

SD EPSCoR RII-Track 1 Proposal Development
Notes from Planning Kick-off for Broader Impacts

Date: January 23, 2023

Broad Impact Components of Existing SD EPSCoR RII

- K-12 Teacher Workshops, Curriculum Modules, Education Research
- Undergraduate Summer Institutes at TCUs
- Undergraduate Research Assistantships
- Dakota Seeds Internships (partnered with GOED)
- Science communication training
- Learning about indigenous cultures

Science & Engineering Topics of New Proposal

- Topics with high potential for broader impacts
 - o Climate change and greenhouse effect
 - o Weather and climate
 - o Soil
 - o Earth system cycles: Carbon cycle, water cycle, nitrogen cycles
 - o Computer science, computational thinking, machine learning, artificial intelligence, robotics
 - o Technology for precision agriculture
 - Measurement of soil properties
 - Application of fertilizer
 - o Genetically modified crops
- Ties to South Dakota's K-12 Science Standards (current version is 2015)
 - o Earth's systems
 - o Earth and human activity
 - o From molecules to organisms: structures and processes
 - o Biological unity and diversity

Potential Audiences

- K-12 students, teachers, and preservice teachers
 - o Early Elementary (kindergarten through 2nd grade)
 - o Upper Elementary (grades 3 through 5)
 - o Middle School
 - o High School
 - o Teacher Leaders
- Undergraduate (research experiences and also perhaps college curriculum)
 - o STEM majors
 - o STEM Education majors
 - o All students
- General Public
 - o Rural and tribal communities
 - o South Dakota citizens, including community science
- Historically under-served and under-represented audiences within STEM
 - o Blind and visually impaired
 - o Other disabilities
 - o Rural and tribal communities

Possible Teacher Supports

- Deepening teacher content knowledge
- Strengthening pedagogy
 - o Meeting the needs of all learners
 - o strengthening students' sense of belonging within STEM
 - o connecting instruction to place
 - to frontier STEM research in South Dakota
 - to local area
 - o Ambitious Science topics that haven't been covered yet...
 - Making claims and creating evidence-based explanations
 - Analyzing and interpreting data and student assessment
- Building capacity of teacher leaders

Possible Components of New Broader Impacts Plan

- K-12 Teacher Workshops, Curriculum Modules, Education Research
 - o Focus on the new science and engineering
 - o Focus on indigenous STEM
 - o Focus on teacher leadership
- Undergraduate Summer institutes at TCUs
 - o Possible connections to the science and engineering of new proposal
 - o Stronger connections with EPSCoR scientists and engineers across campuses
- Undergraduate Research Assistantships
 - o Support of scientists and engineers in being good mentors
 - o Include teacher education majors
- Dakota Seeds
 - o Working well, continue
 - o Includes a focus on entrepreneurship, which NSF appreciates
- SD EPSCoR Seed Grants
 - o Expand Seed Grant Program
 - o Emphasize that broader impacts-related proposals are encouraged.
- Science communication training
- Learning about indigenous cultures and tribal values
- Expand to serve: blind students

Ideas and Resources from 1-23-2023 discussion:

- Ancestral knowledge and ecological knowledge within tribal communities. Indigenous communities were first scientists.
- Interest in STEM wanes by 6th grade.
- Dr. Amy Dolan at NSU has education research data related to the power of curriculum modules in combination with teacher workshops.
- Incorporate indigenous science into curriculum
- More involvement of scientists within broader impacts
- Todd County School District and SD Discovery Center have worked together on indigenous curriculum modules.
- SciComm – science communication training for scientists
- Connect STEM curriculum to indigenous worldview.

- Earth systems and the conservation of energy and matter are consistent with indigenous worldview
- Consider students' science identity, western vs. indigenous worldview, traditional knowledge
- USDA has existing education resources related to soil. SD Discovery Center has soil education grant from USDA.
- Help students to develop a coder mindset (relates to computer programming)
- Virtual reality (VR) is powerful tool for connecting K-12 classrooms with STEM labs on university campuses. Suitcase of 24 VR headsets can be sent to schools. Price point has become affordable (a few hundred dollars per headset).
- CybHer program at DSU has pivoted to serving wider swath of program (not just female students) and younger. Boys & Girls Club model. Could develop curriculum relevant to next track 1. Integrate technology and work with K-12 technology teachers.
- Integrating computational thinking into science and math at the elementary grades is a powerful tool that doesn't ask teachers to find more time in the school day. Pilot project exists west-river that could serve as model and be expanded.
- Consider supporting high school computer science. Identify strong curricular materials that already exist, consider development of locally-relevant module. Could also potentially create connections to the science and engineering of EPSCoR project. Support high school computer science teachers.
- Think about integration of STEM (not stand-alone silos of science and math and engineering and technology).
- Help teachers to use "phenomena" (locally relevant) in instruction.
- Connect to local science, backyard, place-based
- Data sovereignty – who owns the data. Get the data to local communities that are impacted. Make science locally relevant.
- Current EPSCoR curriculum modules start at 3rd grade. Consider going younger.
- Backyard science. Science is for everyone. Eliminate fear of science.
- What Does Success Look Like in 5 Years:
 - o "Science-capable" identity for students, teachers, and pre-service teachers
 - o Connections to place
 - o Building of teacher leaders (leveraged within current Track 1)
 - o Coordinating STEM resources for teachers (EPSCoR as a repository or teacher resource, curation of resources, connector to local science and local education resources; could be a chatbot)
- SD Discovery Center participates in GLOBE Program (Global Learning and Observations to Benefit the Environment). It could be helpful resource. Funded by NASA and other federal agencies.
- Creating curriculum is very time intensive. Don't underestimate time involved in creating high quality curricular materials.
- Helping teachers to create curriculum for their own classroom is easier than creating curricular materials to disseminate more broadly.
- Connect curriculum to SD K-12 Standards (science, math, technology)
- SD EPSCoR can support faculty in writing grant proposals to any agency. What would be most helpful along those lines?

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