



CENTER FOR SCIENCE, MATHEMATICS AND COMPUTER EDUCATION

CSMCE Strategic Plan effective January 1, 2024

The Center for Science, Mathematics and Computer Education (CSMCE) at the University of Nebraska–Lincoln fosters education research in science, technology, engineering, and mathematics (STEM) fields and supports efforts to improve the equitable teaching and learning in STEM in PK–16.

Administratively, the CSMCE is part of the College of Arts and Sciences and collaborates closely with the College of Agricultural Sciences and Natural Resources, the College of Education and Human Sciences, and the College of Engineering. The CSMCE builds upon the research strengths of faculty in discipline-based education research (DBER) and serves as a focal point for Nebraska-based faculty and external collaborators to engage in interdisciplinary collaborative outreach projects with PK–12 educators.

The center's staff and administration currently comprise a director (Dr. Wendy Smith), associate director (Dr. Erin Ingram), events and outreach specialist (Mike Bergland-Riese), project coordinator (Meghan Leadabrand), and research scientist (Dr. Rachel Funk). Numerous science, mathematics, and PK–16 STEM education faculty members are affiliates of the CSMCE and are listed on the website, as well as specific grants and projects: <https://scimath.unl.edu>.

The CSMCE is engaged in multiple research projects that fall under three target areas. They are:

1. Fostering equitable STEM education research across PK–16 formal and informal contexts.
2. Providing STEM professional development for PK–16 educators.
3. Building co-equitable, productive, and sustainable partnerships between higher education and PK–12 settings.

More specifically, the CSMCE has five aims that align with the goals of the University of Nebraska–Lincoln. An intentional focus on diversity, equity, and inclusion (DEI) pervades all of the CSMCE's work, and thus DEI is not a separate aim but is instead woven into all of the aims. As our mission, outreach, and research evolve, these aims are also subject to change.

Alongside this strategic plan, the CSMCE has set a goal to become part of the regular rotation of program evaluation, comparable to Academic Program Review for departments, with an anticipated review start date of 2027.

Aim 1: Provide innovative experiences for students and educators to be lifelong learners and contributors to the STEM workforce.

The growth and sustainability of experiential learning and professional development programs in STEM for PK–16 students and educators (both formal and informal) are core focal points for the CSMCE. The center's personnel strive to ensure these opportunities are accessible to non-traditional students (among both undergraduates and graduate students), part-time graduate students (such as PK–12 teachers), and transfer students. Our common goal is to support more students to succeed in STEM careers, as well as in secondary to post-secondary education pathways. The CSMCE supports and promotes graduate and undergraduate student engagement in STEM education research as experiential learning opportunities, with the goal to apply principles of education research to funded projects and data.

Some of our grants promote the use of technology to educate learners more effectively and research practices that enable students and educators to improve their well-being. Our professional development for PK–12 teachers and informal educators also provides opportunities to engage UNL graduate students in the instruction of those courses.

A critical upcoming project will be to develop and coordinate professional learning opportunities for K–12 computer science education to meet the needs of Nebraska teachers, particularly as the state implements additional computer science graduation requirements. CSMCE leaders and faculty also will discuss the creation of virtual professional learning communities for practitioners and a resource hub for those communities.

Aim 2: Foster STEM education research in PK–16 and a culture committed to supporting and increasing the application of research and creative activity.

STEM education research (i.e., DBER) has the potential to support critical transformations in the United States, where the current educational system results in highly inequitable student outcomes. More research is needed to better understand how to improve inclusive practices and thus the educational culture, and to flatten differential power dynamics, and disrupt beliefs in ways that lead to improved diversity, equity, and inclusion in STEM education. Critical transformations involve changing the underlying inequitable systems, beyond simply tweaking the current systems. Research findings on effective and equitable STEM teaching and learning in formal and informal settings will be disseminated to influence best practices. Thus, research can be a critical bridge to study not just what better education practices are, but how to connect research with effective practices.

The CSMCE will increase visibility of UNL DBER and STEM education-related efforts and grants, as well as develop diverse researchers, scholars and staff and provide them with strong institutional and community support. In particular, the CSMCE will mentor faculty, graduate, and undergraduate researchers new to the field of STEM education research and the DBER community. Such activities can position faculty for increased grant-writing effectiveness and support outreach efforts outlined in projects. Specific services the CSMCE can provide to all UNL STEM education researchers include (some staff support may be charged an hourly fee):

Pre-award services:

- Discuss potential STEM education funding opportunities: contact Wendy Smith
- Help align proposal with educational or broader impact expectations: contact Wendy Smith
- Help design an educational research plan: contact Trish Wonch Hill
- Help design an evaluation plan: contact Trish Wonch Hill
- Provide IRB templates for education research: contact Wendy Smith
- Provide copyediting on STEM education grant proposals (or journal articles) before submission: contact Meghan Leadabrand

Post-award services:

- Recruit participants into educational/outreach activities: contact Erin Ingram
- Helping implement or leading the evaluation plan: contact Trish Wonch Hill
- Contributing to manuscript writing: contact Rachel Funk
- Event planning and web design: contact Michael Bergland-Riese
- Project management: contact Meghan Leadabrand or Rachel Funk

- Provide copyediting and print-ready figures for project products: contact Meghan Leadabrand

Request CSMCE services using this form: <https://go.unl.edu/csmce-request>.

CSMCE leaders and faculty will explore the creation of workshops for those interested in submitting projects addressing DEI, a lecture series or reading seminar about critical work in DEI, and informal methods of mentorship among STEM education researchers.

Aim 3: Value interdisciplinary work and embrace collaboration to address critical educational challenges.

The CSMCE prioritizes diversity of perspectives, approaches, and backgrounds when solving challenges. As an inherently interdisciplinary center, our position outside of a single department helps us to support such collaborations across STEM fields and with the social sciences. The CSMCE provides support to DBER faculty and others engaged in STEM education improvement efforts focused on research and/or outreach. The CSMCE's commitments to specific projects and activities in any given year are based upon the initiative of interested faculty, and we seek to provide support and connections to all such STEM education research activities.

The CSMCE is a key connector among professional networks on campus, helping to connect researchers to one another and to potential collaborators across PK–16 settings. The CSMCE will continue to partner with departments in CAS, CEHS, COE, and CASNR to support departmental change to improve equitable student outcomes in higher education. The CSMCE has expertise in both research and practice to support the cultural and structural changes that initiate, enact, and sustain positive changes to attend to issues of equity in teaching and learning.

STEM education is a field with many pressing challenges, and transformational changes are needed to alter the inequitable educational systems in the U.S. Evolving technologies such as the rise of artificial intelligence also require ongoing research about their appropriate and ethical uses in education and education research. CSMCE leaders and faculty will pay particular attention to the creation of events, forums, or professional development for DBER faculty that will address critical challenges and DEI. The CSMCE also can provide resources as well as institutional change coaching to support departmental efforts. The CSMCE will offer a series of workshops, some in cooperation with the Center for Transformative Teaching, to promote institutional change and support those engaged in equity-focused changes.

Aim 4: Foster co-equitable, productive, and sustainable partnerships in STEM education.

Our goal is to establish and nurture strong, consistent interactive communication with interested and invested groups, facilitating research and learning collaborations. The CSMCE will broaden conceptions of who is included in STEM, to extend partnerships to sociology, extension, agricultural leadership, and other social sciences.

The CSMCE will use available and seek new resources to promote engagement responsive to Nebraska needs in STEM education research and outreach that align with the overall CSMCE mission. We acknowledge that healthy co-equitable partnerships are nurtured over time, and the CSMCE will seek to deepen existing partnerships by adding professional connections, as well as developing new partnerships within the community (e.g., Lincoln STEM Ecosystem, facilitating job shadowing). Co-

equitable partnerships also need specific attention to historic (or current) power imbalances, such as the relative status of instructors at associate's degree-granting bachelor's degree-granting colleges. The CSMCE will continue to nurture and deepen relationships with other Nebraska higher education institutions, particularly around supporting STEM transfer students across associate's and bachelor's degree-granting colleges.

The CSMCE will continue to have a productive relationship with Nebraska Extension, meeting approximately quarterly to discuss ongoing projects and overlapping interests. The CSMCE will connect PK–12 teachers, informal educators, and schools with relevant Nebraska Extension projects to advance STEM literacy through teaching and learning in Nebraska schools and continue the Nebraska Math and Science Summer Institutes.

Aim 5: Provide access to professional development and equitable teaching and learning opportunities for pre- and in-service PK–12 STEM educators.

The CSMCE will work with departments and Nebraska education agencies (e.g., service units, districts, department of education) to coordinate professional development needs, opportunities, and interests, with a purpose of providing ongoing opportunities for PK–12 teachers to expand their repertoire of STEM education practices. A key fundraising goal of the CSMCE is to continue efforts with the Nebraska University Foundation to secure funding for teacher tuition fellowships to sustain and grow the Nebraska Math and Science Summer Institutes.

The CSMCE will also partner with state organizations (including the Nebraska Association of Teachers of Mathematics [NATM], the Nebraska Association of Teachers of Science [NATS], the Nebraska Educational Technology Association [NETA], and the Nebraska chapters of the Computer Science Teachers Association [CSTA]) to coordinate professional development opportunities in STEM, including effective and equitable teaching practices, curriculum design, and formative and summative assessment practices. The CSMCE will continue to connect PK–12 teachers and university faculty to co-create and co-lead professional development opportunities (including graduate courses) to provide rich experiences that attend to both research and practice. The center's outreach staff will build relationships with the K–12 administrators who manage the professional development resources in schools and districts and introduce them to UNL DBER faculty for potential partnerships.

CSMCE leaders will explore the best practices for professional development opportunities in a variety of formats, from formal graduate courses to seminars, workshops, and conferences, and how the center can foster support systems among educators. As the new UNL data science major is launched, the CSMCE will work with the data science program to create appropriate professional development opportunities for K–12 teachers to also learn about data science in ways that can translate to K–12 classrooms and students.