

Minutes (unofficial) for Spring 2024 Directorate for STEM Education Advisory Committee
Theme: Rural and Remote Communities: Examining Ways to Unleash STEM Education and Workforce Opportunities

Opening Session:

Dr. Marilyn Strutchens, EDU AC Chair, began our meeting with a brief introduction to why Rural STEM Education matters. New AC members were introduced.

Dr. Moore, Assistant Director for the Directorate for STEM Education (EDU), was introduced, thanked the AC and the NSF directorate personnel for their service/efforts, and shared a vision for the directorate's priorities including today's focus on rural STEM education.

Session 1: Understanding Rural STEM Education and Workforce Development

A panel of presenters shared expertise, reports, and programs focused on rural STEM education.

Dr. Tabbetha Dobbins shared about the recent CEOSE report, Making Visible the Invisible: STEM Talent in Rural America. The report worked to define 'what is rural', that, while connected to framework of EPSCOR, is beyond this framework. The report examined old or existing strategies for supporting rural STEM to identify recommendations for new strategies.

Dr. Toni Danstep from DRL in Formal and Informal Settings at NSF shared about a joint NSF/NASEM consensus report focused on rural STEM education and workforce development. The committee focused on defining rural. The committee report is expected in Nov. 2024.

Dr. Michael Rook, a program evaluator for the Directorate of STEM Education at NSF shared about active awards on rural topics in nonmetro locales. EDU has 758 active awards with rural as a topic of interest or in a nonmetro locale. Dr. Rook was also able to share which programs fund the most rural projects (nonmetro or rural topics of interests).

After hearing from the panel, the following is what the AC discussed:

- A focus on the Demographic Cliff in relation to the CEOSE report concerning labor and workforce issues in rural locales. Dr. Dobbins shared how the prevailing date is 2025 for markedly lower enrollment in schools with implications for funding, capacity, etc. AC members were also interested in growing Hispanic populations in rural America and how these might also intersect with the pathways approach. The CEOSE identified how programs that involve families as one way that the demographic cliff may be addressed.
- Moving from pipelines to pathways. Specifically, there were discussions about additional costs of shifting to pathways. The CEOSE report did not explore these costs.
- The AC was thinking about partnerships as important contributors to workforce opportunities and success for rural communities. Examples of partnerships might focus on dual enrolment programs, counseling for partners, broadband technology expansion that can facilitate partnerships.
- AC members also thought about the role of AI and the intense resources needed to take advantage of AI (e.g., broadband) [environmental burdens of AI were also considered in later

sessions]. AC members also brought up the differential access across intersecting demographics and how attention needs to be paid to equity.

- The AC thought about how clustering might happen in rural spaces where partnerships happen. Thought was given to the roles industry/employers, K-12, community colleges, and universities might play in changing an ecosystem for a generation or more. Especially important was a consideration for local thriving in ways that thinks about bioregional thriving with some levels of sovereignty, so that rural spaces are thought of as hubs of place-based thriving.
- AC members thought about how long-term trusting relationships with rural communities are potentially in tension with shortened funding cycles (3-5 years).
- The AC thought about inequities in place and race in connection to rural communities. A push was made for thinking about our youngest learners and their families as a foundation for this work in and with rural communities. Post-COVID and other influences (e.g., increased screentime) require more than a focus on access to information and instead suggest a need for counseling, mentoring, and relationships.
- AC members thought about issues and questions (i.e., research questions) beyond implementation, like 'What does STEM mean in rural areas?' or 'What technologies are important for rural communities?'

Session 2: Voices from the Field – The Impact of EDU Investments

Dr. Roz Hobson Hargraves moderating a session focused on existing NSF projects and investments in rural communities.

Dr. Robertha Richardson shared about their work with the Harvest Dreams: Living Learning Lab. They are faced with the realities of under-resourced environments (e.g., internet, transportation, curricular). Sharing visions of what STEM education looks like in a rural community - challenges include, among other things, access to mentors/expertise.

Jack Pakkerbier, a mechanical engineer and master's student at Kansas State University, shared his research focused on rural resource resiliency, especially focused on water retention and how funding from NSF supported his opportunities in graduate school.

Mary Eldredge Sandho, a biology teacher in rural North Dakota, talked about the Planting Science Program from the Botanical Society of America with her sophomore biology students. Students are supported by a student-teacher-scientist partnership to design and carry out their own investigations. Students are supported long-term by a practicing scientist.

TJ Jacobs is an undergraduate at Penn-West benefiting from the NSF S-STEM program. TJ got interested in STEM education through extra-curricular programs (e.g., robotics) in Phoenix. TJ saw the disparity in resources when moving to NC where his rural school was underfunded. The opportunity associated with the S-STEM program TJ could complete his undergraduate degree.

Maria McNamara and Elder Don Charlie at University of Alaska Fairbanks shared about their project focused on Drone Research and Opportunities for Native Elementary Students. Sought to engage learners with cutting-edge technologies in place-based learning (e.g., salmon, erosion,

traditional harvest area). All curriculum incorporated science, culture, and language, while they introduce careers and provided visions for connecting drones with culturally important projects.

Jonathan Townes from Hinds Community College (two campuses, one of which is HBCU) shared about their STEMulating the "M" in STEM focused on increasing math students' math scores on ACT and college level courses. Sought to streamline students from HS into college algebra to successfully complete in two years with possibility of transfer to four-year institutions.

Blais Cross - Noyce Teacher fellow from University Arizona Noyce Borderland Master Teacher Fellowship. Blais works with transnational students [and teachers] among others. Works to make the math relevant for students to build their math identities. Benefits from professional learning opportunities offered by NSF Noyce and other NSF supported funding.

The following represents AC reflections and discussion based on what was shared:

- The AC was grateful to hear about the influence of NSF investments on the ground around the US for teachers and students.
- AC members wanted to know how teachers make space for NSF related partnerships.
- One AC member wanted us to contemplate how opportunities that work well locally (e.g., supporting teaching mathematics for social justice) run into political turmoil at larger scales (e.g., California state working to build mathematics identities) and how NSF could work to support those navigating these tensions.

What caught our attention from voices in field?

- Mathematics (and STEM) connected to worthwhile student pursuits within a context
- How morality intersects with the identity of the students

Any common themes in presentations?

- There is a foundation of care for students and interacting with communities.
- Altering trajectories - financial and relational resources help shift trajectories - direct financial supports to students and teachers matter. Community trajectories also change.
- Appreciated the asset orientation toward rural communities.

How can EDU better capture and communicate this impact?

- How do we move past only aggregative metrics to get at impact (that potentially invisibilize the impact on the ground) capture important facets of NSF's investments?

Additional Questions AC members ask:

- What does going past these individual stories look like?
- How do we create frameworks for different school systems and communities?
- Can EDU think of ways to bring together rural PIs for idea exchanges?

Session 3: Principal Investigator Panel - Rural STEM Education and Workforce Development

Luis Cubano moderated the panel made up of the following presenters:

Dr. Cherise Harrington, NC Central, PRO STEM project focused on key contributors, barriers, to STEM coursework and degrees for rural students and students of color. Biggest need - qualified STEM educators in high school. Familial relationships to STEM professional and self-efficacy/recognition mattered. Looking for where and when to intervene.

Dr. Justin McDaniel, Southern Illinois University, supporting transition for military veterans. Only 7% of veterans nationally involved in STEM occupations. Rural veterans 50% less likely to pursue STEM. Project seeks to microcredential veterans using R-studio for machine learning.

Dr. Amanda Bastoni - rural New Hampshire (UNH and CAST collaborative). Trying to learn about why students in resource extraction communities don't pursue STEM. Can outdoor recreation be a context for students to learn STEM (free-choice learning experiences). Co-researching with middle and high school students. Use youth interests and rural assets.

Dr. Dana Franz - Teacher candidates intention to teach in rural school. Noyce Track 4 - 14 rural state universities (Mississippi State & Texas A&M as lead institutions). Working to understand what it means to teach in a rural school. How do rural EPPs address rurality? Contexts of rurality is varied. Little happening in TE programs focused on teaching in rural settings.

Dr. Sue Ann Heatherly - West Virginia NSF Includes Alliance - Improve the persistence of first-generation STEM students in their state. Most of West Virginia is sparsely populated (non-urban). Identified clusters of rurality. Improvement in persistence in STEM when participating in change ideas developed as part of their NIC driver diagram work.

During Q&A with the AC, the following questions and discussions emerged:

- AC members wondered about what is being noticed about outdoor experiences and how this might correlate with persistence in STEM.
- Questions emerged related to placements for micro-credentialing for military veterans, especially related to the demand for those earning credentials.
- The AC wanted to identify which NSF programs were most appealing for research in rural settings. Responses to this were widely varied with researchers sharing several funding programs (e.g., ITest, AISL, and others)

AC Discussion Questions:

What research questions simply need to be conducted in rural or remote environments?

- How are rural students identifying or moving toward STEM career aspirations?
- How do we train and prepare rural educators?

What information did we hear that might have compelling implications for STEM education practices for rural and remote communities?

- STEM education practices are understood uniquely in the community were taken up
- Thinking about toolkits from improvement science and collections of change ideas that have proven useful and can be potential starting points for others.

What can EDU do to increase adoption of research findings into practice, particularly in rural and remote communities?

- Remote work opportunities can be pursued at the same time as opportunities for local partnerships in place.
- Having local school partners as part of research teams
- Sharing one-pagers about projects to communicate ideas and resources.
- Looking for bi-directional relationships between researchers and schools/teachers/communities to inform research and change in rural settings
- Are there opportunities for regional convenors to set up networks of speakers? If so, who is the target or changemaker?

Session 4: Breakout Discussion - Unleashing Opportunities in Rural and Remote Communities

Scribes assigned for each breakout room and presented in Session 6.

Day 2 - 5/30/2024

To start Day 2. The minutes from the Fall 2023 meeting were approved.

Dr. Okhee Lee shared about CEOSE's activity. Here is a summary of 4 thoughts Dr. Lee shared from the CEOSE about rural STEM education: 1. The Executive Summary of the CEOSE report on Rural STEM highlights that NSF's only program focused solely on rural education was the Rural Systemic Initiative (RSI) from 1994 to 2008, indicating a lack of systematic attention to rural education since then. 2. The RSI aimed to improve STEM K-12 education for five ethnically concentrated rural populations, suggesting an intersectionality between rural education and racial/ethnic groups and helping to conceptualize rural communities and education without overgeneralizing. 3. The Rural STEM education report is significant to EDU, noting EDU activities starting with the RSI and suggesting NSF's leadership potential in enhancing K-12 student participation and showcasing rural talent in science and workforce diversity. 4. The report emphasizes place-based learning and community involvement, aligning with science standards adopted by 49 states that encourage students to explain phenomena and solve local, relevant problems, thus promoting local phenomena and community-based STEM education.

Session 5: Rural STEM Education and Workforce Development Across EDU Divisions

This sessions allowed the AC to hear from the NSF Division Directors regarding which programs are in their divisions and rural projects within their portfolios.

Dr. Monya Ruffin - DRL on Formal & Informal Settings. Rural portfolio projects - 135 topic, 16 locale, 14 overlap.

Dr. Jessie Dearo - Equity for Excellence in STEM (EES). Rural portfolio projects - 33 topic, 84 locale, 16 overlap.

Dr. Jennifer Ellis - DUE. Rural portfolio projects - 178 topic, 128 locale, 104 overlap.

Dr. Jackie Huntoon - DGE. Rural portfolio projects - 19 topic, 30 locale, 1 overlap

Questions and Reflections by AC members:

What is most notable in what was shared?

- All directorates have projects they could point to, yet it was unclear if there was a framework or set of commitments that guided the collective impact or offer an overarching focus of rural projects. Dr. Moore shared how budget appropriations cycles limit focus over multiple years.

Anything you were hoping to hear that you didn't.

- An AC member shared how it might be beneficial to have a synthesis arm of rural STEM education - a remark was made about how synthesis can be transformative as work is done to think across projects already funded. A resource center was suggested. Another AC member suggested how a landscape scan over projects could help set/reset priorities.
- There was interest in a synthesis report from the decade's old rural systemic initiative.
- There was hope of hearing about how a framework like improvement science or another common theoretical framework could be used for making meaning across projects. An AC member shared how a NIC has supported the mathematics education to work across clusters toward common aims).

Session 6: Pulling It All Together to Unleash Opportunities in STEM Education

Dr. Monya Ruffin served as moderator of the session. The session was dedicated to pulling it all together and involved reporting out from the 4 Breakout Rooms from Session 4 on Day 1. The following is a synthesis of the themes shared across these rooms:

What did we hear today that made us excited?

- Excitement about the impact stories from NSF programs/investments (NOYCE, S-STEM)
- Hope inspired by hearing from students and Principal Investigators (PIs)
- Impressive number and range of hyper-local projects with potential global impact
- Enthusiasm for the prospect of a Network Improvement Community (NIC) for rural project collaboratives
- Recognition of the rich work being done in rural spaces and the diversity of partnerships representing students in culturally sustaining organizations
- Observation of the changing role of institutions, including museums, zoos, and libraries
- Discussion on the evolving purpose of STEM education, from preparing for the future to preparing for uncertainty and unimagined worlds.

What are the grand challenges for which EDU needs to attend to assure we unleash opportunities in rural and remote environments for STEM education and workforce development?

- Demographic shifts: STEM teacher demand exceeds supply
- Prepare rural teachers; connect STEM to local issues

- Housing subsidies for STEM teacher retention
- K-12 career awareness
- Complexity of rurality
- Broadband expansion imperative

What role might partnerships play in our approach to Rural STEM Education and Workforce Development?

- Partnerships at multi-levels, including support for students and workplaces receiving rural graduates
- Valuing each partner's expertise, such as recognizing teachers as experts
- Partner diversity, including culturally sustaining organizations in rural communities
- Partnerships fostering new narratives about the value of higher education
- Faith communities as committed partners advocating for community priorities
- Balancing industry helping identify STEM job competences supportive of industry need with dual role of education for supporting students to interrogate/critique and experience the joy, wonder, and beauty of STEM

What education and workforce development approaches should EDU prioritize?

- Establish a research center that values multiple voices and provides resources for students and initiatives
- Invest in diverse pathways beyond traditional pipelines, including scalable projects and rural retention
- Support transitions between grants to sustain long-term partnerships
- Explore the potential of a NIC to enhance rural STEM education
- Emphasize cross-program collaboration across educational levels for horizontal integration
- Propose NSF Principal Investigator (PI) meetings focused on rural education
- Consider alternative funding model strategies (e.g., DoD, Philanthropic)
- Prioritize the voices and possibilities for teachers and students
- Connect educational pathways (K-12, informal, 2-year, 4-year programs, industry partners) for STEM careers
- Increase legislator awareness of rural STEM education and workforce development efforts
- Address barriers within NSF to create supportive STEM education and workforce development ecologies
- Develop incentivization models for recruiting and retaining STEM teachers in rural areas
- Leverage community partners, like faith-based organizations, for establishing partnerships based on existing trust and values
- Fund solutions while ensuring research informs approaches to such foci as rural infrastructure and curriculum development

Meeting with Office of the Director

The AC shared the following recommendations which Becky Wau-Ling Packard helped the AC synthesize with Dr. Karen Marrongelle:

3-5 Recommendations for COO

1. Create, communicate, and distribute widely a public-facing document that synthesizes and shares NSF's investments, research findings, and impacts in rural STEM education, building on the CEOSE report.
2. Consider the creation of a collaborative resource center focused on rural STEM education, that has a broader scope of membership including local community groups (e.g., tribal councils).
3. Create stronger infrastructure and sustainability mechanisms, such as collaborating with funders, for long-term support of effective projects, collaborations, and resilient communities. Convene NSF-PIs who focus on rural STEM education to create community and impact.
4. Identify, invest, and fund long-standing community partners important in gaining trust and collaborating rural STEM education. This includes investigating different models and technologies that effectively influence teacher preparation, recruitment and retention in rural communities (e.g., housing and childcare) and resource these through grant structures such as grant supplements and longer-term grant timelines. Authentic change is a long-term process.
5. Continue to invest in educational research that focuses on rural STEM education with tracks in an RFP and consider additional models and/or partnerships with other funding agencies in this space.

The AC also developed and engaged Dr. Marrongelle in discussion of the following question:
3-5 Questions for COO

1. How is EDU ensuring their investments are reaching diverse rural populations in light of anti-DEI legislation at the state level?
2. How do you see EDU's role in seeing rural STEM Education as a systemic issue, and what is NSF doing to connect on this across Divisions in EDU internally, across other directorates at NSF, and other government agencies to impact rural STEM education?
3. In recognizing diverse assets and expertise, how can NSF involve more stakeholders such as teachers, industry leaders, community members and students so they can advocate for their needs, passions, and communities?
4. How can NSF be more strategic in preparing youth for grand challenges associated with change - i.e. environmental change, workforce related skills, and their perceptions of social instability?

Closing Session/Round

The advisory board expressed a new/renewed appreciation for rural STEM education and rurality. Voices from the field inspired AC members. In fact, there was a desire to hear back from the voices in the field five years from now. AC members expressed a commitment to going back into their own communities to learn more about rural-focused work in their communities. The AC appreciated the value of thematic meetings, like this one focused on rural communities. NSF presented itself as a learning organization through how the AC was engaged. EDU is the connective tissue supportive of rural STEM education across all of NSF.