in vogue, partnerships work best when it is clear who is doing what and there are mutual benefits. Consideration should be given to who leads the partnerships and how the research/deliverables through the partnership benefits communities. Also of importance is that partnerships are costly for organizations. They involve an investment of resources, building new networks, and boundary practices. It is important to weigh the benefits and costs and EHR will need to be very selective about investments in partnerships. The AC members discussed the importance of leveraging partnerships for the purpose of opening funding pathways for institutions currently not seeking NSF funding.

**Closing Remarks** Day 1 – May 18, 2022

The meeting closed with AC members sharing some insights on redefining success in STEM education outcomes to include opportunities for credentialing and for upward mobility. The committee asked EHR to consider differential power balances and where resources are concentrated when thinking about how work will benefit communities. In addition, it is important to identify the workforce development challenges in the local community and how research and education can mitigate those challenges. The committee members resonated with the importance of partnerships; however, they advised that special attention is needed when thinking about who should lead that space. EHR also needs to consider that partnerships can be expensive for institutions, and the benefits of a partnership need to outweigh the costs. The committee was excited about the collaboration between TIP and EHR. To ensure a diverse portfolio, the committee suggested exploring how EHR could partner with TIP to create solicitations that are tiered based on enrollment sizes and types so that similar-sized institutions compete against each other. EHR/TIP can build on existing successful partnerships between industry and K-12 education to learn about engaging and investing in community. However, the committee noted that EHR still needs to look at different types of partnerships such as school partners, universities, community colleges, and some businesses or organizations that will benefit from students graduating in STEM.

## **Day 2 - May 19, 2022, noon – 5 pm**

### **Theme 2: Advancing Racial Equity in STEM Education and Workforce Development**

#### **Noon – 1:10 Session 2 – 1: Pathways for Achieving Racial Equity in STEM Education**

**Moderator:** Diana Elder, DD HRD

**Common Intellectual Experience:** Becky Wai-Ling Packard, Kaye Husbands Fealing, and Ohkee Lee (EHR AC Members)

**Dr. Kaye Husbands Fealing** discussed the challenges of using the term underrepresented and offered clarification about when it is necessary. She shared data that show in the US STEM workforce some groups are underrepresented and others overrepresented. Dr Husbands Fealing presented a study that found not all groups benefit equally from diversity initiatives and that competition across related fields can confound efforts to increase diversity. The main takeaway was that interventions are not one size fits and careful consideration is needed to design interventions that are tailored to specific groups.

**Dr. Okhee Lee** introduced her research about multilingual learners in science classroom that uses an asset-oriented framework. Understanding the intersection between language that cuts across racial groups and gender identities is important. Dr. Lee highlighted the need for science and language integration.

**Dr. Becky Wai-Ling Packard** discussed the advantage of adopting an ecosystem framework to connect mentoring to racial equity. Dr. Packard also discussed the importance of community colleges which are diverse and have lots of intersections. Dr. Packard's research has found that community colleges invest in students despite limited resources. However, when students transfer to four-year institutions, they face barriers and faculty bias. When targeted programs (e.g., mentoring) are embedded into the system, students of color have better outcomes.

#### **AC Discussion Session 2-1:**

The committee members discussed the importance of having assets-based perspectives instead of deficit perspectives, and the need for multidisciplinary approaches to diversifying STEM. AC members especially encouraged more research on the economic impact of diversity beyond individuals to broader communities and enterprises. They also expressed strong agreement that the conversation needs to shift from an emphasis on lack of student preparedness to what needs to change within institutions and disciplines to bring more students into STEM fields. This may vary by discipline and context.

## **1:10 – 2:00 pm Session 2-2: Translating, Scaling, and Transferring Racial Equity Research into Sustainable Practice**

**Moderator:** Rosalyn Hobson-Hargraves

**Common Intellectual Experiences:** Dr. Ellen McCallie and Dr. Toya Frank (EHR Program Officers)

Drs. McCallie and Frank introduced the EHR Racial Equity (EHR-RE) program, which expands NSF's goal to broaden participation. While all programs in EHR can focus on racial equity and many include this in their solicitations, the EHR-RE program funds research that aligns with systemic change and focuses on redesigning educational structures. The program strives to attract new researchers in terms of race and ethnicity and offers a place for these scholars to critique the status quo and offer paths forward for change. The overarching goal is to establish language that other programs and solicitations can use to create a broad portfolio on Racial Equity across the Directorate and the Foundation.

### **AC Discussion Session 2-2**

AC members expressed concern that sometimes "timely" means "in style," which can change. The AC members felt strongly that supports are needed to be sure EHR-RE is enduring. The committee members were encouraged by the current momentum and recognized how this movement has changed the narrative.

AC members recommended getting expertise during the EHR-RE program's development and not just as follow-up. The committee noted that in the last AC meeting, there was a focus on language: better words to use for race/ethnicity and better ways to make statements about groups of people and situations. The committee asked EHR to consider how it can provide language to researchers that encourages people/participants to come on board, rather than being disinterested or closing the door on change.

AC members want to make sure the Racial Equity in STEM program is having an impact inside NSF as well as in the field. They recommended the development and adoption of rigorous evidentiary frameworks and evaluation into how the program interacts with the rest of the foundation and whether principles, practices, and perspectives are having an impact

Dr. Butterfield ended the session by emphasizing that though other programs address racial equity, EHR-RE was created specifically for that purpose. The intention is to continue the program as a stand-alone program that disseminates critical theories and approaches to be integrated into the full EHR portfolio.

## **2:10 – 3:10 pm Session 2-3: Racial Equity, Diversity, and Inclusion: A catalyst for improving graduate education**

**Moderator:** Charisse Carney-Nunes, DDD DGE

**Common Intellectual Experience:** Elizabeth Halimah, Associate Vice Provost for Diversity & Engagement at University of California; Linda Sapochak, Division Director of Division of Materials Research in Mathematics and (MPS/DMR); and Jonathan Madison, Program Director MPS/DMR

**Dr. Jonathan Madison** shared his pivotal research experiences and internships during his undergraduate and graduate education. His experiences aligned with research that has identified two factors associated with success for students who major in physics, belongingness, and physics identity. His research experiences helped him not only feel a sense of belonging but to also envision being part of the physics community for the long term.

**Dr. Linda Sapochak** presented the NSF program Partnerships for Research and Education in Materials Research (PREM) program, which aims to enable, build, and grow partnerships between minority-serving institutions and centers and facilities supported by the Division of Materials Research (DMR). Both entities contribute to the

partnerships, and they are mutually beneficial. The key success of the program is that it meets Minority Serving Institutes (MSI) at the starting point in their own context and give support so that students have pathways to move along that continuum from being retained in STEM to getting their bachelor's degree and graduate degree and then further becoming a professional in the field.

**Dr. Elizabeth Halimah** discussed ways that the University of California uses opportunities to diversify the pathway to PhDs and the professorate. She gave examples of three programs that are successful, all sharing these three traits: research experiences for students, financial resources, and faculty and student mentoring.

### **AC Discussion – Session 2-3**

The committee members noted that faculty should be encouraged to have a different mindset. Faculty often assume students are all in the same place when in fact they are at 3 or 4 different places and there is little acknowledgement of student growth/development. The AC suggested that a catalyst might be to jumpstart dialogues with the individuals that are supervising the faculty. In addition, the AC offered for consideration that there has been a lot of work done from the bottom up, yet more research is needed on ways to change the environment/campus climate/culture. This meeting has had a recurring theme about the importance of sense of belonging for students and their identity as a scientist. Research should be funded that explores ways to cultivate that, and the various challenges for different groups of students and between groups of students at the intersection of race and class.

The work in EHR focused on student preparation should continue, and committee members encouraged EHR to use programs that are already successful as models. The Bridges to Doctorate program is successful for underrepresented student retention in STEM since it creates a community of students, advisors and their team of other faculty members. The committee members noted that advisor training/professional development is important especially since faculty in academia have responsibilities they are required to do such as mentoring, yet they are not trained to do it. Furthermore, EHR could better understand the multiple prongs of mentoring and how advisors can work to support team environment and shared responsibility that create a culture of belonging. The topic of student empowerment also surfaced. This would be an add on to student/professor mentoring relationships and possibly another way to change the culture of the department or university. However, empowering students to change school culture-after learning from students at other schools is not as easy as it seems. While it is beneficial for students to be aware of challenges other students face at different universities, the reality is that support is limited by varying contexts. Even with virtual communities, the bubble is still faculty and students in the lab.

### **4:00 – 4:30 pm Discussion with NSF Director**

The NSF Director, Dr. Sethuraman Panchanathan, addressed the committee. He intoned there have been wonderful candidates put forth for the AD search and they and a final announcement will be made in several weeks.

Dr. Panchanathan reiterated NSF support for the K-12 sector, especially motivating and exciting pre-service preK-12 teachers and ensuring that students are excited and inspired too. The Director informed the AC members about a partnership with the Simons Foundation which is focused on teacher preparation. He also gave some examples of institutions partnering with industry. In addition, the Director highlighted the GRANTED program which will provide research office infrastructure for a wide range of institutions for writing proposals and create a virtual resource office available to all institutions.

Dr. Panchanathan observed the need for more staff resources and acknowledged some budget challenges that have hampered the initiation of new programs. However, the Director expressed his deep commitment to ensuring that diversity is a huge part of how we make awards and assess programs.

The Director has been discussing with NSB performance measures to assess and strengthen impact across all directorates. He acknowledged data challenges and the need to communicate progress with external audiences.

Dr. Panchanathan acknowledged Dr. Okhee Lee for her AERA 2021 award for Exemplary Contribution to Practice-Based research. He thanked the committee and said he appreciates their thoughts, suggestions, and ideas.

**Closing Remarks (4:30-5:00pm) May 19, 2022:**

Marilyn Strutchens, AC Chair, and Sylvia Butterfield, the EHR Acting Assistant Director

Dr. Strutchens asked the committee to think about subcommittees. Suggestions included: working with the EHR Racial Equity programs, impact and measurement, revamping the partnerships committee so that it links with TIP, and K-12 connections. Dr. Strutchens will write up subcommittee ideas and suggest specific deliverables. Committee members expressed appreciation for the topic of belonging which was this spring meeting's first presentation and a consistent thread throughout. The AC members were enthusiastic about the EHR-RE program and are encouraged that steps are being taken so that it is sustained. The committee members are interested in hearing from EHR-RE awardees during a future meeting

Dr. Strutchens asked for each committee member's takeaway from the meeting. Several AC members mentioned the emphasis on DEIA and belonging and saw real value in centering discussions of belonging and inclusion as it relates to race and ethnicity. There is demonstrated success of some inclusion interventions, although larger systemic initiatives may not have had as much success. Other takeaways included the importance of partnerships as well as the role of psychological aspects in mentoring and advising.

Dr. Strutchens and Dr. Butterfield thanked everyone for their participation.