



# Maine Center for Research in STEM Education (RiSE Center)

## Annual Report

July 1, 2020 – June 30, 2021

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## Executive Summary

**Accomplishments and Highlights.** The Maine Center for Research in STEM Education (RiSE Center), with its twenty-one 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. In spite of the pandemic, RiSE members published or have had accepted 20 refereed journal articles and conference proceedings, 1 refereed abstract, 7 non-refereed journal articles, 1 book chapter, and 3 policy reports. Over 50 research presentations were given, almost all virtually, at conferences and other venues. Graduate and undergraduate students are integral to the center's research and, in the past year, 7 Master's theses and 13 honors theses and senior capstone research projects were completed mentored by RiSE faculty members. Seven MST degrees were awarded through the RiSE Center. RiSE faculty and professional staff are Principal Investigator or Co-Principal Investigator on 5 new and 25 continuing grants totaling over \$12 million. The RiSE Center also plays a significant role, with multiple faculty and staff serving as senior personnel, in two ongoing EPSCoR grants: RII Track-1 eDNA and RII Track-2 INSPIRES, totaling another \$26 million. These grants span the spectrum from basic to applied research in teaching and learning and many involve multi-institutional and multi-state partnerships. RiSE personnel supported submission of an additional \$9.4 million through 23 new grant proposals in the past year as either PI or Co-PI and also worked closely with new faculty on career grants to strengthen the broader impacts of the proposed research and to share their grant writing experiences and knowledge.

The RiSE Center has continued to take important steps to sustain and enhance the Maine STEM Partnership at the RiSE Center, a statewide STEM education improvement community for PK-16+ educators. In the pandemic, this community continued to provide a support network for teachers as they worked to provide learning experiences for their students in a variety of modalities. All planned programs of professional learning for teachers quickly pivoted to virtual gatherings, made interactive and engaging through the creativity and skills of RiSE professional staff, faculty, and teacher leaders. Over 300 Maine science and mathematics teachers actively participated in extensive professional learning opportunities in the past year. These PK-12 opportunities were supported by three continuing grants, contributions totaling over \$92,000 from school districts, and generous donations from alumni and friends. Virtual professional learning opportunities were very well received by teachers. One team of 39 new and experienced teachers worked for over 1,000 person-hours during July and August of 2020 to develop and share over 125 learning experiences, ready to be used in the 2020-2021 school year. This collection of instructional resources, *Pinnacles* (pandemic-inspired active learning experiences in STEM), is available to all on the Maine STEM Partnership website and was heavily used by new teachers from the MST Program and others as they began their first year of teaching during the pandemic. Learning experiences were carefully reviewed by faculty and additional teachers, who provided feedback to their developers. In the summer of 2020, RiSE planned and hosted virtual summer offerings for 142 PK-12 teachers who participated in over 3,900 teacher-hours of summer professional learning, all of which included strategies for remote and hybrid modes of instruction. The RiSE Center's 2021 annual June Conference was held virtually with over 70 participants and the Maine STEM Partnership Virtual STEM Summit (Fall, 2020) provided an additional 50 participants with opportunities to learn about and discuss research-supported strategies in STEM education. The Maine STEM Partnership also includes the Faculty Course Modification Incentive Grant – Maine Learning Assistant (FIG – MLA) Program which, in the past year, involved 25 University of Maine faculty across 12 STEM departments, offering 111 MLA positions and enhancing 26 course offerings with total enrollment of over 5,300 students. Supports were provided to faculty and MLAs during this time of remote instruction, and end-of-semester student and faculty surveys indicated the strong value of MLAs, whether instruction was face-to-face, remote or some combination.

The prestigious NSF Teaching Fellowship Program, designed to help meet Maine's workforce need for science and mathematics teachers in high-need districts, had 19 fellows teaching in high-need districts during the 2020-2021 school year, with 7 entering the profession during this year. Through monthly

virtual meetings this community continued its significant role in bringing together new and experienced teachers to accomplish shared goals through working groups focused on improving specific aspects of classroom practices.

#### Faculty, staff, and student achievements

MST graduate **Michael Dudley** was recognized as the Outstanding MST Graduate in May, 2021. **Dr. John Thompson** was recognized by the American Physical Society as an Outstanding Referee, a selective international award to recognize 150 of 71,000 active referees for exceptional contributions in assessing manuscripts for journal publication, <https://journals.aps.org/OutstandingReferees>. **Dr. Asli Sezen-Barrie** was selected for the position of Temporary Program Director at NSF's Division of Research on Learning for Formal and Informal Settings; a recognition of her unique qualifications and contributions to the field, including her work as Chair of the NARST Research Committee and her work on the editorial board for JRST, the publication with the highest impact factor in the field of science education. **Dr. Susan McKay** co-chaired the President's Council on Diversity, Equity, and Inclusion. **Dr. Mitchell Bruce** spearheaded development of a remote, hands-on version of the general chemistry lab courses for over 1,000 undergrads. This extraordinary team effort was highlighted in UMaine News (Article here: <https://umaine.edu/news/blog/2020/12/07/the-grand-challenge-remote-chemistry-labs-for-1000-students/>) and a manuscript on the work has been submitted to the Journal of Chemical Education. Two RiSE staff members, **Laura Honders** and **Erin Vinson**, brought new grant funding to UMaine.

### Fostering Learner Success

#### Undergraduate Student Experiential Learning Initiatives

The RiSE Center provided 88 strong STEM undergraduates with paid experience supporting instruction and student learning through positions as Maine Learning Assistants (MLAs); 50 of these were first-time MLAs who participated in weekly professional learning sessions offered by the RiSE Center to support their professional growth in providing peer instruction. Students in these roles support instruction and help faculty implement course modifications to increase active learning in STEM courses. **Dr. Francois Amar** developed a new Research Learning Experience (RLE) course on sustainability, entitled "Sustainability Science: Engaging the Community to Manage Change" and is currently working on a Sustainability Hub for undergraduate students together with colleagues in the Mitchell Center.

#### Graduate Studies Impact

Seven MST students completed their theses and graduated this year, with **Michael Dudley**, a physics and engineering teacher at John Bapst Memorial High School, selected as the outstanding graduate in May, 2021. The RiSE Center provided 13 graduate course offerings for MST students with students taking 177 credit hours. MST students also participated in a variety of opportunities for professional and career development through grant-funded projects, teaching assistantships in STEM courses, and student teaching placements in middle and high school. Four MST students joined a partnership with RSU #34 to develop a summer program for PK-9 students to bring them back into school and learning in a camp-like atmosphere. MST Graduate Coordinator **Dr. Franziska Peterson** provided leadership for the MST Program's participation in the CAEP accreditation processes in the past year and the MST Program received extremely positive feedback throughout the process. In addition, RiSE faculty have approved plans for a new graduate certificate program in STEM Teacher Leadership that will be brought before the graduate board this fall.

#### Workforce Development Activities

The RiSE Center's NSF Fellowship Program supported 19 new STEM teachers during their first 4 years of teaching in high-need rural schools, with 7 Fellows entering their first year of teaching this year. This program helps to fill a significant workforce need for qualified STEM teachers in rural Maine schools. The program also involved 30 experienced Maine STEM teachers as mentors. The RiSE Center supported 17 MST students through graduate assistantships that provided opportunities to participate in research, support teachers and instruction, and develop a network of colleagues in the K-12 teaching community. MST students also participated in 7 teaching assistantships in STEM departments, providing

them with undergraduate-level instructional experience. Through the USDA-HEC grant the RiSE Center facilitated work across 6 institutions to better align food processing courses to workforce needs, deepen students' active engagement in learning, and address gender inequity in the workforce. The e-DNA Undergraduate Curriculum Innovations Seed Grant Program, conducted by **Dr. Natasha Speer** and **Dr. MacKenzie Stetzer**, awarded 5 seed grants in the past year to faculty across multiple institutions to modify undergraduate courses to leverage eDNA approaches or concepts. **Dr. Franziska Peterson** led a new summer professional development program in mathematics for teachers through a new collaboration with RSU #34 to support teachers through the pandemic; she also led summer and year-round professional learning for K-8 teachers statewide through a program funded by an endowment from a UMaine graduate. **Dr. Timothy Boester** continued to work through the pandemic to provide pre-calculus instruction leading to college credit for high school students in collaboration with high school teachers. **Dr. Natasha Speer** co-organized summer orientation sessions, informed by her own and others' research in mathematics education, to strengthen teaching practices for all new mathematics and science graduate student teaching assistants as part of the Graduate School orientation sessions. **Dr. Chris Gerbi** has continued his work to support and expand the UMaine Arctic community, including connecting Arctic researchers with the RiSE Center to support development of robust proposals to build collaborations between scientists and STEM educators to support education and workforce development goals.

## **Discovering and Innovating**

### **Research and Scholarship Summary**

RiSE members published or have had accepted 20 refereed journal articles and conference proceedings, 1 refereed abstract, 7 non-refereed journal articles, 1 book chapter, and 3 policy reports. Citations for these are listed in Appendix II. Over 50 research presentations were given at conferences and other venues. RiSE faculty are Principal Investigator or Co-Principal Investigator on 5 new and 25 continuing grants totaling over \$12 million. These grants are listed in Appendices III and IV. The RiSE Center also plays a significant role, with multiple faculty and staff serving as senior personnel, in 2 EPSCoR grants totaling another \$26 million (Maine eDNA and INSPIRES, totaling \$26 million). RiSE personnel supported submission of an additional \$9.4 million through 23 new grant proposals in the past year as either PI or Co-PI and also worked closely with new faculty on career grants to strengthen the broader impacts of the proposed research and to share their grant writing experiences and knowledge.

This year the RiSE Center welcomed two new faculty members **Dr. Saima Farooq** and **Dr. Nuri Emanetoglu** as affiliated faculty. **Dr. Farooq** has collaborated with RiSE faculty member **Dr. MacKenzie Stetzer** to extensively modify PHY 121 and 122 to incorporate research-based strategies, including active learning, into these large introductory courses to improve learning outcomes for students. **Dr. Farooq** has also participated in activities to expand diversity, equity and inclusion on campus including by studying the expectations and difficulties of incoming students including first generation students, under-represented minority students, first semester students, and male/female students to assist the students for their overall academic success in their first year at UMaine through the Introductory Course Environment Faculty Learning Community (ICE-FLC) program. **Dr. Emanetoglu** is Principal Investigator for a summer research (REU Site: Sensor Science and Engineering) program that provides undergraduate students with research experiences in sensor science and engineering.

The RiSE Center continued its STEM+C randomized controlled trial, now in its third year, in spite of challenges faced through the pandemic. During the past year two cohorts of science teachers taught and helped to further refine three middle school science modules integrating computer science into life, Earth, and physical science. The project is currently analyzing student survey and teacher interview data and preparing two publications for submission.

**Dr. MacKenzie Stetzer** oversaw over \$1 million in continuing grants including one to study metacognition and reasoning in undergraduate STEM learning and another to study and support the transition from high school to college STEM; 4 of his co-authored journal articles were published this year. **Dr. Natasha Speer** led the RiSE Center's Colloquium Series, inviting local and national education researchers to present their research; this series was offered remotely for the past year due to the pandemic. The RiSE Center offered the Maine STEM Partnership Fall Summit and the annual June

Conference as remote gatherings, involving over 120 participants in presentations and discussions of education research and strategies for bringing research into practice. **Erin Vinson**, coordinator for the RiSE Center's FIG-MLA program and editor of CourseSource, obtained a grant to support instructors in using CourseSource resources for online teaching.

#### Student research, scholarship, or creative activities

The RiSE Research Group, a collaborative group led by RiSE students and supported by RiSE faculty, met weekly throughout the academic year and during the summer to provide support for STEM education research across campus. Group members presented and got feedback on in-progress research, including work leading to Master's theses, dissertations, honors theses, and capstone projects. The Physics Education Research Laboratory (PERL) and the Mathematics Education Research Group (MERG) led by RiSE faculty and students provided similar opportunities for those specific fields. RiSE students are co-authors on five of the RiSE Center's published or accepted journal articles from the past year.

#### Faculty and staff mentoring and professional development

RiSE faculty mentored 13 honors theses and senior capstone research projects. The RiSE Center led professional learning for over 300 Maine K-12 teachers through the Maine STEM Partnership. Veteran RiSE faculty also participated in mentoring new faculty in the RiSE Center. RiSE faculty and staff continued discussions around aspects of the RiSE Center's strategic plan and strategies for accomplishing collective goals.

#### Faculty and staff achievements

These are noted at the end of the executive summary.

### Growing and Expanding Partnerships

#### External Engagements and Collaborations

**Dr. Janet Fairman** collaborated with a faculty member in Australia to identify new ways teachers are engaging in professional development in online and virtual spaces since the pandemic. **Dr. Elizabeth Hufnagel** started a new collaboration with scholars from Spain and Australia focused on examining the emotional sense-making of pre-service primary teachers as they develop science games for children. **Dr. Sara Lindsay** planned and led a workshop focused on implementing department-level changes to support research-based instructional practices for faculty teams to improve undergraduate life science education; this workshop had 90 participants from 26 different life sciences departments at undergraduate institutions in the Northeastern U.S. RiSE Research and Evaluation Coordinator **Laura Honders** is leading external evaluation for a new Gulf of Maine Research Institute grant from NOAA's ELP program focused on increasing resilience to sea level rise due to climate change in coastal communities. Maine STEM Partnership Coordinator **Marina Van der Eb** guided professional learning opportunities for over 300 Maine K-12 STEM teachers through the Maine STEM Partnership; a map of school district participation is included as Appendix VI. RiSE NSF Teaching Fellowship Coordinator **Beth ByersSmall** and **RiSE Administrative Assistant Yadina Clark** spearheaded the *Pinnacles* (pandemic-inspired active learning experiences in STEM) program in Summer 2020, supporting 39 teachers to provide over 1,000 person-hours to develop engaging STEM learning experiences for teachers to use for in-person, remote, and hybrid instructional modes. RiSE Resource and Professional Development Coordinator **Beth Muncey** oversaw science materials and related professional learning for 103 K-12 teachers in 39 schools and 28 school districts across the state, helping to provide over 4,800 students with opportunities to learn science through engaging, research-supported science activities. This included packing over 900 bins of hands-on science materials and coordinating logistics for teachers across the state to exchange materials, to leverage these science materials as a shared statewide resource. The RiSE Center continued to lead a three-state collaboration with New Hampshire and Vermont to integrate quantitative reasoning in forestry contexts using big data into middle and high school instruction through the INSPIRES grant.

## Research Commercialization and Economic Development

**Dr. Justin Dimmel** and **Dr. Eric Pandiscio** used opportunities provided through the Office of Innovation and Economic Development to develop a design and prototype for an invention they created called the SunRule, which allows the user to explore multiplication and division using a physical model that utilizes the parallel rays of the sun to do mathematical work. **Dr. Nuri Emanetoglu**'s patent for the low cost doppler radar to monitor the health of bee colonies that he designed, built and tested in collaboration with UMaine colleagues was published and is waiting for final approval.

## One University Initiatives

**Dr. John Thompson** served as a member on the Gateways to Success working group within the Student Success and Retention Initiative as part of UMS TRANSFORMS.

## Financial Sustainability

### Student Credit Hour Production

The RiSE Center provided 13 graduate course offerings through our MST program with total enrollment of 83 students for 177 credit hours.

### Research Funding

RiSE faculty and staff were awarded 5 new grants totaling over \$845,000 and participated in 27 continuing grants (as PI, Co-PI, or Senior Personnel) totaling over \$38 million. RiSE faculty and staff submitted 23 new grants seeking \$9.3 million in additional revenue.

### Revenue Centers

N/A

### Private

RiSE received \$3600 from a private foundation to support the Maine STEM Partnership Summit.

### Giving/Alumni Cultivation

RiSE received \$2,500 in gifts and donations through our collaborations with the UMaine Foundation and an additional \$15,000 from a donation to support professional learning sessions provide by **Dr. Franziska Peterson** for mathematics teachers.

### Initiatives to Increase Fiscal Efficiency

Hiring administrative specialist **Yadina Clark** supports productivity and efficiency for the Center's faculty and staff. **Dr. Sara Lindsay** will join the Center's staff as Assistant Director (half-time) in September, helping to support the strategic plan by enhancing communications and supporting pursuit of diverse funding opportunities for the Center.

### Other

RiSE received over \$92,000 in payments from schools to support, in part, its Materials Warehouse, which provides task-force evaluated and recommended instructional resources for K-9 science.

## Preserving/Restoring Infrastructure N/A

## Summary of Anticipated Challenges

The RiSE Center faces financial challenges connected with its rapid grant-funded growth as a center. RiSE professional staff are almost totally funded by grants to do work on specific projects. This team of talented, experienced professionals is essential to the grant-writing process in RiSE and to the development of new initiatives. A relatively small increased investment of their time as base-budgeted funding would expand RiSE's ability to submit proposals and take advantage of funding opportunities. It would also provide bridge funding between grants, which is also needed for RiSE graduate students. The flexibility of this type of funding would be a terrific asset for the center.

## Summary of New Initiatives and Opportunities

In addition to the many grants and activities already described in this report, the RiSE Center has continued to pursue new opportunities for partnerships, funding, and innovative research. These include many collaborative grant proposals submitted in the past year, and others currently under development. RiSE has expanded its work through research practice partnerships involving district partners (e.g. RSU #34, described above, and RSU #71, through ITEST proposal development), focusing on persistent problems of practice and ways to support teachers using new modes of instruction during the pandemic.

## Appendix I. List of RiSE Faculty and Staff

### RiSE AFFILIATED FACULTY

<b>Name</b>	<b>Title</b>	<b>Email</b>
Francois G. Amar	Professor, Department of Chemistry and Dean, Honors College	<a href="mailto:amar@maine.edu">amar@maine.edu</a>
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## Appendix II. RiSE Publications 2020-21

(RiSE Faculty, Staff, and Students in Bold)

**Amar, F.** (Accepted 2021). "Honors in the Post-Pandemic World: Situation Perilous." *Journal of the National Collegiate Honors Council* 22(2).

**Bock, C.G., & Dimmel, J.K.** (2021). Digital representations without physical analogues: A study of body-based interactions with an apparently unbounded spatial diagram. *Digital Experiences in Mathematics Education*, 7, 193-221.

Bookman, J. and **Speer, N.** "Supporting faculty who provide professional development for teaching the next generation of college mathematics instructors." *FOCUS*, Newsmagazine of the Mathematical Association of America *FOCUS*, June/July 2021.

Bowen, G.; Taylor, J.; **Sezen-Barrie, A.** (Accepted 2021). "Understanding the Use of Academic Research in Science Education Practitioner Journals". *Journal of the Canadian Association for Curriculum Studies (JCACS)*.

**Cleveland, A., Sezen-Barrie, A.,** Marbach-Ed, G. (Accepted 2021). Conceptualizations of Quantitative Reasoning for Introductory Biology Courses, *Journal of Microbiology and Biology Education*.

**Dimmel, J.K.,** & Herbst, P.G. (2020). Proof transcription in high school geometry: a study of what teachers recognize as normative when students present proofs at the board. *Educational Studies in Mathematics*, 105(1), 75 - 89.

**Dimmel, J., Pandiscio, E., and Bock, C.G.** (2021). "The geometry of movement: Encounters with spatial inscriptions for making and exploring mathematical figures." *Digital Experiences in Mathematics Education*.

**Dimmel, J.; Pandiscio, E.** (2021). "When it's on zero, the lines become parallel: Pre-service elementary teachers' diagrammatic encounters with division by zero." *Journal of Mathematical Behavior* 58(1), 1-22.

**Dimmel, J., Pandiscio, E., and Bock, C.G.** (Accepted 2021). "Multiplication by sunlight: How can a geometric definition be realized in a physical tool?" *Journal of Mathematics Education at Teachers College*.

Erickson, A.W., Herbst, P.G., Ko, I, & **Dimmel, J.K.** (2021). When what routinely happens conflicts with what ought to be done: A scenario-based assessment of secondary mathematics teaching. *Research in Mathematics Education*. DOI: <https://doi.org/10.1080/14794802.2020.1855600>.

**Fairman, J.,** Biddle, C., & Chien, M. (2021). School-community partnerships in Maine. A report of the Maine Education Policy Research Institute (MEPRI). Orono, ME: University of Maine.

**Fairman, J.,** Mette, I., & Frankland, M. (2021). School leadership development programs in Maine: Building statewide capacity and addressing challenges. A report of the Maine Education Policy Research Institute (MEPRI). Orono, ME: University of Maine.

**Fairman, J.,** Smith, D., Pullen, P. & Lebel, S. (2020). The challenge of keeping teacher professional learning relevant. *Professional Development in Education*. DOI: 10.1080/19415257.2020.1827010.

**Gerbi, C.;** Mills, S.; Clavette, R.; Campbell, S.; Bernsen, S.; Clemens-Sewall, D.; Lee, I.; Hawley, R.; Kreutz, K.; Hruby, K. (Accepted 2021). "Microstructures in a shear margin: Jarvis Glacier, Alaska." *Journal of Glaciology*.

Hruby, K.; **Gerbi, C.;** Koons, P.; Campbell, S.; Martin, C.; Hawley, R. (2020). The impact of crystallographic orientation fabric on streaming ice kinematics. *Journal of Glaciology*.

Hruby, K.; **Gerbi, C.**; Koons, P.; Campbell, S.; Martín, C.; Hawley, R. (2020) “The impact of temperature and crystal orientation fabric on the dynamics of mountain glaciers and ice streams.” *Journal of Glaciology* 66(259).

Johnson, S.; Song, W.; Cook, A.; Vel, S.; **Gerbi, C.** (2021). “The quartz  $\alpha \leftrightarrow \beta$  phase transition: does it facilitate damage and reaction in continental crust?” *Earth and Planetary Science Letters* 553.

M. Kryjevskaja, **M. R. Stetzer**, B. A. Lindsey, A. McNerny, P. R. L. Heron, and A. Boudreaux, “Designing research-based instructional materials that leverage dual-process theories of reasoning: Insights from testing one specific, theory-driven intervention,” *Phys. Rev. Phys. Educ. Res.* 16, 020140 (2020). Part of the focused collection Curriculum Development: Theory into Design. <https://doi.org/10.1103/PhysRevPhysEducRes.16.020140>

A. K. Lane, C. L. Meaders, J. K. Shuman, **M. R. Stetzer**, **E. L. Vinson**, B. A. Couch, M. K. Smith, and M. Stains, Making a first impression: Exploring what instructors do and say on the first day of introductory STEM courses,” *CBE Life Sci. Educ.* 20, ar7 (2021). <https://doi.org/10.1187/cbe.20-05-0098>

Lech, P. & **Fairman, J.** (June 2021). Report on classroom practice, coaching and workshop feedback: Program evaluation for Math4ME Initiative 2020-21. A report of the Maine Education Policy Research Institute (MEPRI). Orono, ME: University of Maine.

**Lindsay, S.** (2021). “Integrating microscopy, art, and humanities to power STEAM learning in biology.” *Invertebrate Biology* 140(1).

C. L. Meaders, M. K. Smith, **T. Boester**, A. Bracy, B. A. Couch, A. G. Drake, **S. Farooq**, B. Khoda, C. Kinsland, A. K. Lane, S. E. Lindahl, W. H. Livingston, A. M. Bundy, A. McCormick, A. I. Morozov, J. L. Newell-Caito, K. J. Ruskin, M. A. Sarvary, M. Stains, J. R. St. Juliana, S. R. Thomas, C. van Es, **E. L. Vinson**, M. N. Vitousek, and **M. R. Stetzer**, “What questions are on the minds of STEM undergraduate students and how can they be addressed?” *Front. Educ.* 6, 639338 (2021).

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### Appendix III. Grants Awarded to RiSE Faculty and Staff in 2020-21

Date Awarded	Submission ID	Sponsor(s)	PI/Co-PI Name(s)	Project Title	Sponsor Total	UMaine Total	Project Total
7/2/2020	2020322	ME Dept of Education/US Dept of Education	Janet Fairman (PI)	Math4ME Program Evaluation	\$51,629	\$7,312	\$58,941
7/20/2020	2020712	US Dept of Energy	Nuri Emanetoglu (Co-PI)	Novel Harsh Environment Materials and Fabrication Techniques for Wireless Sensor Applications Yr 2	\$379,918	\$0	\$379,918
8/11/2020	2020584	Maine Legislative Council	Janet Fairman (PI)	Maine Education Policy Research Institute (MEPRI)	\$125,000	\$62,500	\$187,500
3/18/2021	2020800	National Science Foundation	Erin Vinson (UMaine PI)	Collaborative Research: Building Adaptability for Teaching Online through Peer-Reviewed, Active-Learning Resources and Professional Development	\$144,771	\$0	\$144,771
3/30/2021	2020403	Gulf of Maine Research Institute / US Dept of Commerce	Laura (Millay) Honders (UMaine PI)	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	\$74,702	\$0	\$74,702
<b>Total</b>					<b>\$776,020</b>	<b>\$69,812</b>	<b>\$845,832</b>

## Appendix IV. RiSE Faculty and Staff Grants Continuing in 2020-21

Title	Funding Agency	RiSE Personnel	Grant Number	Award Date	Award Amount	Months
<b>A Model NSF Teaching Fellowship Program to Improve STEM Teacher Recruitment, Preparation, Professional Development, and Retention in Rural High-Need Schools</b>	National Science Foundation	Susan McKay (PI), Eric Pandiscio (Co-PI), MacKenzie Stetzer (Co-PI), Franziska Peterson (Co-PI), Elizabeth ByersSmall (Staff), Laura (Millay) Honders (Staff)	1557320	3/24/16	\$1,950,034	71
<b>Understanding Extreme Weather with Big Data</b>	National Science Foundation through EDC	Asli Sezen-Barrie (UMaine PI)	1850447	11/13/19	\$36,000	11
<b>Cultivating Engineering Literacy for Future Science Teachers of Maine</b>	National Aeronautics & Space Administration	Asli Sezen-Barrie (PI)	SG-20-21	12/26/19	\$6,987	17
<b>RII Track-1: Molecule to Ecosystem: Environmental DNA as a Nexus of Coastal Ecosystem Sustainability for Maine (e-DNA)</b>  RiSE contributes by running the e-DNA Undergraduate Curriculum Innovations Seed Grant Program, supporting use of research-supported practices in teaching.	National Science Foundation	Susan McKay, Natasha Speer, MacKenzie Stetzer (Sr. Prs.)	1849227	7/16/19	\$20,000,000	36
<b>Fostering Connections between Macroscopic, Submicroscopic, and Representational Levels Using Analogical Reasoning in the Chemistry Lab</b>	National Science Foundation	Mitchell Bruce (PI)	1610086	9/7/16	\$275,284	35
<b>RII Track 2 FEC: Leveraging informatics to resolve uncertainties in the Northern Forest's carbon budget</b>  RiSE contributes education research and a research-practice partnership with teachers to this project, with Susan McKay, Franziska Peterson, Sara Lindsay, Laura Millay, and Marina Van der Eb all contributing.	National Science Foundation	Laura (Millay) Honders, Sara Lindsay, Susan McKay, Franziska Peterson, (Sr. Prs.); Marina Van der Eb (staff)	1920908	8/9/19	\$6,000,000	48
<b>Comparative Functional Genomics INBRE in Maine</b>	US Dept of Health and Human Services	Francois Amar (PI)		8/6/13	\$81,168	83

<b>Collaborative Research: Research on learning and teaching at the physics-mathematics interface</b>	National Science Foundation	John Thompson (PI)	PHY-1405726	10/14/14	\$197,647	59
<b>Thermochemical Conversion of Woody Biomass to Fuels and Chemicals</b>	US Department of Energy	Francois Amar (Co-PI)		10/12/11, continued 8/6/13	\$1,889,988	83
<b>Collaborative Research: Computational Methods Supporting Joint Seismic and Radar Inversion for Ice Fabric and Temperature in Streaming Flow</b>	National Science Foundation	Chris Gerbi (PI)	1643301	1/30/17	\$195,010	35
<b>Collaborative Research: Influence of Natural Ice Microstructure on Rheology in General Shear: In-Situ Studies in the Alaska Range</b>	National Science Foundation	Chris Gerbi (PI)	1503924	8/11/15	\$420,937	47
<b>Improving the Preparation of Graduate Students to Teach Undergraduate Mathematics</b>	National Science Foundation through Mathematical Association of America	Natasha Speer (PI)	3-8-710-953	11/1/17	\$38,753	47
<b>Collaborative Research: Establishing a new model for research-based curriculum development in physics aligned with dual-process theories of reasoning</b>	National Science Foundation	MacKenzie Stetzer (PI)	1821390	6/22/18	\$863,239	59
<b>Collaborative Research: Promoting instructional change in introductory STEM courses through Faculty Learning Communities focused on the transition from high school to college</b>	National Science Foundation	MacKenzie Stetzer (Co-PI)	1712074	8/21/17	\$154,910	23
<b>Math4ME 2019 (Supplement)</b>	US Dept of Education through ME Dept of Education	Fairman, Janet (PI)	20190226* 2446	12/12/18 and 3/27/20	\$55,902	10
<b>Integrating Computation into Science Teaching and Learning in Grades 6-8: A Diverse Partnership to Develop an Evidence-Guided Model to Serve Rural Communities</b>	National Science Foundation	Susan McKay (PI), Mitchell Bruce (Co-PI), Sara Lindsay (Co-PI), Laura (Millay) Honders (staff), Elizabeth Muncey (staff), Marina Van der Eb (staff),	1842359	9/20/18	\$1,250,000	48
<b>The Geometer's Planetarium II: Exploring the connections between geometry and astronomy in an immersive virtual environment</b>	National Aeronautics and Space Administration through Maine Space Grant Consortium	Justin Dimmel (PI)	SG-19-15	10/19/18	\$24,960	35
<b>A remote multimodal learning environment to increase graphical information access for blind and visually impaired students</b>	National Science Foundation	Justin Dimmel (Co-PI)	1822800	9/11/18	\$747,894	47

<b>How do scale and dimension affect students' perceptions of geometric diagrams?</b>	Spencer Foundation	Justin Dimmel (PI)	201900215	4/12/19	\$49,217	35
<b>Enhancing Learning Outcomes In Food Engineering And Processing Courses For Non-Engineers Using Student-Centered Approaches</b>	US Dept of Agriculture	Susan McKay (PI), Laura (Millay) Honders (Sr. Prs.) Deborah Shulman (staff)	2019- 70003- 29082	1/4/19	\$747,328	36
<b>Acquisition of a 500 MHz NMR Spectrometer with Improved Sensitivity and Accessibility to Benefit Research and Education at Umaine</b>	National Science Foundation	Mitchell Bruce (Co-PI)	1828408	8/28/18	\$535,900	35
<b>Collaborative Research: Beyond procedures: a research-based approach to teaching mathematical methods in physics</b>	National Science Foundation	Thompson, John (PI)	1912087	9/5/19	\$368,061	35
<b>Maine Education Policy Research Institute (MEPRI) FY20</b>	Maine State Legislature through University of Southern Maine	Fairman, Janet (PI)	NSN953	9/4/19	\$125,000	11
<b>Transdisciplinary Predoctoral Training in Biomedical Sciences and Engineering</b>	US Dept of Health and Human Service	Fairman, Janet (Co-PI)	1T32GM13 2006-01	7/15/20	\$217,444	11
<b>Novel Harsh Environment Materials and Fabrication Techniques for Wireless Sensor</b>	US Dept of Energy	Emanetoglu, Nuri (Co-PI)	DE- SC0020126	8/20/19	\$370,082	11
<b>REU Site: Sensor Science and Engineering</b>	National Science Foundation	Emanetoglu, Nuri (PI)	1851998/1 460700	2/22/19	\$831,845	47
<b>PFI:AIR-TT: Lateral Field Excited Acoustic Wave Sensor for Monitoring Thin Film Properties in Solid State Devices</b>	National Science Foundation	Emanetoglu, Nuri (Co-PI)	1701087	6/19/17	\$208,000	42
Total					<b>\$37,641,590</b>	

**Appendix V. Courses Offered by the RiSE Center July 2020 – June 2021**

Semester	Title	Professor	Enrollment	Credit Hours
Summer 2020	SMT 699 Graduate Thesis/ Research	Susan McKay	11	18
Fall 2020	SMT 502 Integrated Approaches to Physics Education II	Michael Wittmann	11	33
Fall 2020	SMT 503 Integrated Approaches in Earth Sciences Education I	Christopher Gerbi	7	21
Fall 2020	SMT 588 Science and Mathematics Education Research (Sem)	Michael Wittmann	8	8
Fall 2020	SMT 598 Special Topics in Science and Mathematics Education (Lec)	Michael Wittmann	6	6
Fall 2020	SMT 699 Graduate Thesis/ Research	Susan McKay	5	9
Fall 2020	MLA Professional Learning Sessions (weekly for first time MLAs)	Sara Lindsay Erin Vinson	35	0
Spring 2021	SMT 500 Educational Psychology with Applications to Science and Mathematics Teaching and Learning	Franziska Peterson	7	21
Spring 2021	SMT 506 Integrated Approaches in Mathematics Education II	Eric Pandiscio	5	15
Spring 2021	SMT 590 Seminar for Teaching Interns	Susan McKay	1	1
Spring 2021	SMT 591 Secondary Student Teaching	Susan McKay	1	5
Spring 2021	SMT 598 Special Topics in Science and Mathematics Education	Mitchell Bruce	4	4
Spring 2021	SMT 598 Special Topics in Science and Mathematics Education Practical Teaching Secondary STEM	Michael Wittmann	5	5
Spring 2021	SMT 699 Graduate Thesis/ Research	Susan McKay	12	30
Spring 2021	MLA Professional Learning Sessions (weekly for first time MLAs)	Sara Lindsay Erin Vinson	15	0

**Appendix VI. Map of School Districts Partnering with RiSE Through the Maine STEM Partnership**

