



**Maine Center for Research in STEM Education
(RiSE Center)
Annual Report
July 1, 2018 – June 30, 2019**



Front cover photos from left to right:

Row 1:

- A. RiSE faculty and staff celebrating RiSE Director Susan McKay's receipt of the Presidential Award for Public Service in May 2019, with UMaine President Ferrini-Mundy, at the faculty luncheon. Photo credit to Brian Roth.
- B. Recipients of the Master of Science in Teaching Outstanding Graduate Award, Bryn Keenhold and Laura Millay, with RiSE Director Susan McKay at the RiSE Graduation Celebration in May 2019. Photo credit to Deborah Shulman.
- C. The Advisory Board for the RiSE Center's NSF-funded STEM+C project posing for a photo after a 2-day meeting in December, 2018 to discuss plans for the grant. Advisory Board members include faculty from UMaine, USM, and institutions outside of Maine as well as representatives from the Maine Department of Education and from Maine non-profit organizations. Photo credit to Maureen Raynes.

Row 2:

- A. National Science Foundation Teaching Fellows, mentors, program staff, and program evaluators pose in front of the sculpture at Schoodic Institute after a successful 2.5-day retreat in June, 2019. Successes at the retreat included plans for enhancing program mentorship, building community among Fellows and mentors, and formation of working groups to support professional growth for Fellows and mentors. Photo credit to Laura Millay.
- B. NSF Teaching Fellows collaborate during the first Fellows and mentors retreat in June, 2019. Photo credit to Laura Millay.
- C. Master of Science in Teaching students collaborate during a meeting of the RiSE Interdisciplinary STEM Education Research Group. Photo credit to Deborah Shulman.

Row 3:

- A. Teachers and university faculty collaborate to develop science modules integrated with computer science for middle school students during a STEM+C Cohort meeting in May 2019.
- B. Third graders at Great Salt Bay Community School learn about the life cycle of a pumpkin in the classroom that is partnered with the Maine STEM Partnership, a research-practice partnership convened by the RiSE Center. UMaine Today ran a story in 2018 featuring the work of the Maine STEM Partnership to improve K-12 STEM education in Maine. Photo credit to Holland Haverkamp.
- C. Master of Science in Teaching student Emma Toth defends her thesis focused on the transition from high school to first year of college for STEM students. Photo credit to Deborah Shulman.

I. EXECUTIVE SUMMARY	1
MAJOR ACCOMPLISHMENTS.....	1
HIGHLIGHTS.....	2
II. SERVING MAINE AND BEYOND	2
COMMUNITY ENGAGEMENT	2
ECONOMIC AND WORKFORCE DEVELOPMENT	2
ONE UNIVERSITY INITIATIVES.....	3
III. FINANCIAL STABILITY	3
RESEARCH FUNDING	3
CONTRACTS.....	3
PRIVATE GIVING / FUNDRAISING	3
PROFESSIONAL DEVELOPMENT/MENTORING OF FACULTY AND STAFF.....	3
FACULTY AND STAFF ACHIEVEMENTS	4
INNOVATIVE PROJECTS	5
V. STUDENT ENGAGEMENT, STUDENT SUCCESS.....	5
STUDENT RESEARCH, SCHOLARSHIP, OR CREATIVE ACTIVITIES	5
STUDENT FUNDING.....	5
STUDENT AWARDS	5
STUDENT PRESENTATIONS AND PROJECTS.....	5
VI. PRESERVING-RESTORING INFRASTRUCTURE.....	5
VII. ANTICIPATED CHALLENGES/NEEDS.....	5
VIII. NEW INITIATIVES	6
IX. INTERNAL OR EXTERNAL CENTER / INSTITUTE REVIEWS	6
APPENDIX I. RISE ANNUAL REPORT TABLES, 2018-19.....	7
APPENDIX II. RISE GRANTS SUBMITTED OR AWARDED IN 2018-19.....	8
APPENDIX III. RISE GRANTS CONTINUING IN 2018-19	14
APPENDIX IV. RISE CENTER STAKEHOLDERS	20
APPENDIX V. COURSES OFFERED BY THE RISE CENTER JULY 2018 – JUNE 2019.....	23
APPENDIX VI. STEM+C GRANT PERSONNEL.....	24
APPENDIX VII. GRAPHIC SUMMARY OF RISE CENTER WORK	26
APPENDIX VIII. MAP OF THE MAINE STEM PARTNERSHIP’S SCHOOL DISTRICT PARTNERS.....	27
APPENDIX IX. RISE PUBLICATIONS, 2018-19	28

RiSE Center Annual Report, 2018-19

I. Executive Summary

Major Accomplishments

The Maine Center for Research in STEM Education (RiSE Center), with its twenty faculty members, over thirty graduate students in the Master of Science in Teaching (MST) Program, and seven professional staff, has had another outstanding year of research productivity, with twenty-eight refereed journal articles and conference proceedings published or accepted for publication and over 112 research presentations at conferences and other venues. Graduate and undergraduate students are integral to the center's research and, in the past year, five Master's theses, two doctoral theses in discipline-based education research, and 37 honors theses and senior capstone research projects were completed mentored by RiSE faculty members. Five MST degrees were awarded through the RiSE Center. In addition, RiSE faculty are Principal Investigator or Co-Principal Investigator on ten new and twenty-six continuing grants totaling over \$14.5 million. RiSE personnel supported submission of over \$40 million in new grant funding proposals in the past year.

The RiSE Center has continued to take important steps to sustain and enhance the Maine STEM Partnership at the RiSE Center, with over 500 Maine science and mathematics teachers actively attending extensive professional learning opportunities in the past year. These opportunities were supported by one new and one continuing grant, contributions totaling over \$85,000 from school districts, and major donations totaling more than \$200,000. The Maine STEM Partnership also includes the Faculty Course Modification Incentive Grant – Maine Learning Assistant (FIG – MLA) Program which, in the past year, involved 23 University of Maine faculty across 14 STEM departments, enhancing 34 course offerings with total enrollment of over 4,800 students across 14 departments. Thus, the Maine STEM Partnership at the RiSE Center continues as a state-wide improvement community for STEM teaching and learning over the grade span PK-16+.

During this year, the prestigious NSF Teaching Fellowship Program, designed to support new science and mathematics teachers from the MST Program as they begin their careers teaching in rural high-need Maine districts, continued with nine of the fellows teaching in high-need districts. Sixteen of the twenty-two fellowship positions have been awarded to date and we anticipate that the remainder will be selected by the Fall. Fellows are supported in their transition from student to teacher by a pool of leading science and mathematics mentor teachers, who are connected with them to provide guidance in all aspects of their classroom practice and their new professional role. The Program held its first retreat for Fellows and mentors in June, 2019 at the Schoodic Institute at Acadia National Park. The retreat provided an opportunity to reflect on the past year, build community between Fellows and mentors, and plan a mentorship structure and working groups to support professional growth for Fellows in the coming year.

The RiSE Center completed an inclusive strategic planning process involving all of the Center's faculty and staff, which culminated in selecting four strategic priorities for the coming year. These are: (1) supporting the RiSE faculty in their STEM education research priorities and pursuits, (2) continuing to enhance our internal and external communications to build the reputation of our Center, (3) providing research-based and evidence-based opportunities for professional learning to STEM educators at all levels of instruction, and (4) increasing organizational efficiency and sustainability. The Center also participated in the University of Maine strategic planning process, including convening, facilitating, and providing a synthesis of two meetings with 20 participants from 9 units across campus to discuss the role of research-practice partnerships in the UM Strategic Plan and the UMS R&D plan. *See Appendix VII for a graphic summary of the RiSE Center's work.*

Our annual Maine STEM Partnership Fall Summit brought 109 participants including K-12 teachers, University faculty, and community partners, in spite of a major snowstorm, to celebrate the accomplishments of the Maine STEM Partnership over the past year. Our eighteenth annual summer conference brought 118 participants to the University of Maine for talks and workshops focused on integrating STEM education research into STEM instruction.

Highlights

- Susan McKay and CoPIs Mitchell Bruce, Jim Fratini, Sara Lindsay, and Harlan Onsrud have received a \$1.25 million NSF STEM+C grant to integrate computing into middle school science teaching and learning. Working with them on this project are 30 middle level science teachers, three Master of Science in Teaching students, and RiSE professional staff members Laura Millay, Elizabeth Muncey, and Marina van der Eb, all involved as a research-practice partnership. This team is designing modules that will be piloted in middle school classrooms across Maine during the 2019-2020 school year. *See Appendix VI for a listing of STEM+C personnel.*
- Justin Dimmel, Assistant Professor of Mathematics Education and Instructional Technology and a member of the RiSE Center, has received a prestigious, nearly \$50,000 Spencer Foundation grant to support research into how students' perceptions of geometric diagrams change when they are able to observe these shapes in higher dimensions and at larger scale, rather than being restricted to the two-dimensional printed page. Additional information is available at <https://umaine.edu/news/blog/2019/04/03/dimmel-receives-grant-to-study-students-perceptions-of-geometric-diagrams-in-virtual-reality-environments/>
- Dr. Balu Nayak, Associate Professor of Food Processing, is the PI on a \$745,465 grant funded recently by the U.S. Department of Agriculture in collaboration with Susan McKay, Laura Millay, and Erin Vinson from the RiSE Center. This grant, "Enhancing Learning Outcomes in Food Engineering and Processing Courses for Non-Engineers Using Student-Centered Approaches", leverages Balu's work in the FIG-MLA Program to work with colleagues across the country (U. of Idaho, Washington State U., Pullman, Iowa State, Virginia Tech, and U. of Kentucky) to redesign an important, common, difficult course for undergraduates.
- RiSE Center Director Susan McKay received the Presidential Award for Public Service for her work to found and build the RiSE Center, with its strong STEM education research focus and state-wide infrastructure to improve STEM education, involving over 2,500 educators in improving STEM education for over 100,000 students across K-16+ instruction.

II. Serving Maine and Beyond

Community Engagement. The RiSE Center continued to expand the Maine STEM Partnership at the RiSE Center, a statewide STEM education improvement community impacting PreK-16+ students in Maine. This community, which arose as a way to sustain and leverage the work of the Maine Physical Sciences Partnership (NSF, \$14 million) and the Maine Elementary Sciences Partnership (Maine Dept. of Education, \$1.7 million), involved over 500 teachers from 104 Maine districts, as well as 55 University of Maine STEM faculty. District partners contributed over \$85,000 to help defray the costs of the Maine STEM Partnership's instructional resources for science classrooms and professional learning for teachers. *See Appendix IV for listing of RiSE stakeholders and Appendix VIII for a map of school district partners.*

Economic and Workforce Development. The RiSE Center contributes to Maine's economic and workforce development through its improvements in STEM education at both the PreK-12 and postsecondary levels. It also recruits, prepares, and works to retain teachers in the STEM disciplines, bringing together new and experienced teachers to benefit from each other's knowledge and experiences. STEM disciplines taught well not only build disciplinary content and practice knowledge, but also support the development of essential workplace skills, such as oral and written communication, problem solving, and teamwork. The RiSE Center is in its fourth year of an NSF Teaching Fellowship Program, which is placing well-prepared science and mathematics teachers in high-need, rural Maine districts. To date, nine fellows have begun teaching in high-need Maine districts, and twelve are placed for the 2019-2020 school year. Providing and supporting these teachers in some of Maine's most economically challenged regions provides significant access to high quality science and mathematics learning in under-served communities. Recognizing the need for future workers skilled in computer science and computational thinking, as mentioned above, the RiSE Center has partnered with middle school teachers

and the UMaine School of Computing and Information Science in an NSF STEM+C grant targeting integrating middle level science with computing. The RiSE Center's annual conference in June 2019 emphasized integrating across the STEM disciplines, including computer science. Offering students opportunities to work across disciplines provides enhanced problem solving and project-based learning experiences. The conference attracted 118 participants, including approximately 85 PreK-12 teachers in the STEM disciplines. The RiSE Center uses Maine sites for its annual summit (109 participants) and annual conference (118 participants). These events require catering, lodging, and hosting of out-of-state presenters in our communities, thus supporting the local economy. This year, the RiSE Center connected with Cianbro's educational leadership, to explore ways that we might collaborate in the future. Cianbro representatives toured the RiSE Center and RiSE members visited Cianbro's education facilities. We anticipate that these early connections will lead to future collaborations.

One University Initiatives. During the past year, the RiSE Center developed a proposal to support professional learning for elementary teachers in mathematics, giving Maine students across the state access to high-quality instruction. This proposal, submitted to Provost Hecker, would involve mathematics educators throughout the UMS and place professional learning coordinators on UMS campuses to provide access for all Maine elementary teachers. These professional learning coordinators would co-design the offerings for teachers, reflect, review, and refine the experiences offered for teachers.

III. Financial Stability

Research Funding. In the past year, RiSE faculty and staff contributed to 23 new proposals submitted for a total of \$40.5 million. Ten new awards were funded for a total of \$6.5 million and 26 awards were continued with total award values of over \$8.3 million, for a total of \$14.8 million (new and continuing). *See Appendix II for grants submitted and awarded and Appendix III for continuing grants.*

Contracts. The Maine STEM Partnership at the RiSE Center developed contracts with 45 districts for instructional resources and professional learning for teachers totaling \$85,135. Janet Fairman, affiliated faculty with the RiSE Center, obtained two contracts from the Maine Legislature totaling \$298,284. In addition, the RiSE Center has an ongoing contract with the Maine Department of Education for sharing of data from statewide testing. Education Commissioner Pender Makin and her staff attended a meeting at the RiSE Center in June, 2018 to discuss possible collaborations for the coming year.

Private Giving / Fundraising. During the past year, the RiSE Center raised a record \$233,860. This year also marked the start of the RiSE Center's first endowment, which targets ongoing professional learning for elementary mathematics teachers. RiSE work also attracted a matching challenge gift (nearly \$30,000 raised; \$60,000 matched) to provide new instructional resources for K-8 science classrooms. Philanthropy officers at the University of Maine Foundation were instrumental in providing connections to potential donors, bringing in significant gifts, and helping the RiSE director and professional staff learn effective fund-raising strategies. RiSE also partnered, for the first time, with Geaghan's Pub and Craft Brewery in Bangor in a fun and very successful fund raising event.

IV. Culture of Excellence

Professional Development/Mentoring of Faculty and Staff. The RiSE Center provides professional development and mentoring throughout our STEM education and research communities. Through the FIG-MLA program, 23 University of Maine STEM faculty receive mentoring from the RiSE Center's education research faculty and staff in using evidence-based course improvement strategies. One of these faculty members (Balu Nayak) worked closely with RiSE Director McKay and RiSE staff (Millay and Vinson) to develop a multi-institutional grant proposal extending his work with the FIG-MLA program; this grant was funded by the USDA and work has begun. Jenn Tyne, recipient of the 2019 Presidential Award for Teaching, has been supported for several years in classroom innovations through the FIG-MLA program. Through the Maine STEM Partnership, both K-12 teacher leaders and University faculty had opportunities to present their classroom innovations and research to colleagues in statewide and national forums. Classrooms of some of these teacher leaders were also showcased through a UMaine

Today news article and video; <https://umainetoday.umaine.edu/stories/2018/whooooa/>. One teacher stated that this was a “once in a teaching career” opportunity to be recognized for his work in the classroom. Professional staff at the RiSE Center have also had opportunities for professional growth and development in the past year, with five staff members presenting at national STEM conferences.

Faculty and Staff Achievements. RiSE faculty members hold leadership positions in professional organizations and are invited participants at many conferences. Their expertise is recognized through national and international collaborations and RiSE research positively impacts the teaching of STEM locally and nationally. *See Appendix IX for a listing of publications.* Additional highlights: **Francois Amar** collaborated on a collaborative project on computer based test taking practice for high-stakes tests in Sierra Leone. **David Batuski** continued modification of AST 109 to a “flipped classroom” model through a FIG grant and introduced elements of this model to PHY 454. **Timothy Boester** developed partnerships with regional schools to bring new research-based pre-calculus materials into high school classrooms. **Mitchell Bruce** continued collaborations with chemistry faculty to introduce Course-Based Undergraduate Research (CUREs) into chemistry courses using assessment and research data from his NSF-funded research project. **Justin Dimmel** was awarded a Spencer Foundation grant to investigate using virtual reality for mathematics teaching and learning. **Janet Fairman** conducted studies and briefings for the Maine Legislature to inform policies on education topics. **Robert Franzosa** completed co-authoring the 4th edition of Rogawski’s Calculus book. **Christopher Gerbi’s** co-authored paper received an honorable mention for the David Elliot Best Paper award, presented each year to an exceptional publication in the fields of tectonics and structural geology. **Elizabeth Hufnagel** modified all science methods courses (both elementary and secondary) offered by the College of Education, to include teaching clinics that enhance partnerships with local schools. **Sara Lindsay** collaborated on two grant-funded projects focused on using research to improve student learning in life sciences in K-12 and at the undergraduate level. **Susan McKay** received the Presidential Award for Public Service for her nearly two decades of work to enhance STEM education research at UMaine and build a strong interdisciplinary community as the foundation for state-wide infrastructure, improving STEM education for over 100,000 students through work with over 2,500 educators, K-16+. **Sarah Nelson** continued to coordinate multiple citizen-science initiatives, served as advisor for 18 undergraduate capstone projects, and was nominated for the UMaine Faculty Mentor Impact Award. **Asli Sezen-Barrie** served on the research committee for the National Association for Research in Science Teaching (NARST) and developed a research podcast, “Communicating Climate Change”. **MacKenzie Stetzer** is currently PI or Co-PI on over \$1.8 million in grants from the National Science Foundation, building on his ground-breaking research into student learning, reasoning, and metacognition in physics. **John Thompson** chaired the American Physical Society Topical Group on Physics Education Research and served as chair of the Nominating Committee. **Eric Pandiscio** expanded his research into the realm of immersive spatial displays and prepared 3 manuscripts on this topic in collaboration with Justin Dimmel. **Franziska Peterson’s** work received a \$100,000 donation to support her K-8 mathematics content immersion workshops for the next 3 years. **Molly Schaufler** co-led a content immersion workshop for K-12 teachers focused on climate change and data literacy in collaboration with Brad Lyons from the Climate Change Institute. **Natasha Speer** supported growth in the FIG-MLA Program, where she mentors faculty in designing and implementing course modifications. **Michael Wittmann** published a journal article extending learning theory to a new physics context using examples from his 20-year professional career.

RiSE professional staff also contributed significantly to the accomplishments of the RiSE Center and its culture of evidence. **Elizabeth Byerssmall** and **Deborah Shulman** collaborated to organize the RiSE Center’s eighteenth annual conference to support integration of STEM education research and teaching. **Laura Millay** and **Marina Van der Eb** collaborated to facilitate strategic planning for the RiSE Center, culminating in a strategic plan, working groups, and contributions to the University of Maine strategic planning process. **Elizabeth Muncney** coordinated instructional resources for over 70 classrooms across 45 school districts, managing hundreds of sets of hands-on science materials to support inquiry-based

instruction. **Maureen Raynes** provided consistent organization for all aspects of the RiSE Center's finances, leveraging her experience to support the RiSE team. **Erin Vinson** coordinated the FIG-MLA program supporting hiring of 105 MLAs and contributing to plans for expanding the program to non-STEM disciplines for next year.

Innovative Projects

The RiSE Center's new STEM+C grant brings together a research-practice partnership to develop strategies and lessons for integrating computer science into middle school science instruction. This project addresses a current need for increased attention to computer science in Maine schools, as well as creating an opportunity for new research into the knowledge and supports teachers need in order to extend their teaching to include computer science. The Center's NSF Teaching Fellowship Program is working to develop innovative models for mentorship and support for new STEM teachers in high-need, rural schools. Justin Dimmel's work, currently funded through multiple grants, focuses on using virtual reality to support teaching and learning in mathematics. MacKenzie Stetzer oversees groundbreaking research, funded through multiple grants, on student learning, reasoning, and metacognition.

V. Student Engagement, Student Success

Student Research, Scholarship, or Creative Activities

Five Master's theses and two doctoral dissertations in education research were completed during the past year by Master of Science in Teaching students and Physics Education Research PhD students.

Student Funding. The RiSE Center's work supported 105 undergraduates in MLA positions across 14 STEM departments and one undergraduate administrative position at the RiSE Center, with a total of \$183,410 devoted to support for undergraduates. The MLA experience has become a common pathway to the MST program and the NSF Teaching Fellowship. Sixteen Master of Science in Teaching students were supported through assistantships and tuition support, for a total of \$93,490.

Student Awards. Master of Science in Teaching Graduates Bryn Keenhold and Laura Millay were co-recipients of the 2019 Outstanding Graduate award for the program. Both students presented their thesis research at the Northeast Education Research Association (NERA) conference in Trumbull, Connecticut in Fall 2018 with faculty member Franziska Peterson. MST Graduate and FIG faculty member Jenn Tyne received the 2019 Presidential Outstanding Teaching Award. MLA Courtney Hatton received the Wallace C. and Janet S. Dunham Prize for academic achievement and overcoming adversity.

Student Presentations and Projects. Seventeen graduate students and one undergraduate student contributed to eleven publications and twenty-six presentations at conferences and professional forums.

VI. Preserving-Restoring Infrastructure (N/A)

VII. Anticipated Challenges/Needs

During its first eighteen years, the RiSE Center has experienced phenomenal growth in productivity, national and international recognition, and personnel. It has developed from a handful of founding faculty advising less than 10 graduate students into 20 faculty members advising over 30 graduate students. It has grown from a center with no professional staff to seven staff members who are essential contributors to all aspects of the Center's work. These staff members contribute to the accomplishments of the RiSE Center and are valuable members of the campus community, building collaborations, assisting with grant proposal preparation, and sharing expertise broadly to the benefit of other faculty and staff. Further, they contribute to professional communities statewide and nationally, by presenting in conferences, serving on committees, and providing professional learning for educators. As RiSE grew, instead of receiving expanded funding for Center infrastructure, the Center's budgets were significantly reduced, along with many other budgets on campus. The RiSE Center, positioned as it is now, needs an assistant director, bridge funding equivalent to about one position's salary and benefits to provide job security to the RiSE

professional staff, and a half-time administrative specialist; yet none of these crucial positions are possible within the Center's budget. Ongoing funding to meet these needs would be a strategic investment in the RiSE Center, improving the efficiency of its operations and expanding its ongoing role as a leader on campus, in Maine, nationally, and internationally.

From our school partners, parents, the Maine Department of Education, and other stakeholders, there is increased demand for comprehensive mathematics teacher professional development, similar in scope to that provided for science through the MaineESP and MainePSP. The model developed and the lessons learned from these partnerships could be applied and refined for mathematics, but a similar large investment in mathematics teaching and learning has not been forthcoming. This opportunity needs to be realized, and the RiSE Center, with its previous experience working in PreK-12, is well positioned to lead a UMS partnership in this area if funding becomes available. UMaine recently took a key step in this direction with the hiring of a faculty member specializing in elementary and middle level mathematics teaching and learning, joint appointed between the Department of Mathematics and Statistics and the RiSE Center, Dr. Franziska Peterson.

VIII. New Initiatives

See the "Highlights" section for highlights from new grant-funded initiatives. In addition:

1. RiSE faculty members have agreed to pilot two new seminar courses in 2019-2020 for Master of Science in Teaching students that meet identified needs to strengthen the program. One is a seminar for first-semester students that focuses on introducing students to key elements of middle and high school science and mathematics teaching. The second is a teaching practicum experience to take place in each student's second semester in the program, modeled after the RiSE Center's Teaching Partner Program, originally funded through the Maine Physical Sciences Partnership. *See Appendix V for a listing of MST courses offered last year.*
2. RiSE Research and Evaluation Coordinator Laura Millay facilitated the formation of a campus-wide group involved in research-practice partnerships; this group has contributed to the development of the University of Maine's strategic plan and has begun to share strategies and challenges of their work.
3. The RiSE Center received a very generous donation from Mary Eckton, a graduate of the University of Maine and former high school teacher and guidance counselor, to continue the summer K-8 mathematics content immersions for teachers led by Dr. Franziska Peterson for the next three years. NSF Teaching Fellows serve as assistants in these content immersions, deepening their understanding and developing their leadership skills.

IX. Internal or External Center / Institute Reviews

The RiSE Center is participating in the preparation of the University of Maine's application for accreditation by CAEP (Council for the Accreditation of Educator Preparation) in collaboration with the College of Education and Human Development. During the past year, RiSE faculty members, led by Dr. Deborah Shulman, MST Program Graduate Coordinator, have been examining the assessments used to determine whether MST graduates meet required standards associated with teaching knowledge and practices (INTASC standards), professional dispositions for teaching, and ISTE technology standards. Review of the standards and the MST curriculum have led to the addition of two new seminar courses (#2 in New Initiatives above) and a closer look at ensuring that the program's curriculum provides learning opportunity to support all standards, regardless of students' choices of core courses and electives. The University participates in a dual review by both CAEP and the Maine Department of Education, with the report submitted in late 2019 and a site visit to take place in 2020-2021. The MST Program will also be reviewed through the University review of all graduate programs. This review will include both tracks through the program, the track that prepares graduates for secondary certification in science and/or mathematics and the track designed for those who want to learn more about research related to teaching and learning in the STEM disciplines without earning certification.

Appendix I. RiSE Annual Report Tables, 2018-19

Awards Submitted (#)	Awards Submitted (\$)	Awards Received (#)	Awards Received (\$)
23	\$40,553,215	10	\$6,524,610

Contracts Received (#)	Contracts Received (\$)
47	\$383,419

UGrads Supported (#)	UGrads Supported (\$)	Grads Supported (#)	Grads Supported (\$)
105	\$186,930	16	\$93,490

Staff Supported (#)	Staff Supported (\$)
7 (6.5 FTE)	\$460,596.56 (with fringe)

Joint Faculty (#)	Associate Faculty (#)	External Associates (#)	Research Faculty (#)
2	18	0	0

Publications (#)	Presentations (#)	Workshops (#)	Tours (#)
38	85	26	20

Patents (#)	Licenses (#)	Spin-off Companies (#)	IP Revenue (\$)
0	0	0	0

Gifts/Donations (\$)	Other Revenue (\$)
\$233,860	0

Appendix II. RiSE Grants Submitted or Awarded in 2018-19

Title	Funding Agency	RiSE Personnel	Request Amount	Submitted	Award Amount	Award Date	Status
Integrating Computation into Science Teaching and Learning in Grades 6-8: A Diverse Partnership to Develop an Evidence-Guided Model to Serve Rural Communities	National Science Foundation	Susan McKay (PI), Mitchell Bruce (Co-PI), Sara Lindsay (Co-PI), Laura Millay (staff), Marina Van der Eb (staff), Elizabeth Muncey (staff)	\$1,250,000	7/2/18	\$1,250,000	9/20/18	Awarded
Proposal Title: Use of Vanadyl Acetylacetonate to Detect and/or Sequester Ethanol in Water	American Chemical Society	Mitchell Bruce (Co-PI)	\$2,750	4/15/19	\$2,750	4/19/19	Awarded
Maine Education Policy Research Institute (MEPRI) FY19	Maine State Legislature through University of Southern Maine	Fairman, Janet (PI)	\$125,000	7/20/18	\$125,000	8/23/18	Awarded
MEPRI FY20	Maine State Legislature	Fairman, Janet (PI)	\$125,000	6/7/19			Submitte

Understanding and advancing early high school Earth and physical science teachers' knowledge of mathematics and physical science	National Science Foundation	Michael Wittmann (PI), Franziska Peterson (Co-PI), Laura Millay (Co-PI), Susan McKay (Co-PI), Chris Gerbi (Sr. Per.)	\$3,000,000	11/14/18			Not Funded
MRI: A high-performance computing instrument for deep learning, modeling/simulation, and scientific visualization for STEM	National Science Foundation	Chris Gerbi (Sr. Per.)	\$674,276	1/20/19			Submitte
Stress-induced weakening in the viscous regime	National Science Foundation	Chris Gerbi (PI)	\$332,815	8/1/18			Submitte
RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA)	National Science Foundation	Susan McKay (Co-PI), Natasha Speer (Co-PI), MacKenzie Stetzer (Co-PI)	\$20,000,000	7/31/18			Submitte
Watershed factors influencing aquatic food web mercury concentrations in the traditional sustenance diet of the Penobscot Indian Nation, Maine	US Dept of the Interior	Sarah Nelson (Co-PI)	\$39,994	10/10/18			Submitte

Linking freshwater mercury concentrations in parks to risk factors and bio-sentinels: a national-scale research and citizen science partnership	US Dept of the Interior	Sarah Nelson (PI)	\$44,457	3/25/19			Submitte
CAREER: Rigorous, Relevant, Rural STEM Education (R3SEd) Opportunities and Challenges in Transforming STEM Education in Rural Classrooms	National Science Foundation	Asli Sezen-Barrie (PI)	\$683,607	7/17/18			Submitte
Spatial Visualization modules and 3D printing in CAD instruction, and their effect on student learning in engineering	National Science Foundation	Asli Sezen-Barrie (Co-PI)	\$299,999	9/6/18			Submitte
Understanding Extreme Weather with Big Data	National Science Foundation through Education Development Center	Asli Sezen-Barrie (PI)	\$97,382	8/3/18			Submitte
Training the Next Generation of K-12 Engineering Educators	National Science Foundation	Asli Sezen-Barrie (Co-PI)	\$649,515	3/27/19			Submitte
IUSE/PFE: RED Innovation TRUST: Teaming to Revolutionize Undergraduate Student Thinking	National Science Foundation	Asli Sezen-Barrie (Co-PI)	\$1,999,039	1/24/19			Submitte

Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics	National Science Foundation	John Thompson (PI)	\$507,162	11/26/18			Submitte
Building and strengthening connections between mathematics and physics education research	National Science Foundation	John Thompson (PI)	\$314,008	12/11/18			Submitte
Pre-proposal: Teachers using refined models of knowledge to guide classroom communication in the physical sciences	James S. McDonnell Foundation	Michael Wittmann (PI)	\$1,785,063	5/8/19			Submitte
Down to Earth: Climate and Weather Learning for Planetarians	National Science Foundation	Michael Wittmann (Co-PI)	\$1,133,373	11/7/18			Submitte
Acquisition of a 500 MHz NMR Spectrometer with Improved Sensitivity and Accessibility to Benefit Research and Education at Umaine	National Science Foundation	Mitchell Bruce (PI)			\$535,900	8/28/18	Awarded
Enhancing Learning Outcomes In Food Engineering And Processing Courses For Non-Engineers Using Student-Centered Approaches	US Dept of Agriculture	Susan McKay (Co-PI), Laura Millay (Sr. Prs.), Erin Vinson (Sr. Prs.)			\$747,328	1/4/19	Awarded

Linking freshwater mercury concentrations in parks to risk factors and bio-sentinels: a national-scale research and citizen science partnership +\$	US Dept of the Interior	Sarah Nelson (PI)			\$43,247	9/18/18	Awarded
NRT: Enhancing conservation science and practice: An interdisciplinary program	National Science Foundation	Sarah Nelson (Co-PI)			\$2,998,314	9/4/18	Awarded
RII Track-2 FEC: Leveraging Intelligent Informatics and Smart Data for Improved Understanding of Northern Forest Ecosystem Resiliency (INSPIRES)	National Science Foundation	Susan McKay (Sr. Prs.), Franziska Peterson (Sr. Prs.), Sara Lindsay (Sr. Prs.), Sarah Nelson (Sr. Prs.), Laura Millay (Sr. Prs.), Deborah Shulman (Sr. Prs.)	\$6,000,000	1/25/19			Submitte
A remote multimodal learning environment to increase graphical information access for blind and visually impaired students	National Science Foundation	Justin Dimmel (Co-PI)	\$747,894		\$747,894	9/11/18	Awarded
How do scale and dimension affect students' perceptions of geometric diagrams?	Spencer Foundation	Justin Dimmel (PI)	\$49,217		\$49,217	4/12/19	Awarded

The Geometer's Planetarium II: Exploring the connections between geometry and astronomy in an immersive virtual environment	National Aeronautics and Space Administration through Maine Space Grant Consortium	Justin Dimmel (PI)	\$24,960		\$24,960	10/19/18	Awarded
CAREER:The Geometry of Starlight: A research-practice partnership to reimagine STEM education in rural Maine schools	National Science Foundation	Justin Dimmel (PI)	\$601,486	7/18/18			Submitte
A remote multimodal learning environment to increase graphical information access for blind and visually impaired students	National Science Foundation	Justin Dimmel (Co-PI)	\$15,360	4/22/19			Submitte
Collaborative Research: Tutor-Student Undergraduate Mathematics Interactions (TSUnaMI)	National Science Foundation	Timothy Boester (PI)	\$50,858	5/20/19			Submitte
TOTAL SUBMITTED			\$40,553,215				
TOTAL AWARDED					\$6,524,610		

Appendix III. RiSE Grants Continuing in 2018-19

Title	Funding Agency	RiSE Personnel	Grant Number	Award Date	Award Amount	Months
A Model NSF Teaching Fellowship Program to Improve STEM Teacher Recruitment, Preparation, Professional Development, and Retention in Rural High-Need Schools	National Science Foundation	Susan McKay (PI), Eric Pandiscio (Co-PI), MacKenzie Stetzer (Co-PI), Franziska Peterson (Co-PI), Elizabeth ByersSmall (Staff), Laura Millay (Staff)	1557320	3/24/16	\$1,950,034	71
MADE CLEAR (Maryland and Delaware Climate Change Education and Assessment Research)	National Science Foundation through Towson University	Asli Sezen-Barrie (PI)	35	4/5/18	\$8,000	11
Fostering Connections between Macroscopic, Submicroscopic, and Representational Levels Using Analogical Reasoning in the Chemistry Lab	National Science Foundation	Mitchell Bruce (PI)	1610086	9/7/16	\$275,284	35
The Synthesis of X-Ray Quality Crystals for Use in Introductory Chemistry	American Chemical Society	Mitchell Bruce (PI)	NSN849	5/2/18	\$5,000	2

Collaborative Research: Research on learning and teaching at the physics-mathematics interface	National Science Foundation	John Thompson (PI)	PHY-1405726	10/14/14	\$197,647	59
Comparative Functional Genomics INBRE in Maine (Honors College)	US Department of Health and Human Services through Mount Desert Island Biological Lab	Francois Amar (PI)	P20GM103423-18/UMHC and P20GM103423-18/UMHC	8/29/17	\$310,931	11
Thermochemical Conversion of Woody Biomass to Fuels and Chemicals	US Department of Energy	Francois Amar (Co-PI)		10/12/2011, continued 8/6/2013	\$1,889,988	83
Geometer's Planetarium	National Aeronautics and Space Administration through Maine Space Grant Consortium	Justin Dimmel (PI)	SG-18-06	9/28/17	\$10,000	18
CAREER: Identifying the Dominant Controls on Strain Localization in the Lower Crust	National Science Foundation	Chris Gerbi (PI)	1150438	4/15/12	\$462,380	71

Collaborative Research: Computational Methods Supporting Joint Seismic and Radar Inversion for Ice Fabric and Temperature in Streaming Flow	National Science Foundation	Chris Gerbi (PI)	1643301	1/30/17	\$195,010	35
Collaborative Research: Influence of Natural Ice Microstructure on Rheology in General Shear: In-Situ Studies in the Alaska Range	National Science Foundation	Chris Gerbi (PI)	1503924	8/11/15	\$420,937	47
Origin and Vertical Extent of Damage Zones Around Continental Strike-Slip Faults	National Science Foundation	Chris Gerbi (Co-PI)	1347087	3/27/14	\$282,951	44
Developing a Curriculum-Aligned Assessment of Student Learning in Marine Sciences: Essential Groundwork	University of Maine Office of Assessment Mini-Grant	Sara Lindsay (PI)		1/1/18	\$1,000	9
(Seed Grant) Maine's Changing Winter: focus on natural resources, ecology, and the economy	US Department of the Interior	Sarah Nelson (PI)	G16AP00057	6/21/17	\$5,000	17

EPA IAG for Clean Air Act trends research 2017-2018 (Determining the effectiveness of the Clean Air Act and Amendments on the recovery of surface water)	US Environmental Protection Agency through University of New Hampshire	Sarah Nelson (PI)	15-006	3/8/17	\$80,918	42
Linking freshwater mercury concentrations in parks to risk factors and bio-sentinels: a national-scale research and citizen science partnership	US Department of the Interior	Sarah Nelson (PI)	G14AC00135	7/14/17	\$20,000	23
RAPID: Experimental Recovery at the Bear Brook Watershed in Maine	National Science Foundation	Sarah Nelson (Co-PI)	1704200	12/16/16	\$49,720	23
Technical Assistance: GLKN Monitoring Larval Dragonflies for Mercury	US Department of the Interior	Sarah Nelson (PI)	P16AC01050	9/8/16	\$30,000	63
Winter Weather Whiplash: Developing Indices of Extreme Winter Weather Variability and Socio-Ecological Responses	NSF-SESYNG	Sarah Nelson (Co-PI)		7/1/17		24

Improving the Preparation of Graduate Students to Teach Undergraduate Mathematics	National Science Foundation through Mathematical Association of America	Natasha Speer (PI)	3-8-710-953	11/1/17	\$38,753	47
Catalyzing Institutional Change Through Synergistic Observation and Professional Development Programs	National Science Foundation	MacKenzie Stetzer (Co-PI), Susan McKay (Co-PI)	DUE-1347577	9/18/13	\$249,851	59
Collaborative Research: Examining the development of student reasoning skills through scaffolded physics instruction	National Science Foundation	MacKenzie Stetzer (PI)	DUE 1431940	9/19/14	\$169,806	59
Collaborative Research: Establishing a new model for research-based curriculum development in physics aligned with dual-process theories of reasoning	National Science Foundation	MacKenzie Stetzer (PI)	1821390	6/22/18	\$863,239	59
Collaborative Research: Promoting instructional change in introductory STEM courses through Faculty	National Science Foundation	MacKenzie Stetzer (Co-PI)	1712074	8/21/17	\$154,910	23

Learning Communities focused on the transition from high school to college						
Research on learning and teaching at the physics-engineering interface: thermodynamics and electronics	National Science Foundation	John Thompson (PI), MacKenzie Stetzer (Co-PI)	DUE-1323426	9/19/13	\$599,999	71
Math4ME 2019	US Dept of Education through ME Dept of Education	Fairman, Janet (PI)		12/12/18	\$48,292	10
Total					\$8,319,650	

Appendix IV. RiSE Center Stakeholders

FACULTY

Name	Title	Email
Francois G. Amar	Professor, Department of Chemistry and Dean, Honors College	amar@maine.edu
David J. Batuski	Professor and Chair, Department of Physics and Astronomy	batuski@maine.edu
Mitchell R. Bruce	Associate Professor of Chemistry	mbruce@maine.edu
Justin Dimmel	Assistant Professor of Mathematics Education and Instructional Technology	justin.dimmel@maine.edu
Robert D. Franzosa	Professor of Mathematics and Statistics	robert.franzosa@maine.edu
Christopher Gerbi	Associate Professor of Earth and Climate Sciences	christopher.gerbi@maine.edu
Janet Fairman	Associate Research Professor of Education	janet.fairman@maine.edu
Elizabeth Hufnagel	Assistant Professor of Science Education	elizabeth.hufnagel@maine.edu
Sara Lindsay	Associate Professor, School of Marine Sciences	slindsay@maine.edu
Susan R. McKay	Director, RiSE Center, and Professor of Physics	susan.mckay@maine.edu
Sarah Nelson	Associate Research Professor, Senator George J. Mitchell Center, and Associate Research Professor in Watershed Biogeochemistry, School of Forest Resources	sarah.j.nelson@maine.edu
Eric A. Pandiscio	Associate Professor of Mathematics Education	ericp@maine.edu
Franziska Peterson	Assistant Professor of Mathematics Education	franziska.peterson@maine.edu
Molly Schauffler	Research Assistant Professor (adjunct), School of Earth and Climate Sciences and Climate Change Institute	mschauff@maine.edu
Michelle Smith	Associate Professor of Biological Sciences, C. Ann Merrifield Professor in Life Science Education, and Cooperating Associate Professor of STEM Education	michelle.k.smith@maine.edu
Natasha Speer	Associate Professor of Mathematics Education	natasha.speer@maine.edu
MacKenzie Stetzer	Assistant Professor of Physics and Cooperating Assistant Professor of STEM Education	mackenzie.stetzer@maine.edu
John R. Thompson	Professor of Physics and Cooperating Professor of STEM Education	thompsonj@maine.edu
Michael C. Wittmann	Professor of Physics and Cooperating Professor of STEM Education	mwittmann@maine.edu

STAFF

Name	Title	Email
Elizabeth Byers-Small	NSF Teaching Fellowship Program Coordinator	elizabeth.byerssmall@maine.edu
Laura Millay	Research and Evaluation Coordinator	laura.millay@maine.edu
Elizabeth Muncey	Professional Development and Resource Coordinator	elizabeth.muncey@maine.edu
Deborah Shulman	Professional Development and Resource Coordinator	deborah.shulman@maine.edu
Erin Vinson	Campus Initiatives Coordinator	erin.vinson@maine.edu
Maureen Raynes	Financial and Personnel Manager	maureen.raynes@maine.edu
Marina Van der Eb	Maine STEM Partnership Coordinator	marina.van@maine.edu

CURRICULUM MODIFICATION REVIEW BOARD

Name	Title	Email
Robert Kumpa		bobkumpa@gmail.com
Susan O'Brien		sobrien@rsu22.us
Kate Hayes		kate.m.hayes@gmail.com
James Fratini		fratinij@hermon.net
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Patricia Adams		padams@msad11.org
Susan Smith		ssmith@rsu63.org
Karen Wood		k.wood@cdsedu.org
Helene Adams		adams@cheverus.org
John McDonald		jmcdonald@rsu13.org

MAINE STEM PARTNERSHIP LEADERSHIP TEAM

Name	Title	Email
Elaine Bartley	Executive Director, Penobscot River Educational Partnership	elaine.bartley@maine.edu
Kathleen Dixon-Wallace	Teacher	kdixon-wallace@msad41.us
Elizabeth Haynes	Teacher	umpie24@gmail.com
Bob Kumpa	Teacher	bobkumpa@gmail.com
Cynthia Lambert	Teacher	clambert@mdirss.org
Jim Lenke	Teacher	jlenke@mmhsbulldogs.org
Andrew Myers	Teacher	andrew.myers@rsu34.org
Christina Randall	Teacher	Crandall@rsu19.net
Reg Ruhlin	Principal, Orono High School	rruhlin@rsu26.org

K-12 CO-PIs ON RISE GRANTS

Name	Title	Email
Heather Rockwell	RSU 67 Curriculum Coordinator, Co-PI on NSF Teaching Fellowship Grant	hrockwell37@gmail.com
Jim Fratini	Hermon Middle School Science Teacher, Co-PI on NSF STEM+C Grant	fratinij@hermon.net

Appendix V. Courses Offered by the RiSE Center July 2018 – June 2019

Semester	Title	Professor	Enrollment
Summer 2018	SMT 598 Special Topics Intro to 3D Print/Design Educator	Susan McKay	2
Summer 2018	SMT 699 Graduate Thesis/ Research	Susan McKay	10 with 12 credit hours
Fall 2018	SMT 502 Integrated Approaches to Physics Education II	Michael Wittmann	5
Fall 2018	SMT 503 Integrated Approaches in Earth Sciences Education	Christopher Gerbi	6
Fall 2018	SMT 505 Integrated Approaches in Mathematics Education I	Natasha Speer	5
Fall 2018	SMT 598 Special Topics in Science and Mathematics Education	Elizabeth Hufnagel	4 with 8 credit hours
Fall 2018	SMT 699 Graduate Thesis/ Research	Susan McKay	16 with 35 credit hours
Fall 2018	INT 492 Maine Learning Assistant Pedagogy Seminar	MacKenzi Stetzer with Erin Vinson	38
Spring 2019	SMT 500 Educational Psychology with Applications to Science and Mathematics Teaching and Learning	Franziska Peterson	10
Spring 2019	SMT 506 Integrated Approaches in Mathematics Education II	Justin Dimmel	8
Spring 2019	SMT 590 Seminar for Teaching Interns	Susan McKay	5
Spring 2019	SMT 591 Secondary Student Teaching	Susan McKay	5
Spring 2019	SMT 699 Graduate Thesis/ Research	Susan McKay	10 with 20 credit hours
Spring 2019	INT 492 Maine Learning Assistant Pedagogy Seminar	MacKenzie Stetzer with Erin Vinson	35

Appendix VI. STEM+C Grant Personnel

Integrating Computing into Science Teaching and Learning in Grades 6-8: A Diverse Partnership to Develop an Evidence-Guided Model to Serve Rural Communities

Leadership Team

[Susan McKay](#), PI, Professor of Physics, Director of the RiSE Center, University of Maine

[Mitchell Bruce](#), coPI, Professor of Chemistry, RiSE Center Faculty, University of Maine

[Robin Clukey](#), Middle School Science Teacher, [Central Middle School](#)

[Jon Doty](#), Director of Curriculum, Instruction, and Assessment, [Regional School Unit 34](#)

[Jim Fratini](#), coPI, Middle School Science Teacher, [Hermon Middle School](#)

[Andre Khalil](#), Associate Professor of Chemical and Biomedical Engineering, Director of the CompuMAINE Lab, University of Maine

[Torsten Hahmann](#), Assistant Professor of Spatial Informatics, School of Computing and Information Science, University of Maine

[Connie Holden](#), Professor of Developmental Mathematics and Science, University of Maine
Augusta

[Sara Lindsay](#), coPI, Associate Professor of Marine Sciences, RiSE Center Faculty, University of
Maine

[Laura Millay](#), Research and Evaluation Coordinator, RiSE Center

[Beth Muncey](#), Professional Learning and Resource Coordinator, RiSE Center

[Harlan Onsrud](#), coPI, Professor of Spatial Informatics, School of Computing and Information
Science, University of Maine

[Marina Van der Eb](#), Maine STEM Partnership Coordinator, RiSE Center

[Katie Wright](#), Middle School Science Teacher, [Houlton Middle School](#)

Professional Learning and Module Design Team

Marina Van der Eb, Project Coordinator (Chair)

Mitchell Bruce

Robin Clukey

Jim Fratini

Torsten Hahmann

Connie Holden

Susan McKay

Beth Muncey

Course Design Team

Sara Lindsay, coPI (Chair)

Torsten Hahmann

Connie Holden

Research and Evaluation Team

Laura Millay, Research and Evaluation Coordinator (Chair)

Mitchell Bruce

Jim Fratini

Sara Lindsay
Susan McKay
Harlan Onsrud
Marina Van der Eb
Advisory Board

[Dr. George Bodner](#), Professor of Chemical Education, Purdue University

[Dr. Marie desJardins](#), Dean, College of Organizational, Computational, and Information Sciences, and Professor of Computer Science, Simmons College, whose research interests include K-12 computer science education and pedagogical innovation

[Dr. Amy Johnson](#), Co-Director, Maine Education Policy Research Institute, and Assistant Director, Center for Education Policy, Applied Research, and Evaluation, University of Southern Maine

[Dr. Jason Judd](#), Program Director of [Project>Login](#) at Educate Maine and Chair of the recent Maine Computer Science Task Force

Beth Lambert, Coordinator of Secondary Education and Integrated Instruction, Maine Department of Education

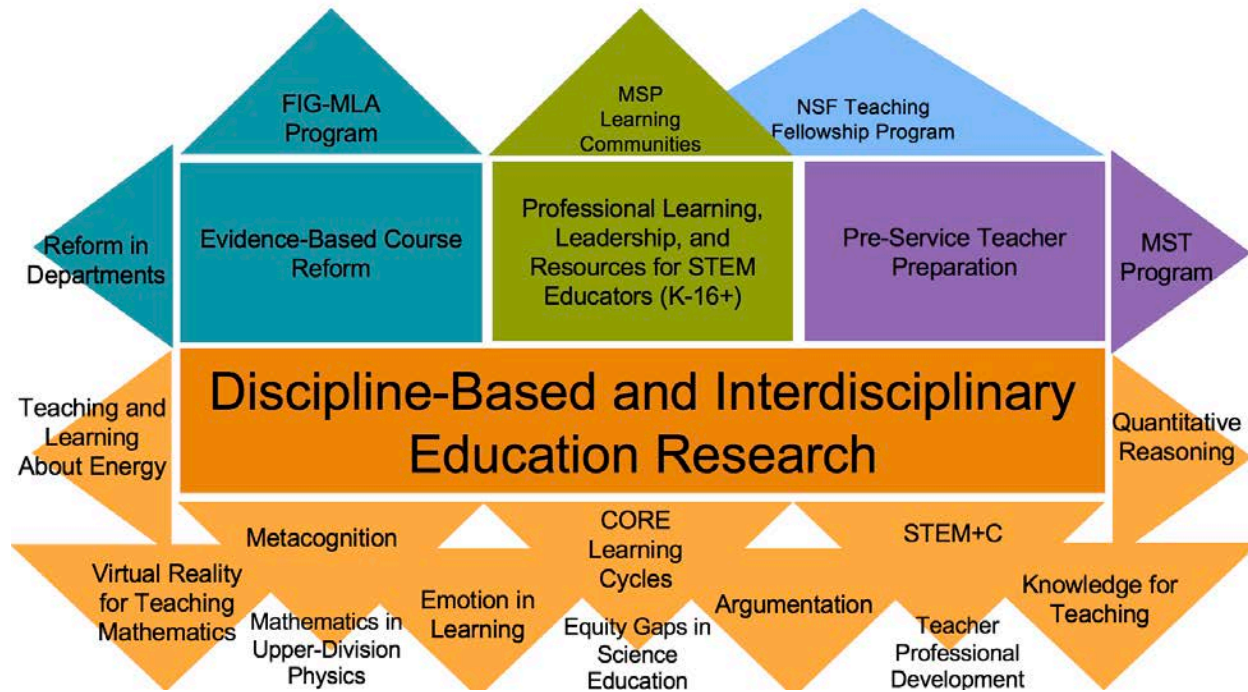
John McDonald, Superintendent of [Regional School Unit 13](#) and RiSE Curriculum Modification Review Board member

[Dr. Robert Pockalny](#), Associate Marine Research Scientist at the University of Rhode Island Graduate School of Oceanography and co-PI on [funded STEM+C project](#)

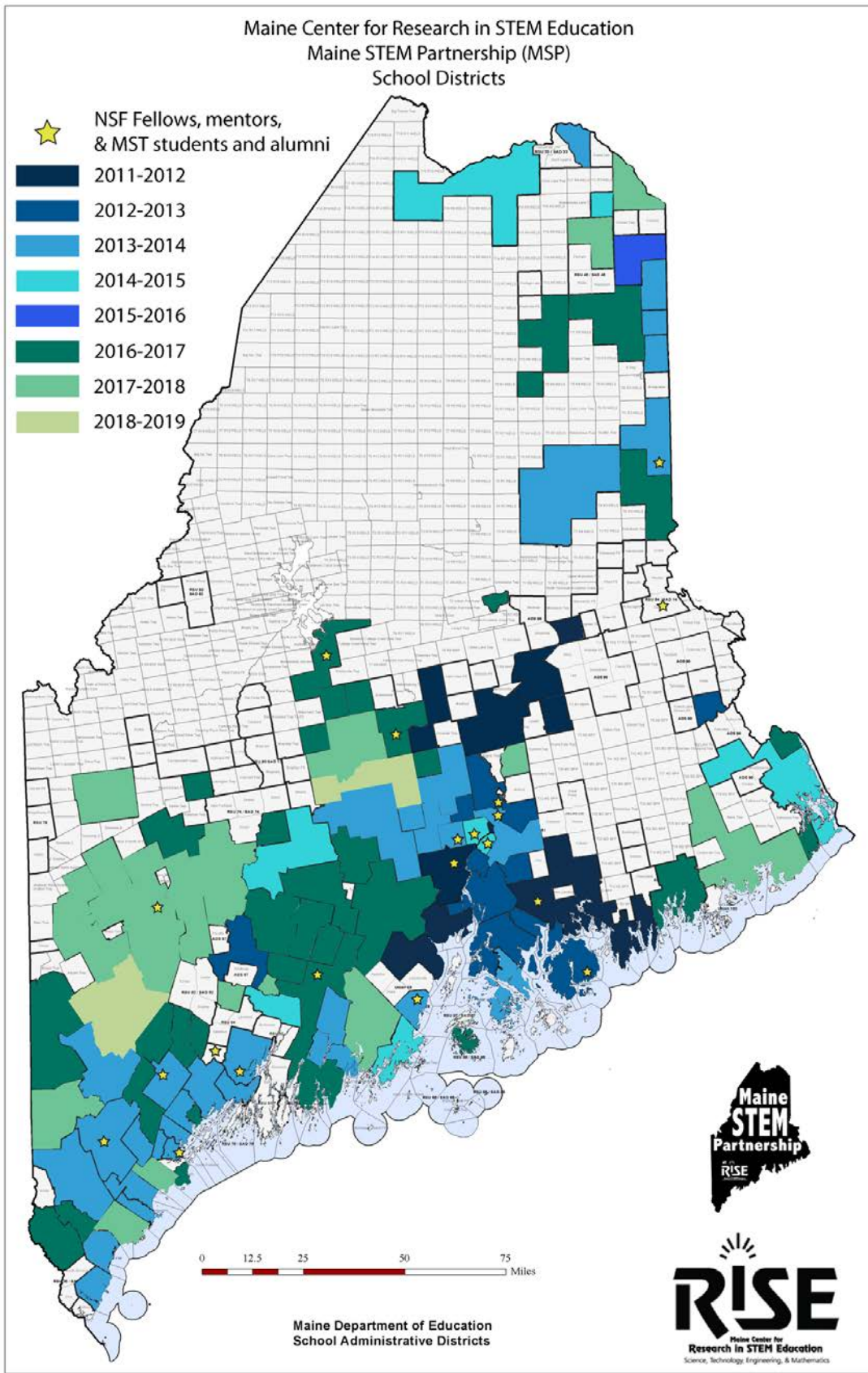
[Dr. Penny Rheingans](#), Director, School of Computing and Information Science, University of Maine

[Dr. Ben Saylor](#), Professor of Physical Science and Mathematics, Director of the [Sanford Center for Science Education](#) at Black Hills State University and PI on [funded STEM+C project](#).

Appendix VII. Graphic Summary of RiSE Center Work



Appendix VIII. Map of the Maine STEM Partnership's School District Partners



Appendix IX. RiSE Publications, 2018-19

Type	Peer Rev.	Citation	Submitted	Accepted	Published
Journal Article	Yes	Avargil, S., Bruce, M., Klemmer, S., & Bruce, A. (2018). A Professional Development Activity to Help Teaching Assistants Work as a Team to Assess Lab Reports in a General Chemistry Course. <i>Israel Journal of Chemistry</i> , 58, 1-11.	3/3/18	11/3/18	11/29/18
Journal Article	Yes	Miner, K., Gerbi, C., Campbell, S., Liljedahl, A., Anderson, T., Perkins, B., Gatesman, T., and Kreutz, K., 2018, Organochlorine pollutants within a polythermal glacier in the Interior Eastern Alaska Range, <i>Environmental Science and Technology</i> . v. 10, n. 9, 1157.	8/8/18	8/25/18	8/29/18
Book Chapter	No	Dimmel, J., & Pandiscio, E. (n.d.). Continuous directed scaling: How could dynamic multiplication and division diagrams be used to cross mathematical boundaries?	9/1/18	3/1/19	
Book	No	Rogawski, J., Adams, C., & Franzosa, R. (2019). <i>Calculus: Early Transcendentals</i> (4th ed., p. 1216). W.H. Freeman.			2/1/19
Journal Article	Yes	Melosh, B., Rowe, C., Gerbi, C., Smit, L., & Macey, P. (2018). Seismic cycle feedbacks in a mid-crustal shear zone. <i>Journal of Structural Geology</i> .	8/1/17	4/5/18	7/1/18
Journal Article	Yes	Sezen-Barrie, A., Miller-Rushing, A., & Hufnagel, E. (2019). It's a Gassy World': Starting with Students' Wondering Questions to Inform Climate Change Education". <i>Environmental Education Research</i> .	11/1/18	4/1/19	5/1/19
Journal Article	Yes	Johnson, S., Song, W., Cook, A., Vel, S., & Gerbi, C. (n.d.). Quartz $\alpha \leftrightarrow \beta$ phase transition drives damage and reaction in continental crust. <i>Nature</i> .	6/28/19		
Journal Article	Yes	Peteroy-Kelly, M., Brancaccio-Taras, L., Awong-Taylor, J., Balser, T., Jack, T., Lindsay, S., . . . Pape-Lindstrom, P. (2019). A qualitative analysis to identify the elements that support department level change in the Life Sciences: The PULSE Vision & Change Recognition program. <i>PLOS ONE</i> , 14(5), E0217088.	12/20/18	5/3/19	5/30/19
Journal Article	Yes	Weatherbee, R., & Lindsay, S. (2018). Designing a curriculum-aligned assessment of cumulative learning about marine primary production to improve an undergraduate marine sciences program. <i>Journal of Microbiology and Biology Education</i> , 19(3), 19.3.103.	7/31/17	8/22/18	12/14/18
Journal Article	Yes	Contosta, A., Casson, N., Garlick, S., Nelson, S., Fernandez, I., Patel, K., & 12 others. (n.d.). Northern forest winters have lost cold, snowy conditions that are important for ecosystems and human communities. <i>Ecological Applications</i> , <i>In press</i> .		5/1/19	

Journal Article	Yes	Contosta, A.; Casson, N.; Garlick, S.; Nelson, S.; Fernandez, I.; Patel, K.; 12 others. Northern forest winters have lost cold, snowy conditions that are important for ecosystems and human communities			8/1/18
Journal Article	Yes	Patel, K., Jakubowski, M., Fernandez, I., Nelson, S., & Gawley, W. (2019). Soil nitrogen and mercury dynamics seven decades after a fire disturbance: A case study at Acadia National Park. <i>Water, Air, and Soil Pollution</i> , 230(29).			1/1/19
Journal Article	Yes	Patel, K., Nelson, S., Spencer, C., & Fernandez, I. (2018). Fifteen-year record of soil temperature for the Bear Brook Watershed in Maine. <i>Scientific Data</i> , DOI: 10.1038/sdata.2018.153.			7/1/18
Journal Article	Yes	Sebestyen, S., 30 others, Nelson, S., & Fernandez, I. (n.d.). Unprocessed atmospheric nitrate in waters of the Northern Forest Region in the USA and Canada. <i>Environmental Science & Technology</i> , 53(7), 3620-3633.		4/1/19	
Journal Article	Yes	Sebestyen, S., 31 others, Fernandez, I., & Nelson, S. (2019, March). Nitrate isotope database for meteoric waters, surface waters, soil waters, and groundwaters. Available: https://doi.org/10.2737/RDS-2019-0003			3/1/19
Journal Article	Yes	Watkins, T., Miller-Rushing, A., & Nelson, S. (2018). Science in Places of Grandeur: Communication and Engagement in National Parks. <i>Integrative and Comparative Biology</i> , 58(1), 67-76.			12/1/18
Journal Article	Yes	Patel, K., Fernandez, I., Nelson, S., Gruselle, M., Norton, S., & Weiskittel, A. (2019). Forest N dynamics after 25 years of whole watershed N enrichment: The Bear Brook Watershed in Maine. <i>Soil Science Society of America Journal</i> .			2/1/19
Journal Article	Yes	Patel, K., Tatariw, C., MacRae, J., Ohno, T., Nelson, S., & Fernandez, I. (2018). Soil carbon and nitrogen responses to snow removal and concrete frost in a northern coniferous forest. <i>Canadian Journal of Soil Science</i> , 98, 436-447.			10/1/18
Journal Article	Yes	Rice, L., Lindsay, S., & Rawson, P. (2018). Genetic Homogeneity among Geographically Distant Populations of the Blister Worm, <i>Polydora websteri</i> . <i>Aquaculture Environment Interactions</i> , 10, 437-446.	3/26/18	8/10/18	10/11/18
Journal Article	Yes	Wolfson, J., Stapleton, M., & Sezen-Barrie, A. (n.d.). Where have all the oysters gone? Exploring the effects of ocean acidification on shell formation in oyster larvae. <i>The Science Teacher</i> .	12/1/18	5/20/19	
Journal Article	Yes	Bragdon, D., Pandiscio, E., & Speer, N. (2018). University students' graph interpretation and comprehension abilities, <i>Investigations in Mathematics Learning</i> , 1-16.			7/18/18

Journal Article	Yes	Case, J., & Speer, N. (n.d.). Calculus students' deductive reasoning and strategies when working with abstract propositions and calculus theorems. <i>PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studie.</i>		12/1/18	
Proceedings	Yes	Hauk, S., & Speer, N. (2019). <i>Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.</i>	11/1/18	12/1/18	4/1/19
Book	Yes	Kung, D., & Speer, N. (n.d.). <i>What Could They Possibly Be Thinking?!? Understanding your college math students.</i> Mathematical Association of America.	3/1/19		
Proceedings	Yes	Laursen, S., Hauk, S., Speer, N., & Deshler, J. (2019). <i>Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.,.</i>	11/1/18	12/1/18	4/1/19
Proceedings	Yes	Speer, N., Andrews, T., & Shultz, G. (2019). <i>Proceedings of the 22nd Annual Conference on Research in Undergraduate Mathematics Education.,.</i>	11/1/18	12/1/18	4/1/19
Journal Article	Yes	C. L. Meaders, E. S. Toth, A. K. Lane, J. K Shuman, B. A. Couch, M. Stains, M. R. Stetzer, E. L. Vinson, and M. K. Smith, "What will I experience in my college STEM courses? An investigation of student predictions about instructional practices in introductory courses," submitted to CBE Life Sci. Educ. (2019).	5/7/19		
Journal Article	Yes	K. L. Van De Bogart and M. R. Stetzer, "Investigating student understanding of bipolar junction transistor circuits," <i>Phys. Rev. Phys. Educ. Res.</i> 14, 020121 (2018).	6/1/18	9/1/18	11/20/18
Journal Article	Yes	Schermerhorn, B., & Thompson, J. (2019, February 14). Physics students' construction and checking of differential volume elements in an unconventional spherical coordinate system. Available: https://doi.org/10.1103/PhysRevPhysEducRes.15.010112	5/1/18		2/14/19
Journal Article	Yes	Schermerhorn, B., & Thompson, J. (2019, February 14). Physics students' construction of differential length vectors in an unconventional spherical coordinate system. Available: https://doi.org/10.1103/PhysRevPhysEducRes.15.010111	5/1/18		2/14/19
Journal Article	Yes	Gray, K., Wittmann, M., Vokos, S., & Scherr, R. (2019). Drawings of energy: Evidence of the Next Generation Science Standards model of energy in diagrams. <i>Physical Review Physics Education Research.</i>	11/1/18	3/1/19	5/17/19
Journal Article	Yes	Springuel, R.P., Wittmann, M.C., Thompson, J.R. (to be published 2019) Reconsidering the encoding of data in PER. Accepted for publication in <i>Physical Review Physics Education Research</i> on Dec 18, 2018. To be published in a focused collection, Summer 2019.	6/1/18	12/1/18	

Book Chapter	Yes	M. C. Wittmann, "Research in the Resources Framework: Changing environments, consistent exploration," in Getting Started in PER, edited by C. Henderson and K. A. Harper (American Association of Physics Teachers, College Park, MD, 2018), Reviews in PER Vol. 2. http://www.per-central.org/items/detail.cfm?ID=14726	10/1/17	1/1/18	7/1/18
Journal Article	Yes	Wittmann, M.C., Millay, L.A., Alvarado, C., Lucy, L., Medina, J., and Rogers, Z.A. ((2019). Applying the resources framework of teaching and learning to issues in middle school physics instruction on energy. AJP June 2019	11/1/18	4/1/19	Jun-19
Journal Article	Yes	Dimmel, J.K., & Bock, C.G. (in press). Dynamic mathematical figures with immersive spatial displays: The case of HandWaver. The appear in G. Aldonand J. Trgalova (eds.), Digital technology to teach, learn and assess mathematics: Featuring extended selected papers of ICTMT 13. Berlin:Springer	9/1/17	3/1/19	
Journal Article	Yes	Dimmel, J., & Milewski, A. (n.d.). Scale, perspective, and natural mathematical questions: Re-thinking representations of the world in real-life problems.	3/1/19	5/1/19	
Book Chapter	No	Hertel, J., Enzinger, N., & Dimmel, J. (n.d.). Mathematics Education Communities Crossing Digital Boundaries.	10/1/18	5/1/19	
Book Chapter	No	Hufnagel, E. (2019). Emotional discourse as constructed in an environmental science course. In Theory and Methods for Sociocultural Research in Science and Engineering Education. New York: Routledge.			1/1/19
Journal Article	Yes	Biddle, C., & Hufnagel, E. (n.d.). Navigating the "danger zone": Tone-policing and bounding civility in the practice of student voice. American Journal of Education.	9/1/18	2/1/19	
Journal Article	Yes	Hufnagel, E. (n.d.). The "subtext of everything": High school science teachers' conceptualizations of emotions and their related teaching practices. Canadian Journal of Science, Mathematics, and Technology Education.	12/1/18		
Book Chapter	No	Hufnagel, E. (n.d.). The Language and Materiality of Emotions in Science Education. In Handbook of Language and Science.	4/1/18	2/1/19	
Journal Article	Yes	Hufnagel, E. (2018). Frames for emotional expressions across discourse forms in an ecology course. International Journal of Science Education.			9/1/18
Journal Article	Yes	Jaber, L., Hufnagel, E., & Radoff, J. (n.d.). "This is really frying my brain!": How affect supports inquiry in an online learning environment. Research in Science Education.	12/1/18		

Master's Thesis	No	Millay, L. Teachers' Professional Knowledge and Formative Assessment Practices: An Empirical Study from Middle School Earth Science Instruction in the Context of an Education Improvement Community. Master's Thesis. University of Maine. Orono, Maine. December, 2018.			
Master's Thesis	No	Keenhold, B. Assessing Quantitative Reasoning in a Ninth Grade Science Class Using Interdisciplinary Data Story Assignments. Master's Thesis Completed May 10, 2019.			
Master's Thesis	No	The High School to First Year College Instructional Transition: An Investigation of the Predictions and Perceptions of STEM Students, Master's thesis completed May, 2019.			
Master's Thesis	No	A Granular Account of Students' Understanding Reasoning within an Everyday and Scientific Contexts. Master's thesis completed August, 2018.			
Master's Thesis	No	Understanding student development of science literacy skills in an undergraduate environmental science course. Master's thesis completed August 2018.			
PhD Dissertation	No	New Methodologies for Examining and Supporting Student Reasoning in Physics. PhD Dissertation completed May, 2019.			
PhD Dissertation	No	Using question variations to access alternate student thinking about the same physical situations. PhD Dissertation defended April, 2019.			