

EHR¹ ADVISORY COMMITTEE MEETING MINUTES

November 9 - 10, 2022

Approved by EHR AC: May 31, 2023

Session 1 – From Pre-K to a STEM Literate Citizenry and Workforce: A Look Across the Directorate’s Spatial Cognition Portfolio

During the opening of Session 1, Principal Investigators (PIs) and a Graduate Research Fellowship Program (GRFP) fellow presented their funded work in spatial cognition. This included presentations from David Uttal (1906808, 2115905, 1759360, 2201307, 2135743), Peggy McNeal (2043616, 2225637), Daniel Ness (2050483), Cynthia Orona (2048987) and GRFP recipient, Annie Klyce. Their presentations were followed by a brief question and answer period when the AC members expressed gratitude for the presentations. During the Q&A, questions focused on how this information could be transferred into classroom practices, and the role of measurement and technology in understanding and advancing spatial cognitive development.

Advisory Committee (AC) members noted during the discussion that the presentations weaved three elements into one coherent theme: spatial reasoning, spatial cognition, and spatial representation. They contemplated the implications of spatial recognition as foundational to the entire discipline of science and were excited about the possibilities. AC members observed that spatial skills cut across disciplines. This could imply that spatial cognition is foundational yet domain generic.

These novel ideas led AC members to ponder, in addition to Spatial Cognition, what are the other foundational topics worthy of study and investment that would maintain NSF’s standing as the lead agency in STEM Education research.

Within the context of a specific topic, AC members learned that spatial cognition skills enhance thinking about societal problems such as climate change within the context of economics and other inequities. Relatedly, AC members wondered if spatial reasoning could be an overlooked gatekeeping skill and a key factor related to the “Missing Millions.”

AC members also noted that the presentations about spatial cognition have many implications for teacher practices. They inquired about DUEs strategies for turning these findings into integration by teachers in their day-to-day classroom practices.

Another topic that surfaced based on the presentations was the benefits of Virtual Reality and 3D-printing projects. AC members wondered what kinds of strategies can help additional classrooms and spaces gain access to these materials and if there any suitable 3D computerized alternatives that are more affordable. AC members addressed post-secondary pathways that do not involve education and instead upskilling and reskilling. They noted that tools based on spatial cognition, such as 3D printing, can make learning more tactile. Limited access for those in K-12 and the workforce can directly lead to inequities.

¹ Note: The Directorate for STEM Education’s Advisory Committee is still going under the name of EHR because of FACA requirements. Specifically, EHR AC cannot change its name to EDU AC until the COVs and Subcommittee started under EHR have concluded. The name change is expected to take place at the end of June 2023.

AC members encouraged EDU to consider ways to leverage these findings across directorates some of which are already using technology related to spatial reasoning such as eye-tracking and image recognition. AC members also encouraged better measurement and interventions across the agency.

Session 2 – Improving Equity in STEM through EDU Investments

The session opened with a roundtable of recently funded Racial Equity Program Description Principal Investigators: Tamera Pearson (2140890), Verónica Vélez (2201930), Julie Poynsenby from Coeur d' Alene Tribe (2200838), Benjamin Flores, (2201576), Julius Davis, (2201904)

The AC members acknowledged and appreciated the diversity of funding to institutional/organizational type as well as the diversity of the PIs. The AC highlighted the importance of balancing a diverse team of experts that includes diversity in “lived experiences.”

The AC members were optimistic regarding the potential information that could come from the inter-disciplinary efforts seen funded through the newly established Racial Equity Program Description. They raised concerns regarding how varying pockets of the nation may receive the findings of this program, and they spoke of the importance of high-quality dissemination of those findings. Questions were raised regarding the impact of potential court rulings and state-level legislation that has the potential to quell advances in STEM education research and implementation, particularly in the context of equity. The AC encouraged interagency partnerships including those between NSF and OSTP for the purpose of assuring the advancement of equity in STEM education, in broad, vast, and diverse ways. They encourage the support of rigorous methodology in these complex projects. Discussed was the financial and national urgency for assuring equity in STEM education. Several deemed this our nation’s “Sputnik Moment.”

Session 3 – STEM Partnerships, Alliances, and Collaborative Models

The session opened with an overview of partnerships as an NSF priority, and continued with Jolene Jesse, Senior Advisor for Partnerships, interviewing AC member, Lorelle Espinosa about partnering with funding agencies to achieve STEM equity goals. Dr. Espinosa discussed her experiences with varying forms of partnerships. She spoke in depth of Sloan’s Equity Collective, an intentional partnership designed to have greater impact through collaboration. The coordination of funding dollars can go farther enabling a wider reach. Research and evaluation are central to the Equity Collective as is a commitment to systemic change. Success through the Equity Collective is realized through collaboration and partnerships.

During the question and answer session, topics of the limitation of demographic data were raised (e.g., the loss of important details in categorical data). Concerns were also raised if we are unintentionally creating inequities just because we are doing things the same way. There was general agreement that if we continue to use the same approach in the development of the solicitation, in the outreach being done, in review panels and even in the reliance on certain Universities or PIs, this may lead to inequities. We need to examine these aspects of grant making and collect data to better understand where we may be perpetuating inequalities.

Different organizations with the same mission/vision have numerous goals however, attaining them all within a partnership is not always feasible. Partnerships have the potential to increase the number of goals that can be accomplished.

Divisions often work in silos and many are unaware of existing partnerships. More collaboration is needed across divisions. Furthermore, there are lessons to be learned from past partnerships that were successful that

can be applied to establishing future partnerships and co-funding. One example is the 2018 NSF/Boeing partnership. An additional type of partnership to consider is with smaller philanthropies where EDU partnerships could aid them in the merit review process while they aid EDU broadening participation.

Networking becomes necessary and needs to be prioritized within EDU staff's busy schedules. Looking to ways of expanding connections could aid in partnership building (e.g. PI convenings.) The AC recommends that staying connected to the field will enable EDU to increase community involvement, a necessary component of partnership success. The AC also reminded EDU that novel ideas may arise from smaller communities, yet NSF needs to provide funding to make them come to fruition.

Currently there are bipartisan policy initiatives that have made STEM exciting again. However, there have been no policy initiatives around STEM education. AC members challenged EDU to extend research into education policy.

Session 4 – Evaluating EDU Investments: Generating Evidence for Improvement

AC members learned about EDUs extensive involvement in evaluation programmatically in all four divisions and in aggregate for the directorate. Currently, EDU Core Research (ECR), is a four division, cross-cutting program that funds most of the research on education evaluation. AC members also learned about the federal context regarding legislative acts, guidance, and progress reports related to evaluation. The three examples were: the goals of the Federal STEM Education Strategic Plan which align well with directorate goals, the Evidence Act which required the agency to find a chief evaluation officer, and the budget request that includes program level evaluation plans to provide evidence for accountability and outreach. Additional information was shared with the AC regarding solicitation language in the context of a dynamic, equity and inclusion, space.

AC members encouraged EDU to gather data to determine the proportions of investments focused on systems-level changes and how those are evaluated.

There was consensus among AC members that STEM education needs to include and engage a diverse public audience in their multiple ways of knowing. Language, in particular, has the ability to be inclusive or exclusive. Thus, education is needed and should include potential PIs and reviewers. The AC members acknowledged the tremendous challenges EDU faces with the many iterations of revising language to be inclusive in public documents such as solicitations, panel reviewer training, and principal investigator outreach. The AC recognized that this work is political and commended EDU for its commitment. Since inclusive language is dynamic and critical in broadening participation, the AC encouraged EDU to continue with the current efforts. The AC recognizes that NSF can play an important role in understanding and using inclusive language; however, it does not need to take the lead. It is important for NSF to get feedback from the field.

The AC encourages EDU to consider creating a repository of resources with a current, contemporary reading list. Examining models like the Gendered Innovations work from Stanford University could also serve as models of best practices. The Directorate needs to continue advocacy around intersectional work, from the perspectives of reviewing, funding, and conducting research, and to better understand broadening participation efforts and outcomes. EDU's goal should continue to be to grow the community by nurturing people rather than making criteria that may potentially exclude others.

Enabling cross division, directorate and federal agency sharing of information could benefit EDU, while enabling EDU to benefit others. It is important to learn from similar broadening participation programs at other foundations and agencies. NSF could compare the language that is used. This could help create consistency across foundations and agencies.

AC Preparation for Discussion Regarding “Subcommittees”

The goal of this session is to determine if EHR’s AC should consider engaging in subcommittee work. Many questions were raised and topics for consideration discussed regarding subcommittees. These included: What are the eligibility criteria for subcommittee members? Should a topic that is important to the education committee be part of the main committee meeting instead of creating a subcommittee? What are privacy concerns which then impacts which meetings are opened to the public? Ad hoc committees with predetermined timelines to complete tasks may better accommodate work schedules than standing committees. Additionally, it was suggested that subcommittee reports be shortened since people usually focus on the executive summary.

AC members who served on subcommittees in the past shared their experiences. Previously, subcommittees were created to achieve specific goals. Subcommittees are beneficial since they allow opportunity for EDU staff and AC members to work collaboratively. However, limits to AC member terms and rotating EDU staff have extended the time frame (duration) for subcommittee work. Discussion was designed to continue during Day 2 of the AC meeting.

Session 5 – Briefings from Recent Committee of Visitors (COVs)

Recent Committee of Visitors (October 2022) presented their findings for the Division of Undergraduate Education (DUE) and the Division of Graduate Education (DGE).

The COV provided several points of positive feedback including DUE’s increase in funding rates for community colleges, management of constraints for congressionally mandated projects and cross directorate initiatives, and response to PI communities and providing new opportunities and that time frame included the COVID pandemic.

The COV encourages DUE to continue current practices that include diversifying panels, use of virtual and hybrid panels, and continuing to offer opportunities to get input from a broad range of scholars and stakeholders.

Recommendations included conducting a finer analysis of institution types to assist proposals from states with consistently low funding rates, partnering with EPSCoR, creating a division or agency wide database of reviewers to make it easier to identify COIs before panel, and document how input from a broad range of scholars/stakeholders is being incorporated into the design of new programs and the implementation of existing programs.

The COV recognized several points of positive feedback for DGE including that there is a broad range of disciplines and subdisciplines in the portfolio as well as innovative and potentially transformative projects. DGE pivoted well to using virtual platforms during the pandemic. Highly qualified reviewers have been identified and the quality of reviews were strong. COIs were handled well.

The COV offered several recommendations for DGE including that clarity is needed about how the critical criteria of intellectual merit and broader impacts are weighed when scoring proposals. There were concerns expressed about the lack of diversity for GRFP awards. The COV recommends it engages in broadening participation efforts

including broadening the reviewer pool and increasing the budget for programs that support innovation such as NRT.

The AC discussed the report and made the following recommendations. There should be a centralized reviewer database. Clarity regarding what constitutes a successful proposal needs to be present in all solicitations. This needs to be extended to reviewer training and monitoring of reviewers during the merit review process. PIs who receive declinations should get more information about how to make revisions, suggestions for writing a stronger proposal, and a more detailed official note from NSF. A greater understanding is needed about how program officers balance conflicting reviews, think about summary reviews, engage with PIs who submitted proposals with weaknesses, and their decisions to fund or decline.

Community colleges are a relatively new area for NSF. Though there are efforts to increase the number of submissions and awards, program officer turnover in programs could yield inconsistent messages to the field. Tensions appear to arise with panelists from 4-year institutions of higher education (IHEs) who may underestimate qualifications of reviewers and PIs from 2-year IHEs.

Session 6 – Facilitating Varying on and off Ramps to STEM Workforce Development and a STEM Literate Citizenry

This session began with presentations by three AC members conducting work in this space.

Marilyn Strutchens presentation was about the Strategic Taskforce to Accelerate Mathematics Pathways (STAMP) which is a group of Alabama teachers, mathematicians, teacher educators, administrators, guidance counselors, business people, and others. Ada Monzon's presentation was about Ecoexploratorio, a science hub designed to inspire students' interest/efficacy/skills and to change negative opinions and fixed mindsets about science. Juan Gilbert's presentation focused on his current efforts to broaden participation in STEM that were influenced by his personal experiences.

During the question and answer session AC members spoke of the importance of enabling varying pathways, beyond the GREs, for admittance into doctoral programs. There was also an emphasis on fellowships which provide students with a sense of independence; however, fellowships need to expand to include research experiences with faculty.

AC members acknowledged that STEM Education often requires longitudinal research methods that are difficult to implement. Targeted financial support for longitudinal research in STEM education is needed, including leveraging state, school-level systems, and existing big data.

AC members were excited to see funding for informal STEM environments and encourage funding to continue. They were excited to learn about studies that show ways in which youth connect to science through engaging with museums and experiential learning. Members encouraged funding research about informal learning for adults.

The AC discussed challenges with reaching the Missing Millions when considering on-and off ramps towards a STEM literate citizenry and the STEM education enterprise. One such challenge is the power dynamics that exist when implementing approaches that involve multiple pathways. Another challenge is for students of color who attend community college with the plan for pursuing 4-year degrees yet are discouraged from doing so because of racialized advising. In addition, EDU should strongly consider various ways to address students who have

incurred large debt at the time they discontinue formalized pathways without completing a secondary, post-secondary, or graduate degree in STEM.

AC members had several recommendations for expanding on and off ramps for improving STEM Education. One recommendation that could have a major impact on equity and justice is supporting connections between varying STEM infrastructures for students. AC members encouraged EDU to think about creating funding opportunities that bring different systems together that are typically segmented such as K12, postsecondary, 2-year and 4-year college programs. Along those lines, there should be support for gatherings between district personnel, teachers, researchers, and legislators.

Microcredentials was also a topic for discussion. They could be a scalable alternative to more common initiatives like workshops that only impact small groups. Creating programs and supports for microcredentials could be a pathway into numerous STEM disciplines. They could also help STEM teachers learn about culturally relevant pedagogy. In addition, microcredentials may provide a route for broadening participation of teachers of color to engage in STEM.

AC members also encouraged exploration of "grow-your-own" initiatives that are often used to prepare STEM teachers. These efforts create integrated pathways that begin in K-12 and support students throughout their careers. They also rely heavily on community colleges, where many students of color begin their post-secondary education journeys.

The AC asked EDU to consider how to extend research for expanding on and off ramps for improving STEM Education beyond individual students. The committee suggested funding research about environments, systems, pathways and the role of leadership. There are areas where policy, practice and process decisions are made.

Discussion on EHR AC Subcommittee possibility

The AC continued the discussion about subcommittees. Previously, the AC discussed creating subcommittees to report on the political atmosphere and impact on research, and on open access to data and publications. The AC considered if STEM is currently in a second "Sputnik era," in terms of an equity social justice revolution. They recommended a short-term subcommittee that looked at reaching the missing millions, and that would be open for all AC member involvement.

Discussion with Office of the Director

During the discussion with the Office of the Director, the following topics were discussed:

- Facilitating Longitudinal research in STEM ED, particularly focused on DEIA research/practices
- Leveraging Big Data has the potential to increase understanding in STEM Education.
- School/Home/Community engagement is needed.
- Facilitating disseminations of funded findings is an important goal for EDU.
- How do we evaluate "success" with varying on ramps?
- How do we reach MORE?
- What is the role of "middle skills" and stackable credentials in STEM and how can NSF facilitate it?
- Partnership Strategies are important, what are the plans for advancing partnerships, particularly in the space of creating on-ramps.
- "Sputnik" is not just about a call to justice, it's a call to tackling the most challenging issues of our time. We are in a Sputnik Moment.