

# Maine Center for Research in STEM Education Annual Report FY2023: July 1, 2022–June 30, 2023



# Table of Contents

<b>I. Executive Summary: RiSE Center Activities FY2023</b> .....	<b>3</b>
STEM Education Research Within and Across Disciplines.....	3
Community Partnerships and Innovative Collaborations at All Educational Levels.....	3
Graduate Education and Professional Learning for STEM Educators and Researchers.....	4
Statewide Professional Communities Using Research to Improve STEM Education.....	4
<b>II. RiSE Center Mission and Goals</b> .....	<b>4</b>
<b>III. Efforts to Improve Diversity, Equity and Inclusion</b> .....	<b>5</b>
<b>IV. Key Performance Indicators (KPIs) with 5-Year trends</b> .....	<b>5</b>
<b>V. Alignment with UMS Strategic Vision and Values</b> .....	<b>6</b>
<b>VI. Infrastructure/Facilities/Equipment Projects (Completed/Planned)</b> .....	<b>6</b>
<b>VII. Summary of Anticipated Challenges</b> .....	<b>6</b>
<b>VIII. New Initiatives, Opportunities, Major Accomplishments and Highlights</b> .....	<b>7</b>
<b>IX. Carnegie R1 Classification</b> .....	<b>7</b>
Activities and projects which expand research opportunities, and contribute to essential growth needed to preserve the R1 classification.....	7
Center role and progress in increasing social and economic mobility of students.....	7
<b>Appendix 1. List of RiSE Center Faculty and Staff, FY2023</b> .....	<b>8</b>
RiSE Center Affiliated Faculty.....	8
RiSE Center Staff.....	9
<b>Appendix 2. Funding Awarded to RiSE Center Faculty and Staff, FY2023</b> .....	<b>10</b>
<b>Appendix 3. Continuing Funding Awarded to RiSE Faculty and Staff, FY2023</b> .....	<b>11</b>
<b>Appendix 4. Published and Accepted Works by RiSE Center Faculty, Staff and Students, FY2023</b>	<b>15</b>
<b>Appendix 5. Courses Offered by the RiSE Center, FY2023</b> .....	<b>18</b>
<b>Appendix 6. Map of School Districts Partnering with RiSE through the Maine STEM Partnership</b> ..	<b>19</b>
<b>Appendix 7. RiSE Center 5-Year Key Performance Indicator Data</b> .....	<b>20</b>
<b>Appendix 8. RiSE Center Base Budget Investment FY05-FY24</b> .....	<b>21</b>

## I. Executive Summary: RiSE Center Activities FY2023

From its core emphasis on STEM Education Research, the RiSE Center reaches out to foster Community Partnerships and Innovative Collaborations that support STEM learning at all grade levels, provide Graduate Education for STEM educators and researchers, and sustain a Statewide Professional Community using research to improve STEM education. RiSE Center faculty, staff and students have made significant contributions in each of these areas during the last year. These contributions continued on par with past years despite the departures of key personnel and considerable time required to recruit and hire new staff members in soft money positions. In addition to welcoming two new professional learning specialists, a faculty and student success program coordinator, and research and evaluation specialist, the RiSE Center also welcomed **Dr. Joan Ferrini-Mundy** to its affiliated faculty in May 2023. See [Appendix 1](#) for the roster of RiSE Center faculty and staff.

### STEM Education Research Within and Across Disciplines

**RiSE Research Portfolio:** RiSE faculty and staff served as PI, Co-PI or Senior Personnel on six new awards (\$5,176,493, [Appendix 2](#)) and 41 continuing awards (\$28,835,927, [Appendix 3](#)), and submitted an additional 9 grant proposals or letters of intent (\$14,120,239). Awarded grants include: support for the Maine Education Policy Research Institute led by **Dr. Janet Fairman**; work with early career educators in the EPSCoR Track 1 Maine e-DNA project by **Dr. Susan McKay**, **Dr. MacKenzie Stetzer**, **Dr. Natasha Speer** and **Gabrielle Holt**; research by **Dr. John Thompson** investigating methods for teaching mathematics in physics courses; and a new collaboration by **Dr. Stetzer** and **Dr. Mitchell Bruce** to investigate reasoning processes in chemistry and physics education.

**RiSE Presentations and Publications:** Thirty-two works were published or accepted for publication, nearly all of which were peer reviewed, with an additional five journal articles and one book in review ([Appendix 4](#)). This publication rate is similar to FY2022 and greater than the five-year average of 29.8 published or accepted works annually. Notably, **Dr. Heather Falconer** received the 2023 Best Monograph in Writing Across the Curriculum from the Association of Writing Across the Curriculum for her book, *Masking Inequality with Good Intentions: Systemic Bias, Counterspaces, and Discourse Acquisition in STEM Education*. RiSE faculty, staff and students shared their research in 42 presentations, of which 15 were at national meetings, 10 at international meetings, and 8 were invited presentations.

**Research Practice Partnerships:** With new NSF funding, RiSE faculty (**Dr. McKay**, **Dr. Sara Lindsay**, **Dr. Franziska Peterson**) and staff (**Marina Van der Eb**, **Gabrielle Holt**, **Jennifer Fronczak**, **Christina Siddons**, **Kelsey Davis**) launched a novel partnership among UMaine marine science and education researchers and K-12 educators to enhance K-12 instruction with technology-infused, authentic research related to ocean sciences. The **ITEST Coastal TRACERS (Tech-infused Research and Community-based Experiences)** for middle and high school students initially focuses on teachers and students in Belfast, Maine. Project participants are working together to create exciting opportunities for students to explore the local coast, build community relationships, and experiment with new technology.

**Additional Research Project Highlights:** In August 2022, RiSE staff (with **Siddons** as lead) convened a workshop for faculty members from six different institutions across the nation to facilitate their work revising undergraduate courses in Food Sciences and Engineering to improve student learning outcomes (funded by USDA grant 2019-70003-29082, **McKay**, PI). These faculty reconvened in May 2023 at the RiSE Center for a final workshop to report on their course modifications and plan research publications. RiSE faculty and staff working on the EPSCoR Track 2 INSPIRES project continued working with middle and high school teachers from Maine and Vermont to integrate forest and climate-related research and quantitative reasoning into their existing curricula. The teachers' work will be shared widely on a website available through the Maine STEM Partnership. **Dr. Peterson** presented our initial findings about engaging teachers, education researchers and scientists in authentic investigations with forestry data at the New England Educational Research Organization annual meeting (May 2023) and a manuscript is in preparation. Several Maine teachers are interested in seeking funding with RiSE faculty and staff to continue and expand this work.

### Community Partnerships and Innovative Collaborations at All Educational Levels

**RiSE Materials Warehouse:** **Beth Muncey** packed more than 650 kits this year to provide science materials and related professional learning for 115 K-12 teachers in 35 schools and 31 school districts

across the state. These kits helped to provide >4,600 students with opportunities to learn science through engaging, research-supported science activities.

**FIG-MLA program:** The Faculty course modification Incentive Grant-Maine Learning Assistant (FIG-MLA) program supported 122 undergraduate peer learning assistants who assisted 33 faculty to implement research-based course modifications in 28 separate STEM courses at UMaine, enhancing the learning experiences of 5,995 undergraduate students. RiSE Center Faculty & Student Success Program Coordinator **Torey Bowser** supports the FIG-MLA program and Gateways to Success pilot programs across the UMS. Participating in MLA-supported courses increases student retention.

**New Collaborations:** Quantitative literacy underlies and unites all STEM disciplines. As part of her research on how students and teachers acquire and apply quantitative reasoning, **Dr. Franziska Peterson** is working with a team led by the new Dean of the College of Engineering and Computing, Dr. Giovanna Guidoboni, to design a pilot program that will integrate engineering education and middle school mathematics. This is an exciting new collaboration to support recruitment and retention of students in Engineering and Computing. Building on pilot work by Dr. Peterson, and with her guidance, RiSE Professional Learning Specialist **J. Fronczak** implemented a program of district-level, in-school professional learning and curriculum development support for mathematics instruction in RSU 34 and RSU 63, reaching >40 teachers and >1000 students, as well as numerous support professionals and administrators.

### **Graduate Education and Professional Learning for STEM Educators and Researchers**

**Student Mentoring:** RiSE faculty provided 144 graduate student credit hours in the MST program (see [Appendix 5](#)) and mentored 17 Master of Science in Teaching (MST) students, as well as 15 PhD students in STEM Education or Physics Education Research. Seven students graduated from the CAEP-accredited MST program between August 2022 and June 2023.

**Professional Learning:** RiSE staff and faculty led 48 professional learning opportunities for PK-12 teachers, representing 124 individual events or meetings that were attended by 259 unique participants resulting in 4,794 participant hours. Opportunities included content immersions in mathematics, content discussions, materials training, Teaching Fellowship program meetings, and conference gatherings.

**RiSE Center Conference:** In June 2023, the RiSE Center welcomed educators and researchers from across the state and New England for the RiSE Center Conference on STEM Education and Related Research to learn and share best practices around the conference theme of *Integrating Research and Practice: Engaging Students with Authentic Research and Problem Solving in STEM*. This year, we reached out to a broader scope of STEM Education practitioners, and saw a tenfold increase in attendance by participants affiliated with Maine nonprofit STEM organizations and State agencies.

### **Statewide Professional Communities Using Research to Improve STEM Education**

**Maine STEM Partnership:** STEM educators at all educational levels gathered in person for the RiSE Summit meeting in November, 2022 where they focused on re-envisioning the Maine STEM Partnership to support STEM learning in the post-COVID landscape. Reviewing data and listening to perspectives from a variety of panelists, educators considered the important question: *How do we work together to build excellence in STEM education for all students?* See [Appendix 6](#) for a map of MSP partner districts.

**NSF Teaching Fellowship Program transition:** The NSF Teaching Fellowship Program transitioned into the RiSE Center Teaching Fellowship Program this year, and the community retained all but one of its members and continued its work without interruption. The community comprises 11 Fellows (teachers within their first 4 years of teaching), 15 experienced teachers (5 of these teachers were former Fellows), and one RiSE Center staff member who is the program coordinator (**Beth ByersSmall**). The Teaching Fellowship Program helps teachers across the state build their professional network and toolbox of effective teaching practices, and provides key mentoring support for new teachers. Fellows share their expertise with the broader K-12 community throughout the year.

## **II. RiSE Center Mission and Goals**

*The mission of the Maine Center for Research in STEM Education is to advance the research and practice of teaching and learning in science, technology, engineering, and mathematics, the STEM*

disciplines.

**Goals:** From its core emphasis on STEM Education Research, the RiSE Center reaches out to foster Community Partnerships and Innovative Collaborations, provide Graduate Education and Professional Learning for STEM educators and researchers, and sustain a Statewide Professional Community using research to improve STEM education

### III. Efforts to Improve Diversity, Equity and Inclusion

In April 2023, Administrative Specialist **Yadina Clark** gave an Introduction to Neurodiversity talk hosted by the Office for Diversity and Inclusion as part of Diversity Week, and facilitated a separate informal student discussion. At the **RiSE Center Conference** on STEM Education and Related Research: Integrating Research and Practice, keynote speaker Dr. Jennifer Page and several other speakers shared their expertise in a conference strand dedicated to Universal Design for Learning to Support Equity in Authentic Research. **Dr. Heather Falconer's** award winning book, *Masking inequality with good intentions: Systemic bias, counterspaces, and discourse acquisition in STEM education*, is one example of how RiSE faculty are shining a light on issues of equity and inclusion in STEM disciplines through their research. In our **professional learning** work, RiSE faculty & staff emphasize modeling and promoting practices that provide a space for all learners. Through the Maine STEM Partnership, the **RiSE Materials Warehouse** supports schools with high quality, low-cost instructional materials that increase equity and access to quality science education. RiSE faculty and staff pursued funding from the William T. Grant Foundation Reducing Inequality program to expand the reach of this program and better serve economically disadvantaged youth in rural schools. Additionally, the RiSE Center's **Teaching Fellowship Program**, designed to help meet Maine's workforce need for science and mathematics teachers in high-need districts, had 10 fellows teaching in high-need districts during the 2022-23 school year.

### IV. Key Performance Indicators (KPIs) with 5-Year trends

**Goal: Conduct and Sustain STEM Education Research Within and Across Disciplines**

**See Appendix 7A.** RiSE Center Faculty, staff and graduate students are integral to a robust research program. Over the last 5 fiscal years, RiSE faculty collectively received an average of 9.5 awards annually worth approximately \$4.7 million. During the same period, the RiSE research portfolio included on average 34 continuing awards worth \$23.2 million annually. Proposals submitted have declined somewhat in the last two years, but averaged about 16 proposals submitted annually, worth nearly \$17 million. RiSE faculty, staff and students consistently report their research findings in publications and presentations, with a 5-year average of 30 publications and 52 presentations per year by Center affiliates.

**Goal: Foster Community Partnerships and Innovative Collaborations at All Educational Levels**

**See Appendix 7B:** The RiSE center sustains the Maine STEM Partnership (K-12) and FIG-MLA (undergraduate) programs. These programs build partnerships between and among educators and researchers to improve student learning and engagement in STEM disciplines. Over the last 3 fiscal years, the **Maine STEM Partnership Materials Warehouse** supported an average of 112 teachers in 36 schools and 29 districts with hands-on, research supported materials and activities for STEM learning that directly impacted an average of 4957 K-12 students per year. In the last 5 fiscal years, the **FIG-MLA program** has supported annually an average of 30 faculty members to implement evidence-based changes in 27 STEM courses, with an average of 126 undergraduate Maine Learning Assistants employed, and impacting an average of 5468 students enrolled in those courses. In FY2023, the program impacted 5995 students. Analysis of first-year students enrolled in the 2016-17, 2017-18, and 2018-20 cohorts indicates those who took one or more FIG-MLA courses were more likely to be retained to the second year than those who did not take FIG-MLA courses (70% for 0 FIG-MLA courses vs. 76% to 85% for students who take 1-3 FIG-MLA courses, respectively).

**Goal: Provide Graduate Education for STEM Educators and Researchers**

**See Appendix 7C.** The CAEP-accredited Master of Science Teaching program prepares students to teach and conduct educational research in STEM disciplines. In the last 5 years, the number of MST graduates has remained steady, at an average of 7 degrees awarded per year. During that time, RiSE faculty offered on average 15 courses per academic year, corresponding to an average of 149 student credit hours per year.

### *Goal: Sustain a Statewide Professional Community Using Research to Improve STEM Education*

See [Appendix 7D](#): RiSE Faculty & Staff provide professional learning & community building for PK-16+ educators. Professional learning participation has been somewhat lower during the pandemic, but averaged >400 participants annually over the last 4 years, representing an average of 4828 contact hours per year over the same period. Attendance at the Maine STEM Partnership Summit held in the fall, and the RiSE Center Conference on STEM Education and Related Research (held in June) has averaged 95 and 101 participants per year over the last 5 years. In particular, participation in the fall Summit increased dramatically this year (121 participants) with the return to an in-person gathering.

## V. Alignment with UMS Strategic Vision and Values

**Fostering Learner Success:** RiSE Center faculty (**Dr. Sara Lindsay, Dr. Natasha Speer, Dr. Timothy Boester**) and staff support the FIG-MLA program in which STEM faculty modify their courses to use evidence based practices, including undergraduate learning assistants, to improve student learning. Four new courses were added this year (ERS101, BMB208, PHY236, PHY241). Additionally, RiSE Center Faculty & Student Success Program Coordinator **Torey Bowser** is supporting faculty and administrators at other UMS campuses who are implementing Learning Assistant programs as part of the UMS TRANSFORMS Gateways to Success pilot program. Most UM courses targeted in the Gateways to Success program are already part of the FIG-MLA program, and so were not eligible for funding. However, several new initiatives were funded through Gateways to Success that will expand opportunities in CHY and ECO courses, and build student leadership capacity within the MLA program. Building effective teaching capacity among early career scientists & mathematicians, **Dr. Speer** has been instrumental in developing training specifically for new STEM Graduate Teaching Assistants.

**Discovering and Innovating:** The NSF Teaching Fellowship Program during its six years of funding has explored strategies to retain STEM teachers in high-need rural districts, both those in their first four years of teaching and more experienced teachers. Through robust evaluation of various approaches, this team has developed a model that has retained over 85% of new STEM teachers for at least four years and has re-energized experienced teachers. The model hinges upon teachers identifying areas of practice for a yearlong focus and then forming small working groups, with support from RiSE faculty and staff, to improve their practice. The RiSE Center, in partnership with Bill Zoellick of the Schoodic Institute, is currently working to raise funds to continue this highly successful and very needed program now that grant funding has ended.

**Growing and Expanding Partnerships:** After sustaining the Maine STEM Partnership through the pandemic, the RiSE Center is actively pursuing opportunities to expand this network that supports K-16 STEM learning throughout the state. This includes sharing our findings from STEM+C research related to integrating Computing in science curricula; partnering with K-12 districts to improve Mathematics professional learning; working with middle and high school teachers in innovative research practice partnerships to engage students in authentic, community-related research related to forests, oceans and climate change; establishing the RiSE Teaching Fellowship Program; and working with researchers from UM and around the state to conduct fundamental research that informs STEM teaching practices and workforce development.

## VI. Infrastructure/Facilities/Equipment Projects (Completed/Planned)

None completed. **Planned:** To support flexible meeting and teaching modalities, the RiSE Center needs to upgrade technology in its primary meeting and teaching space, the Fireside conference room (Estabrooke 113). We are working with facilities and IT to determine what systems can be installed in this space given physical plant and building constraints. Ideally we seek to install several large format displays, responsive sound tracking microphones and an upgraded speaker system. Funding will be needed to support this transformation that will improve our ability to interact with remote stakeholders.

## VII. Summary of Anticipated Challenges

The RiSE Center desperately needs UMaine investment in faculty with STEM discipline-based education research expertise, and it needs its budgets restored to at least the levels when the (much smaller) center

was founded (see [Appendix 8](#)). RiSE has been hard-hit historically and in the most recent deep budget cut, reducing the center's base budget by 63% in the last two decades. With two recent faculty departures and at least three retirements anticipated in FY24, RiSE needs new, joint-appointed faculty to maintain earlier areas of strength (chemistry, earth and climate sciences, life sciences, mathematics, and physics) and to build important new ones: computer science and engineering. It also needs resources and faculty to sustain the Master of Science in Teaching Program. Restoration of the recently cut Financial and Personnel Manager position, and base budgeting of the assistant director are two immediate challenges. These steps should be coupled with a plan for ongoing base-budget investment with solid commitment by the administration.

## VIII. New Initiatives, Opportunities, Major Accomplishments and Highlights

**Summary:** RiSE Center faculty are exploring exciting opportunities to collaborate with the College of Engineering and Computing. We continue to play a role in the Computer Science Landscape Survey development in cooperation with the DoE and other entities. We have sustained and are building successful Research Practice Partnerships with K-12 educators across the state. Our STEM+C, INSPIRES, and Coastal TRACERS projects set the stage for current community-relevant work in marine science with coastal communities and forested rural areas, providing ample opportunity to expand reach related to CS in STEM integration and Forestry workforce development. Through our Materials Warehouse, Professional Learning, and other programs, we have sustained the Maine STEM Partnership communities through the pandemic; we are working with these communities to re-envision and expand this work. In addition, the FIG-MLA leadership team has been working with the UMS TRANSFORMS Gateways to Success team to leverage our experience implementing a successful undergraduate learning assistant program and support the system-wide pilot initiative to foster student success in gateway STEM courses across the system.

Building on the CAEP accreditation of the MST Program and prior strategic planning, and in response to the Center's self-study and external review, the RiSE Center will be exploring cluster hires of joint appointed positions in engineering education and RiSE, as well as ways to fund new joint appointed positions crucially needed in the life sciences, Earth and climate sciences, physics, chemistry, and mathematics education.

## IX. Carnegie R1 Classification

### Activities and projects which expand research opportunities, and contribute to essential growth needed to preserve the R1 classification

Through its robust education research activities and grant funding, the RiSE Center contributes to the research capacity of the University of Maine, while at the same time supporting Maine educators at all educational levels to provide strong STEM instruction that includes authentic research and inquiry related to local, state, national and even global priorities (e.g., changing forests and oceans). RiSE Center faculty and staff are building partnerships and connections to increase student awareness and preparation for productive STEM careers. In addition to its MST graduate program, which recently passed the 100 graduates mark, the RiSE Center faculty currently mentor 9 PhD students in STEM Education or Physics Education Research programs. RiSE faculty and staff collaborate with researchers across the nation and around the world, enhancing the visibility and reputation of the University.

### Center role and progress in increasing social and economic mobility of students

The work of the RiSE Center in supporting STEM teachers and bringing access to high-quality STEM education to Maine's high-need districts is key to social and economic mobility of students. Further, two major RiSE projects described above have linked science and mathematics education with local community interests and workforce needs: NSF-funded Coastal TRACERS and INSPIRES. Engaging students in STEM research that is clearly relevant to their communities and informs planning and policy is crucial for healthy communities and economic mobility. Additionally, through its NSF-funded STEM+C grant, the RiSE Center is integrating computing, computational thinking, and technology into middle school science, to give students an introduction to these areas that are foundational for most 21st century positions.

## Appendix 1. List of RiSE Center Faculty and Staff, FY2023

### RiSE Center Affiliated Faculty

Name	Title	Email
<b>Amar, François</b>	Professor of Chemistry	amar@maine.edu
<b>Batuski, David</b>	Professor of Physics	batuski@maine.edu
<b>Boester, Timothy</b>	Lecturer, Mathematics	timothy.boester@maine.edu
<b>Bruce, Mitchell R.</b>	Professor of Chemistry	mbruce@maine.edu
<b>Dimmel, Justin</b>	Assistant Professor of Mathematics Education and Instructional Technology	justin.dimmel@maine.edu
<b>Emanetoglu, Nuri</b>	Associate Professor of Electrical & Computer Engineering	nuri.emanetoglu@maine.edu
<b>Fairman, Janet</b>	Associate Professor, School of Learning and Teaching	janet.fairman@maine.edu
<b>Falconer, Heather</b>	Assistant Professor of Professional and Technical Writing	heather.falconer@maine.edu
<b>Farooq, Saima</b>	Lecturer, Physics and Astronomy	saima.farooq@maine.edu
<b>Ferrini-Mundy, Joan</b> (since 5/2023)	President of the University of Maine and the University of Maine at Machias	joan.ferrinimundy@maine.edu
<b>Franzosa, Robert D.</b>	Professor of Mathematics	franzosa@math.umaine.edu
<b>Gerbi, Christopher</b>	Professor, School of Earth & Climate Sciences	christopher.gerbi@maine.edu
<b>Hufnagel, Elizabeth</b>	Assistant Professor, School of Learning and Teaching	elizabeth.hufnagel@maine.edu
<b>Lindsay, Sara</b>	Assistant Director of the RiSE Center and Associate Professor, School of Marine Sciences	slindsay@maine.edu
<b>McKay, Susan</b>	Director of the RiSE Center and Professor of Physics	susan.mckay@maine.edu
<b>Pandiscio, Eric</b>	Associate Professor, School of Learning and Teaching	eric.pandiscio@umit.maine.edu
<b>Peterson, Franziska</b>	Assistant Professor of Mathematics and RiSE Center Graduate Coordinator	franziska.peterson@maine.edu
<b>Schauffler, Molly</b>	Assistant Research Professor, School of Earth and Climate Sciences, Climate Change Institute	mschauff@maine.edu
<b>Sezen-Barrie, Asli</b>	Associate Professor, School of Learning and Teaching	asli.sezenbarrie@maine.edu
<b>Speer, Natasha</b>	Associate Professor, Mathematics	speer@math.umaine.edu
<b>Stetzer, MacKenzie</b>	Associate Professor, Physics and Astronomy	mackenzie.stetzer@maine.edu
<b>Thompson, John R.</b>	Professor of Physics / Department Chair, Physics and Astronomy	thompsonj@maine.edu



## RiSE Center Staff

<b>Name</b>	<b>Title</b>	<b>Email</b>
<b>Bowser, Torey</b> (since 8/2022)	RiSE Center Faculty & Student Success Programs Coordinator (regular position began 01/2023)	torey.bowser@maine.edu
<b>ByersSmall, Beth</b>	RiSE Center Teaching Fellowship Program Coordinator	elizabeth.byerssmall@maine.edu
<b>Clark, Yadina</b>	Administrative Specialist CL3	yadina.clark@maine.edu
<b>Davis, Kelsey</b> (since 1/2023)	STEM Education Research Associate	kelsey.e.davis@maine.edu
<b>Fronczak, Jennifer</b> (since 9/2022)	Professional Learning Specialist	jennifer.fronczak@maine.edu
<b>Holt, Gabrielle</b> (since 9/2022)	Professional Learning Specialist	gabrielle.holt@maine.edu
<b>McKinnon, Cara</b> (7–8/2022)	Interim FIG-MLA Program Coordinator (temporary)	cara.mckinnon@maine.edu
<b>Muncey, Beth</b>	Resource and Professional Development Coordinator	elizabeth.muncey@maine.edu
<b>Raynes, Maureen</b> (until 1/2023)	Financial & Personnel Manager	maureen.raynes@maine.edu
<b>Siddons, Chrissy</b>	Program Evaluation Specialist	christina.siddons@maine.edu
<b>Van der Eb, Marina</b>	Maine STEM Partnership Coordinator	marina.van@maine.edu

## Appendix 2. Funding Awarded to RiSE Center Faculty and Staff, FY2023

Only RiSE personnel are listed below; see UMaine Research Reporting Dashboard for complete listing.

Award Date	Title	Funding Agency	RiSE Personnel Involved	Sponsor Total
07/27/2022	Maine Education Policy Research Institute (MEPRI)	ME Dept of Education through Maine State Legislature	Fairman, Janet	\$125,000
08/31/2022	Collaborative research: Developing, testing, and disseminating reasoning chain construction tools for use in physics and chemistry	National Science Foundation	Stetzer, MacKenzie/ Bruce, Mitchell	\$470,673
09/05/2022	RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA) Yr4	National Science Foundation	McKay, Susan/ Speer, Natasha/ Stetzer, MacKenzie	\$4,260,563
10/18/2022	IPA DRK-12 Program Yr2	National Science Foundation	Sezen-Barrie. Asli	\$130,019
3/27/2023	Maine EPSCoR RII Track-1 Planning Grant	National Science Foundation	McKay, Susan	\$100,000
4/28/2023	Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics +\$ (Supplement)	National Science Foundation	Thompson, John	\$90,238
Total Awarded in FY2023				\$5,176,493

### Appendix 3. Continuing Funding Awarded to RiSE Faculty and Staff, FY2023

Only RiSE Personnel are listed below; see UMaine Research Reporting Dashboard for complete listing.

Award Date	Title	Funding Agency	RiSE Personnel Involved	Sponsor Total
3/24/2016	A Model NSF Teaching Fellowship Program to Improve STEM Teacher Recruitment, Preparation, Professional Development, and Retention in Rural High-Need Schools	National Science Foundation	McKay, Susan (PI) Pandiscio, Eric Stetzer, MacKenzie	\$1,950,034
6/22/2018	Collaborative Research: Establishing a new model for research-based curriculum development in physics aligned with dual-process theories of reasoning	National Science Foundation	Stetzer, MacKenzie	\$863,239
9/11/2018	A remote multimodal learning environment to increase graphical information access for blind and visually impaired students	National Science Foundation	Dimmel, Justin (Co-PI)	\$747,894
9/20/2018	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	McKay, Susan (PI) Bruce, Mitchell (Co-PI) Fratini, James (Co-PI) Lindsay, Sara (Co-PI)	\$1,250,000
1/4/2019	Enhancing Learning Outcomes In Food Engineering And Processing Courses For Non-Engineers Using Student-Centered Approaches	US Dept of Agriculture	McKay, Susan (PI)	\$747,328
2/22/2019	REU Site: Sensor Science and Engineering	National Science Foundation	Emanetoglu, Nuri (PI)	\$430,897
4/12/2019	How do scale and dimension affect students' perceptions of geometric diagrams?	Spencer Foundation	Dimmel, Justin (PI)	\$49,217
6/27/2019	A remote multimodal learning environment to increase graphical information access for blind and visually impaired students	National Science Foundation	Dimmel, Justin (Co-PI)	\$15,360
8/20/2019	Novel Harsh Environment Materials and Fabrication Techniques for Wireless Sensor Applications yr1	US Dept of Energy	Emanetoglu, Nuri (Co-PI)	\$370,082
9/5/2019	Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics	National Science Foundation	Thompson, John R (PI)	\$282,066
8/12/2020	Understanding Extreme Weather with Big Data Yr2	National Science Foundation through Education Development Center	Sezen-Barrie, Asli (PI)	\$38,991

3/12/2021	Examining Academic Self-Efficacy and Writing Development in Students with Specific Learning Disabilities	NCTE/Conference on College Composition and Communication	Falconer, Heather (Co-PI) (through Curry College)	\$4,000
7/22/2021	Maine Education Policy Research Institute (MEPRI)	ME Dept of Education through Maine State Legislature	Fairman, Janet (PI)	\$125,000
7/30/2021	Math4ME	US Dept of Education through ME Dept of Education	Fairman, Janet (PI)	\$60,062
9/10/2021	IPA DRK-12 Program	National Science Foundation	Sezen-Barrie, Asli (PI)	\$130,708
5/1/2022	National Examination Test Tool Version 2.2.1MS, Servant Heart Research Collaborative, UMaine Honors College. Co-PIs: François G. Amar, Julie DellaMattera, Melissa Ladenheim	New Covenant Foundation via Office of Innovation	Amar, François (Co-PI)	\$30,064
6/28/2022	Math4ME Program Evaluation	US Dept of Education through ME Dept of Education	Fairman, Janet (PI)	\$67,544
11/1/2017	Improving the Preparation of Graduate Students to Teach Undergraduate Mathematics	National Science Foundation through Mathematical Association of America	Speer, Natasha (PI)	\$25,510
8/23/2018	Improving the Preparation of Graduate Students to Teach Undergraduate Mathematics	National Science Foundation through Mathematical Association of America	Speer, Natasha (PI)	\$37,265
6/24/2019	Transdisciplinary Predoctoral Training in Biomedical Science and Engineering	US Dept of Health & Human Services	Fairman, Janet (Co-PI)	\$217,444
8/9/2019	RII Track 2 FEC: Leveraging informatics to resolve uncertainties in the Northern Forest's carbon budget RiSE contributes education research and a research-practice partnership with teachers to this project, with RiSE personnel listed all contributing.	National Science Foundation	Honders, Laura Lindsay, Sara McKay, Susan Peterson, Franziska Van der Eb, Marina (Aaron Weiskittel, PI)	\$3,000,000
6/29/2020	Transdisciplinary Predoctoral Training in Biomedical Science and Engineering Yr2	US Dept of Health & Human Services	Fairman, Janet (Co-PI)	\$86,400

9/9/2020	Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics	National Science Foundation	Thompson, John R (PI)	\$85,995
3/18/2021	Collaborative Research: Building Adaptability for Teaching Online through Peer-Reviewed, Active-Learning Resources and Professional Development	National Science Foundation	Vinson, Erin (PI) Stetzer, MacKenzie (new PI)	\$144,771
3/30/2021	Community Resilience Informed by Science and Experience: Developing Knowledge, Skill and Relationships to Build the Capacity of Rural Coastal Communities to Plan for a Resilient Future	Gulf of Maine Research Institute / US Dept of Commerce	McKay, Susan, Speer, Natasha, Stetzer, MacKenzie	\$74,702
10/8/2021	RII Track 2 FEC: Leveraging informatics to resolve uncertainties in the Northern Forest's carbon budget  RiSE contributes education research and a research-practice partnership with teachers to this project, with RiSE personnel listed all contributing.	National Science Foundation	Honders, Laura Lindsay, Sara McKay, Susan Peterson, Franziska Van der Eb, Marina (Aaron Weiskittel, PI)	\$1,500,000
10/13/2021	Next Generation Harsh-Environment Materials and Wireless Sensor Techniques for Energy Sector Application	US Dept of Energy	Emanetoglu, Nuri (Co-PI)	\$1,072,930
10/27/2021	RII Track 2 FEC: Leveraging informatics to resolve uncertainties in the Northern Forest's carbon budget  RiSE contributes education research and a research-practice partnership with teachers to this project, with RiSE personnel listed all contributing.	National Science Foundation	Honders, Laura Lindsay, Sara McKay, Susan Peterson, Franziska Van der Eb, Marina (Aaron Weiskittel, PI)	\$599,999
8/22/2019	RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA)	National Science Foundation	McKay, Susan, Speer, Natasha Stetzer, MacKenzie	\$2,877,854
10/1/2020	RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA) Yr2	National Science Foundation	McKay, Susan, Speer, Natasha Stetzer, MacKenzie	\$4,471,539
9/18/2021	RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA) Yr3	National Science Foundation	McKay, Susan, Speer, Natasha Stetzer, MacKenzie	\$4,372,317

9/23/2021	Recruitment, Reproduction and Larval Supply in Alaskan Deep-Water Corals	US Dept of Commerce through Cooperative Institute for the North Atlantic Regi	Gerbi, Christopher (PI)	\$44,998
10/12/2021	Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics Yr3	National Science Foundation	Thompson, John R (PI)	\$85,994
9/1/2021	Collaborative research: From community to practice: Evaluating how open educational resources facilitate implementation of Vision and Change principles across diverse institutional contexts	National Science Foundation	Stetzer, MacKenzie (PI) (transferred from Erin Vinson)	\$362,761
6/10/2022	DTI: A Model Program to Engage Students in Authentic, Technology-Infused Coastal Research and Monitoring: Building Student Data Literacy and Career Competency through Partnership	National Science Foundation	McKay, Susan (PI) Lindsay, Sara Peterson, Franziska Van der Eb, Marina	\$1,350,000
8/16/2019	Collaborative Research: Research on learning and teaching at the physics-mathematics interface +\$	National Science Foundation	Thompson, John R (PI)	\$282,066
1/31/2022	NSF CAREER: Beyond two-dimensional diagrams: Spatial inscriptions and the future of school geometry	National Science Foundation	Dimmel, Justin (PI)	\$164,711
6/14/2022	NSF CAREER: A Transformative Approach for Teaching and Learning Geometry by Representing and Interacting with Three-dimensional Figures - YR3	National Science Foundation	Dimmel, Justin (PI)	\$180,863
6/29/2020	A remote multimodal learning environment to increase graphical information access for blind and visually impaired students	National Science Foundation	Dimmel, Justin (Co-PI)	\$16,000
10/1/2020	Examining the impact of the Partnership for Undergraduate Life Sciences Education Recognition Program as a Mechanism to Foster Departmental Transformation	National Science Foundation	Lindsay, Sara (Sr. Pers.) (Award to Dartmouth College, Thomas P. Jack, PI)	\$600,322
5/10/2021	Improving the Preparation of Graduate Students to Teach Undergraduate Mathematic	National Science Foundation through Mathematical Association of America	Speer, Natasha (PI)	\$19,000
Total Awarded grants Continuing in FY2023:				\$28,835,927

## Appendix 4. Published and Accepted Works by RiSE Center Faculty, Staff and Students, FY2023

RiSE-affiliated authors indicated in bold

Ahmad, A. A., Marutheri Parambath, J. B., Postnikov, P. S., Guselnikova, O., Chehimi, M. M., <b>Bruce, M. R.</b> , Bruce, A. E., & Mohamed, A. A. (2021). Conceptual developments of aryldiazonium salts as modifiers for gold colloids and surfaces. <i>Langmuir</i> , 37(30), 8897–8907. <a href="https://doi.org/10.1021/acs.langmuir.1c00884">https://doi.org/10.1021/acs.langmuir.1c00884</a>
<b>Bruce, M. R.</b> , Bruce, A. E., & Walter, J. (2022). Creating representation in support of chemical reasoning to connect macroscopic and submicroscopic domains of knowledge. <i>Journal of Chemical Education</i> , 99(4), 1734–1746. <a href="https://doi.org/10.1021/acs.jchemed.1c00292">https://doi.org/10.1021/acs.jchemed.1c00292</a>
Frei, A., Elliott, A. G., Kan, A., Dinh, H., Bräse, S., Bruce, A. E., <b>Bruce, M. R.</b> , Chen, F., Humaidy, D., Jung, N., King, A. P., Lye, P. G., Maliszewska, H. K., Mansour, A. M., Matiadis, D., Muñoz, M. P., Pai, T.-Y., Pokhrel, S., Sadler, P. J., ... Blaskovich, M. A. (2022). Metal complexes as antifungals? from a crowd-sourced compound library to the first <i>in vivo</i> experiments. <i>JACS Au</i> , 2(10), 2277–2294. <a href="https://doi.org/10.1021/jacsau.2c00308">https://doi.org/10.1021/jacsau.2c00308</a>
Wilhelm, K. Stolpman, D., Mehta, S., Villacob, R., Zechmann, B., Solouki, T., Pokhrel, S., Ahmad, A. L., <b>Bruce, M. R.</b> , Bruce, A. E., Worth, C., & Taube, J. (2023). <i>Tri(2-furyl) and Triphenyl Phosphine Gold(I) Pyridyl- and Pyrimidine-Thiolate Complexes Exhibit Differential Anti-Cancer Cytotoxic Activities</i> [Manuscript submitted for publication]. Department of Chemistry and Biochemistry, Baylor University, Department of Chemistry, University of Maine, and Department of Biology, Baylor University.
<b>Bruce, M. R.</b> , Bruce, A. E., Bernard, S. E., Bergeron, A. N., Ahmad, A. A., Bruce, T. A., Perera, D. C., Pokhrel, S., Saleh, S., <b>Tyrina, A.</b> , & Yaparathne, S. (2021). Designing a remote, synchronous, hands-on General Chemistry Lab Course. <i>Journal of Chemical Education</i> , 98(10), 3131–3142. <a href="https://doi.org/10.1021/acs.jchemed.1c00559">https://doi.org/10.1021/acs.jchemed.1c00559</a>
Doore, S. A., <b>Dimmel, J.</b> , Kaplan, T. M., Guenther, B. A., & Giudice, N. A. (2023). Multimodality as universality: Designing inclusive accessibility to graphical information. <i>Frontiers in Education</i> , 8. <a href="https://doi.org/10.3389/educ.2023.1071759">https://doi.org/10.3389/educ.2023.1071759</a>
<b>Dimmel J. K.</b> (2023) Reduction and enactment with digital images: What can 0s and 1s represent? <i>Constructivist Foundations</i> 18(2), 206–209. <a href="https://constructivist.info/18/2/206">https://constructivist.info/18/2/206</a>
Blaszkievicz, M., Caron, L., Villinski, B., Passarelli, J., Donnelly, J., Towne, J. M., Story, N. M., Merchant, E., Khan, F. S., <b>Emanetoglu, N.</b> , Kass, L., Smith, R. L., & Townsend, K. L. (2023). <i>Transdermal electrophysiological recordings of diabetic peripheral neuropathy using a needle electrode array in mice and men</i> . bioRxiv. <a href="https://doi.org/10.1101/2023.03.03.530993">https://doi.org/10.1101/2023.03.03.530993</a>
Winters, S., Thapa, N., Doucette, L., Kincaid, J., Cui, Q., <b>Emanetoglu, N.</b> , & Pereira da Cunha, M. (2023). <i>High-Temperature Wireless Sensor Platform Powered by Energy Scavenging</i> [Manuscript submitted for publication]. Electrical and Computer Engineering, University of Maine.
Trusty, Y., Khmeleva, E., Hartz, J., McGann, J., <b>Emanetoglu, N.</b> , & Vetelino, J. (in press). A Temperature-Compensated Lithium Tantalate Sensor Platform. In Proceedings of <i>IEEE 2023 Ultrasonics Symposium</i> .
<b>Fairman, J.</b> , Smith, D., Pullen, P. & Lebel, S. (2023). The challenge of keeping teacher professional learning relevant. In S. Swaffield & P. Poekert (Eds.), <i>Leadership for professional learning: Perspectives, constructs and connections</i> (Chpt. 17). Routledge.
<b>Fairman, J.</b> , & Lech, P. (2023). <i>Factors driving undergraduate students' choice of a college major and perceptions about teaching as a career choice</i> . Maine Education Policy Research Institute (MEPRI). <a href="https://bpb-us-w2.wpmucdn.com/wpsites.maine.edu/dist/e/97/files/2023/05/Factors-Driving-Undergraduate-Students-Choice-of-a-College-Major-and-Perceptions-about-Teaching-as-a-Career-Choice.pdf">https://bpb-us-w2.wpmucdn.com/wpsites.maine.edu/dist/e/97/files/2023/05/Factors-Driving-Undergraduate-Students-Choice-of-a-College-Major-and-Perceptions-about-Teaching-as-a-Career-Choice.pdf</a>

**Fairman, J., Lech, P., & Crane, R.** (2023). *Maine principals' views on emergency-certified teachers*. Maine Education Policy Research Institute (MEPRI).  
[https://bpb-us-w2.wpmucdn.com/wpsites.maine.edu/dist/e/97/files/2023/06/Maine\\_Principals\\_Views\\_on\\_Emergency-Certified\\_Teachers.pdf](https://bpb-us-w2.wpmucdn.com/wpsites.maine.edu/dist/e/97/files/2023/06/Maine_Principals_Views_on_Emergency-Certified_Teachers.pdf)

**Falconer, H. & Payne, E.** (2022). Workshop: Incorporating Ethics and Justice in STEM Communication Courses. In *Proceedings of the 2022 IEEE International Professional Communication Conference (ProComm)*, (pp. 467-468). Limerick, Ireland: IEEE Press. <https://doi.org/10.1109/ProComm53155.2022.00093>.

**Falconer, H.** (Spring 2023). *Masking inequality with good intentions: Systemic bias, counterspaces, and discourse acquisition in STEM education*. University Press of Colorado/Practices and Possibilities, Fort Collins, CO.

**Falconer, H., and McClary, L.** (Eds.) (In review). *Inclusive STEM: Transforming disciplinary writing instruction for a socially-just future*. University Press of Colorado/The WAC Clearinghouse.

Kelly, M., **Falconer, H.**, Gonzalez, C., & Dahlman, J. (Eds.). (2023). *Adapting the past to reimagine possible futures: Celebrating and critiquing WAC at 50*. University Press of Colorado/The WAC Clearinghouse.  
<https://doi.org/10.37514/PER-B.2023.1947>

**Geheb, E., Sezen-Barrie, A., & Tilbury, K.** (2022). Research on Engineering Education at K-12 Settings across Communities of Practice: A Systematic Literature Review (2009-2018). In *Proceedings of the 2022 ASEE Annual Conference & Exposition*. Minneapolis, MN: ASEE PEER. <https://peer.asee.org/41112>.

Song, B. R., Song, W. J., Johnson, S. E., **Gerbi, C. C.**, & Vel, S. S. (2022). Elastic contrast, rupture directivity, and damage asymmetry in an anisotropic bimaterial strike-slip fault at middle crustal depths. *Journal of Geophysical Research: Solid Earth*, 127(7). <https://doi.org/10.1029/2021jb023821>

Martin, L., **Hufnagel, E.**, Amat, A., Espinet, M., & Bellocchi, A. (2023). Pre-service Elementary Teachers as Game Designers: Emotional Experiences from the Field. In G. P. Thomas & H. J. Boon (Eds.), *Challenges in science education: Global perspectives for the future* (pp. 133–153). Palgrave Macmillan.  
<https://link.springer.com/book/10.1007/978-3-031-18092-7>

**Lindsay, S.** (in press) Sublethal Predation. In D. Gibson (Ed.), *Oxford Bibliographies in Ecology*. New York: Oxford University Press.

**Peterson, F.** (2022). Creating data stories: Students' reasoning skills when working with an online data platform. In *Proceedings of the 44th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Nashville, TN.

Byun, S., Weiland, T., Cannon, S. O., Fernandes, A., Nti-Asante, E., **Peterson, F.**, Smucker, K., & Engledowl, C. (2023, in press). Teaching and learning with data investigation [Working Group Report]. In *Proceedings of the 45th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Reno, NV.

Byun, S., Weiland, T., Cannon, S. O., Fernandes, A., Nti-Asante, E., **Peterson, F.**, Smucker, K., Adamoah, K., & Engledowl, C. (2023, in press). Teaching and learning with data investigation: Toward a socially and environmentally just world [Working Group]. In *Proceedings of the 45th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Reno, NV.

**Peterson, F., Toolin, R., Siddons, C., Lindsay, S., McKay, S., & Van der Eb, M.** (2023). Engaging teachers, education researchers, and scientists in authentic investigations with forestry data. In *Proceedings of the 54th annual meeting of the New England Educational Research Organization (NEERO) Conference*. Portsmouth, NH.

**Schauffler, M., Zoellick, B., Hunter-Thomson, K., Nelson, S., Laursen Brickley, A., & Peterson, F.** (2022). Partners in Data Literacy. <https://partnersindataliteracy.com/>

**Sezen-Barrie, A., & Avraamidou, L.** (2022). "A Different Kind of Middleman": Preservice Science Teachers' Agency for Climate Change Education. In *Justice and Equity in Climate Change Education* (pp. 174-197). Routledge.  
<https://www.routledge.com/Justice-and-Equity-in-Climate-Change-Education-Exploring-Social-and-Ethical/Walsh/p/book/9781032162560>

**Sezen-Barrie, A.** (2023). WeatherX. <https://sites.google.com/view/edcweatherx/home>



Fensie, A., Pierre, T. St., Jain, J., & **Sezen-Barrie, A.** (2023). Engaged learning during distraction: A case study of successful working moms in distance education. *Journal of Computing in Higher Education*.  
<https://doi.org/10.1007/s12528-023-09359-0>

**Sezen-Barrie, A.**, Stapleton, M. K., Marbach-Ad, G., & **Miller-Rushing, A.** (2023). Epistemic discourses and conceptual coherence in students' explanatory models: The case of ocean acidification and its impacts on oysters. *Education Sciences*, 13(5), 496. <https://doi.org/10.3390/educsci13050496>

**Siddons, C., Bruce, M. Callahan, M., Lindsay, S., Millay, L., McKay, S., Muncey, E., Oesterlin, E., Van der Eb, M.** (2023). *Integrating computer science into middle school science instruction: assessing barriers and opportunities across diverse school districts* [Manuscript submitted for publication]. Center for Research in STEM Education, University of Maine.

Andrews, T., **Speer, N.**, & Shultz, G. (2022). Building bridges: A review and synthesis of research on teaching knowledge for undergraduate instruction in science, engineering, and mathematics. *International Journal of STEM Education*, 9(1), 1-21. <https://doi.org/10.1186/s40594-022-00380-w>

Brale, E., Bookman, J., Gehrtz, J. & **Speer, N.** (2023). A Survey of Programs Preparing Graduate Students to Teach Undergraduate Mathematics. In Proceedings of the *25th Annual Conference on Research in Undergraduate Mathematics Education*, Omaha, NE.

Hauk, S. & **Speer, N.** (2023). Decentering and Interconnecting as Professional Skills in the Preparation of New College Mathematics Instructors. Proceedings of the *25th Annual Conference on Research in Undergraduate Mathematics Education*, Omaha, NE.

Sowles, E., Rosen, D. J., & **Stetzer, M. R.** (2022). Using metacognitive prompts to explore student reasoning trajectories. In B. W. Frank, D. Jones, & Q. X. Ryan (Eds.), *Proceedings of the 2022 Physics Education Research Conference*, (pp. 438-443). Grand Rapids, MI. <https://doi.org/10.1119/perc.2022.pr.Sowles>

Fittswood, T., Rosen, D. J., & **Stetzer, M. R.** (2022). Insights from an intervention designed to support consistent reasoning. In B. W. Frank, D. Jones, & Q. X. Ryan, *Proceedings of 2022 Physics Education Research Conference* (pp. 170-175). Grand Rapids, MI. <https://doi.org/10.1119/perc.2022.pr.Fittswood>

Speirs, J. C., **Stetzer, M. R.**, & Lindsey, B. A. (2023). *Utilizing network analysis to explore student qualitative inferential reasoning chains* [Manuscript submitted for publication]. Department of Physics and Astronomy, University of Maine.

Lindsey, B. A., **Stetzer, M. R.**, Speirs, J. C., Ferm Jr., W. N., & van Hulten, A. (2023). Investigating student ability to follow reasoning chains: The role of conceptual understanding. *Physical Review Physics Education Research*, 19(1). <https://doi.org/10.1103/physrevphyseduces.19.010128>

Riihiluoma, W., Topdemir, Z., & **Thompson, J. R.** (2022). Applying a symbolic forms lens to probability expressions in upper-division quantum mechanics. In Q. X. Ryan, D. Jones, & B. W. Frank (Eds.), *2022 Physics Education Research Conference Proceedings* (pp. 383–388). American Association of Physics Teachers. <https://www.per-central.org/items/PERC.cfm?Y=2022> (full text available at <https://doi.org/10.1119/perc.2022.pr.Riihiluoma>)

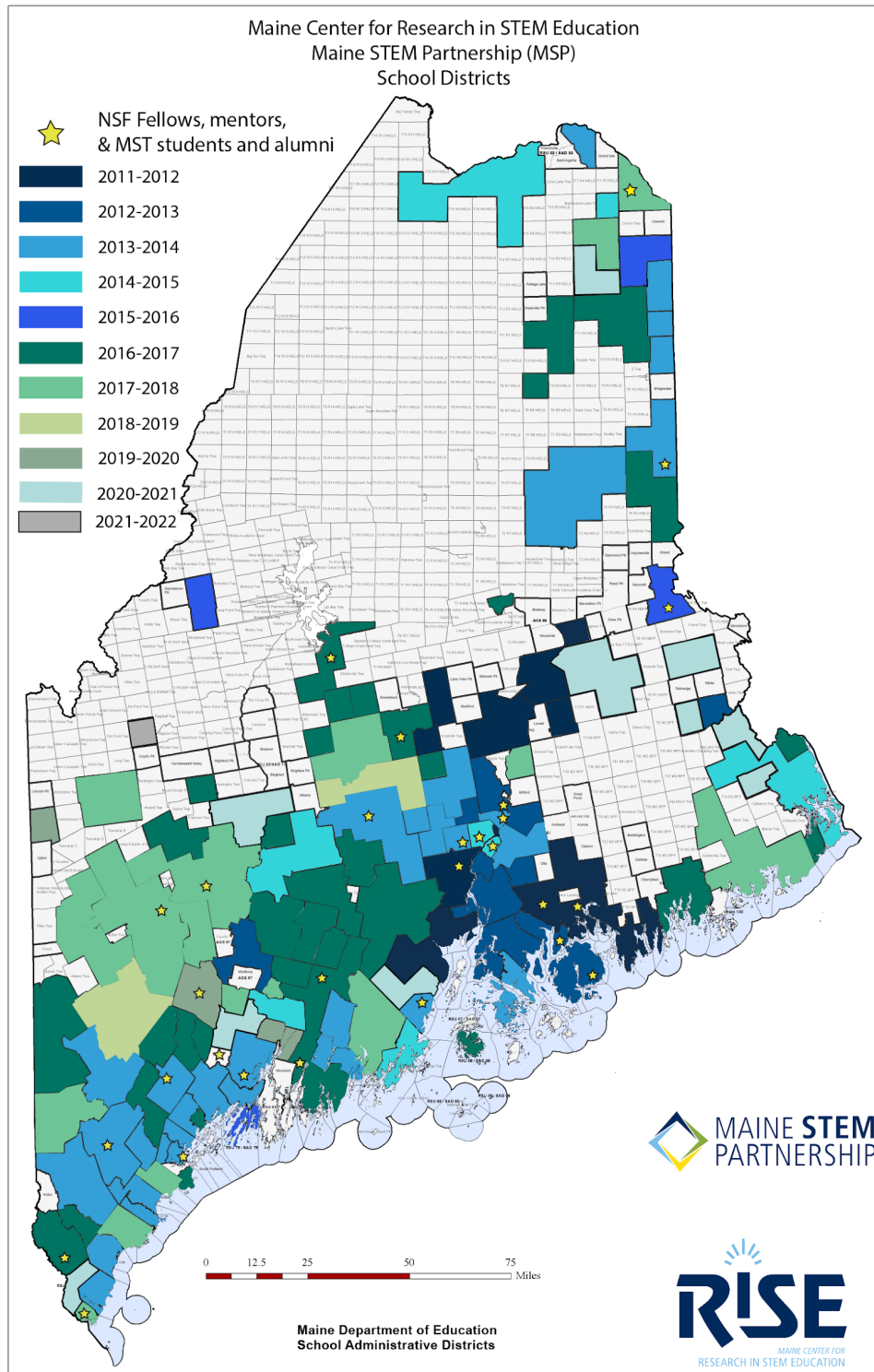
Bajracharya, R. R., Sealey, V. L., & **Thompson, J. R.** (2023). Student understanding of the sign of negative definite integrals in mathematics and physics. *International Journal of Research in Undergraduate Mathematics Education*, 9(1), 62–91. <https://doi.org/10.1007/s40753-022-00202-y>

Schermerhorn, B. P., & **Thompson, J. R.** (2023). *Symbolic Blending: Incorporating symbolic forms into conceptual blending to account for contextual conceptual understanding in equation construction and interpretation* [Manuscript submitted for publication]. Department of Physics and Astronomy, University of Maine.

## Appendix 5. Courses Offered by the RiSE Center, FY2023

Semester	Title	Professor	Enrollment	Credit Hours
Summer 2022	SMT 699 Graduate Thesis/ Research	Susan McKay	8	13
Fall 2022	SMT 501 Integrated Approaches to Physics Education I	Drew Rosen Zeynep Topdemir	4	12
Fall 2022	SMT 503 Integrated Approaches in Earth Sciences Education I	Christopher Gerbi	7	21
Fall 2022	SMT 588 Science and Mathematics Education Research (Seminar)	Franziska Peterson	1	1
Fall 2022	SMT 589 Graduate Seminar: STEM Teaching and Learning	Franziska Peterson	2	2
Fall 2022	SMT 699 Graduate Thesis/ Research	Susan McKay	4	10
Fall 2022	MLA Professional Learning Sessions (1 hour weekly for first time Maine Learning Assistants offered twice a week)	Sara Lindsay Torey Bowser	41	0
Spring 2023	SMT 500 Educational Psychology with Applications to Science and Mathematics Teaching and Learning	Franziska Peterson	6	18
Spring 2023	SMT 590 Seminar for Teaching Interns	Susan McKay	4	4
Spring 2023	SMT 591 Secondary Student Teaching	Susan McKay	4	20
Spring 2023	SMT 598 Special Topics in Science and Mathematics Education– Integrated Methods in Chemical Education Research	Mitchell Bruce	4	12
Spring 2023	SMT 598 Special Topics in Science and Mathematics Education	Jonathan Doty	5	5
Spring 2023	SMT 699 Graduate Thesis/ Research	Susan McKay	3	8
Spring 2023	MLA Professional Learning Sessions (1 hour weekly for first time Maine Learning Assistants, offered twice a week)	Timothy Boester Torey Bowser	26	0

## Appendix 6. Map of School Districts Partnering with RiSE through the Maine STEM Partnership



Although new schools were added, no additional districts were added as Maine STEM Partners in FY2023.

## Appendix 7. RiSE Center 5-Year Key Performance Indicator Data

### A. Conduct and Sustain STEM Education Research Within and Across Disciplines

Performance Indicator	FY2019	FY2020	FY2021	FY2022	FY2023	5-YR Average
Awards Received: Millions of Dollars (#)	\$6.52 (10)	\$0.81 (11)	\$0.78 (5)	\$10.15 (16)	\$5.18 (6)	\$4.69 (9.6)
Continuing Awards: Millions of Dollars (#)	\$8.32 (28)	\$10.3 (21)	\$37.64 (27)	\$30.84 (53)	\$28.84 (41)	\$23.19 (33.6)
Submitted Proposals: Millions of Dollars (#)	\$40.00 (20)	\$7.80	\$9.40 (23)	\$13.57 (11)	\$14.12 (9)	\$16.98 (15.8)
Published & Accepted works (#)	28	25	32	32	32	29.8
Presentations (#)	>112	>70	>50	36	42	62

### B. Foster Community Partnerships and Innovative Collaborations at All Educational Levels

Performance Indicator	FY2019	FY2020	FY2021	FY2022	FY2023	3 or 5-YR Average
<i>Maine STEM Partnership Materials Warehouse provides hands-on, research supported materials and activities for STEM learning (K-12)</i>						
Districts / Schools (#)	NA	NA	28 / 39	28 / 34	31 / 35	29 / 36
Teachers participating (#)	NA	NA	103	117	115	111.7
Students impacted (#)	NA	NA	4800	5400	4672	4957.3
<i>Faculty course modification Incentive Grant-Maine Learning Assistant (FIG-MLA) program supports faculty and peer learning assistants in STEM courses to improve learning and student retention (undergraduate)</i>						
Courses Supported (#)	25	31	26	25	28	27
Faculty participating (#)	29	35	27	28	33	30.4
Undergraduate MLAs (#)	131	145	109	125	122	126.4
Students Impacted (#)	4862	5710	5348	5427	5995	5468.4

### C. Provide Graduate Education for STEM Educators and Researchers

Performance Indicator	FY2019	FY2020	FY2021	FY2022	FY2023	4 or 5-YR Average
Graduate Courses offered	NA	16	15	14	14	14.8
Graduate Student Credit Hours	NA	281*	176	144	126	148.7
MST degrees awarded	5	4	7	5	7	5.8
*includes INT482 seminar for Maine Learning Assistants which was replaced with a weekly professional meeting beginning FY2021 (no credit hours)						

### D. Sustain a Statewide Professional Community Using Research to Improve STEM Education

Performance Indicator	FY2019	FY2020	FY2021	FY2022	FY2023	4 or 5-YR Average
Professional Learning: Participants	NA	>765	>300	290	259	403.5
Professional Learning: Contact Hours	NA	>5000	>3900	5618	4794	4828
RiSE Conference Attendance	131	postponed	87	98	89	101.3
Maine STEM Partnership Summit Attendance	107	111	62	76	121	95.4

## Appendix 8. RiSE Center Base Budget Investment FY05-FY24

In terms of 2023 dollars, the RiSE base budget total (E&G and MEIF) has decreased by 63% from FY05 to FY24. The MST budget, which supports the Master of Science in Teaching Program, a highly regarded program for secondary mathematics and science teacher preparation that meets a crucial Maine and national workforce need, has decreased by 74%.

### General Notes:

In FY05, the RiSE Center E&G budget (without faculty joint appointment and administrative salaries included) was \$150,380 from the MST budget and \$50,000 from the Maine Academic Prominence Initiative (MAPI), which was awarded as an ongoing annual award. When the Center was founded, four faculty positions (two in physics education and two in mathematics education) were added to UMaine, with expectations for teaching in the MST Program and research in the Center. Salaries and benefits for these four faculty and the director were retained in their home department budgets, so we have removed faculty and director salary and benefit allocations in FY23 and FY24 for this comparison. Considering the change in purchasing power of the dollar from 2005 to 2023, in 2023, \$1.5623 is required to have the same buying power as \$1.00 in 2005. This figure provides a conservative estimate, since higher education costs have increased faster than the general inflation rate. Details of adjustments in the FY23 and FY24 budgets are provided in the second table below. The FY24 July GL budget figures are preliminary and do not include, for example, AFUM raises. A benefit rate for base-budgeted salaries of 51% was used for both FY23 and FY24.

### Summary Comparison of RiSE Budget Reduction

#### FY05 – FY24

	FY05 Base Funds	FY05 Base Funds in 2023 dollars	Adjusted FY23 Budget	Adjusted FY24 Budget	% Budget Reduction from FY05 to FY23 (2023 \$)	% Budget Reduction from FY05 to FY24 (2023 \$)
MST Budget (E&G)	\$150,380	\$234,939	\$108,701	\$60,062 <sup>1</sup>	54%	74%
MAPI Budget (E&G)	\$ 50,000	\$ 78,115	\$39,189	\$38,179	50%	51%
MEIF Budget	\$ 35,000	\$ 54,680	\$38,688	\$38,679	29%	29%
<b>TOTAL</b>	<b>\$235,380</b>	<b>\$367,734</b>	<b>\$186,578</b>	<b>\$136,920</b>	<b>49%</b>	<b>63%</b>

<sup>1</sup>This huge one-year cut reflects the loss of 2/3 of the RiSE Financial and Personnel Manager position.

### Details of Adjustments in FY23 and FY24 Budgets

	<u>MST Budget FY23</u>	<u>MAPI Budget FY23</u>	<u>MEIF Budget FY23</u>	<u>MST Budget FY24</u>	<u>MAPI Budget FY24</u>	<u>MEIF Budget FY24</u>
GL Listed Amount	\$217,210	\$39,189	\$63,602	168,571	\$38,179	\$84,012
Reduction amount of faculty salary and benefits	\$108,509	—	\$24,914	\$108,509	—	\$45,333
<b>Adjusted Balance</b>	<b>\$108,701</b>	<b>\$39,189</b>	<b>\$38,688</b>	<b>\$60,062</b>	<b>\$38,179</b>	<b>\$38,679</b>