MAINE CENTER FOR RESEARCH IN STEM EDUCATION

ANNUAL REPORT
July 1, 2010 – June 30, 2011

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Prepared by Susan R. McKay, Center Director and Professor of Physics
MAINE CENTER FOR RESEARCH IN STEM EDUCATION (RiSE CENTER)

FACULTY AND STAFF

Erika Allison
Maine Physical Sciences Partnership Project Operations Director (starting August, 2011)

Francois G. Amar
Associate Professor of Chemistry

David J. Batuski
Professor of Physics and Chair, Department of Physics and Astronomy

Katrina Black
Postdoctoral Research and Teaching Associate

Mitchell R. Bruce
Associate Professor of Chemistry

Elizabeth Burroughs
Interim Project Coordinator, Maine Physical Sciences Partnership, and Interim RiSE Center Assistant Director

Patricia L. Byard
Administrative Assistant I (shared with the Department of Physics and Astronomy)

Daniel Capps
Assistant Professor of Science Education (starting August, 2011)

Krista Capps
Postdoctoral Research and Teaching Associate (starting September, 2011)

Erik daSilva
Interim Project Coordinator, Maine Physical Sciences Partnership

Frank Dudish
Lecturer in Physics and Center Research Associate

Brian Frank
Postdoctoral Research and Teaching Associate

Robert D. Franzosa
Professor of Mathematics and Statistics

Christopher Gerbi
Assistant Professor of Earth Sciences

Kirk A. Maasch
Professor of Earth Sciences and Climate Change Institute
RiSE CENTER FACULTY AND STAFF (cont.)

Susan R. McKay
Director, RiSE Center, and Professor of Physics

Stephen A. Norton
Professor Emeritus of Geological Sciences and Climate Change Institute

Eric A. Pandiscio
Associate Professor of Mathematics Education

Leisa S. Preble
Secretary (shared with the Department of Physics and Astronomy)

Tracy Richardson
Financial and Personnel Manager (starting July, 2011)

Molly Schauffler
Research Assistant Professor (adjunct) with the Climate Change Institute

Jonathan Shemwell
Assistant Professor of Science Education (starting August, 2011)

Michelle Smith
Assistant Professor of Biological Sciences (starting August, 2011)

Natasha Speer
Assistant Professor of Mathematics Education

MacKenzie Stetzer
Assistant Professor of Physics (starting August, 2011)

John R. Thompson
Associate Professor of Physics and Cooperating Associate Professor of Education

Thomas Wemyss
Postdoctoral Research and Teaching Associate

Michael C. Wittmann
Associate Professor of Physics and Cooperating Associate Professor of Education

Paul Wlodkowski
RiSE Center Research Associate and Sabbatical Visitor (2010-2011 academic year)
Mission of the Maine Center for Research in STEM Education: To advance the research and practice of teaching and learning in science, technology, engineering and mathematics (STEM).
RiSE CENTER FY2011 HIGHLIGHTS

- RiSE Center faculty members, partnering with 48 schools in Maine, were awarded a proposal for $12.3 million by the National Science Foundation's Math Science Partnership Program to form the Maine Physical Sciences Partnership, targeting the teaching and learning of physical sciences in grades 6-9 and the preparation of science teachers at the University of Maine. This proposal, entitled “Maine Physical Sciences Curriculum Partnership: Research and Infrastructure for Ongoing Educational Improvement”, was awarded effective July 1, 2010. The project includes Rise Center director Susan McKay as PI, and RiSE Center faculty members Mitchell Bruce, John Thompson, and Michael Wittmann as co-PIs, along with Owen Maurais, Executive Director of the Penobscot River Educational Partnership: Professional Development Network. Senior personnel who are playing an important role in the Partnership are RiSE Center faculty members Francois Amar, Chris Gerbi, and Natasha Speer, Susan Smith, Executive Director of the Down East Educational Partnership, and John McDonald, Assistant Superintendent of Regional School Unit #20 (Belfast and Searsport area). Supporting partners on this grant include SERC Institute (formerly Acadia Partners for Science and Learning), the Institute for Broadening Participation, the Maine Department of Education (Anita Bernhardt and Jeff Mao), and the Maine Mathematics and Science Alliance.

- RiSE Center faculty members had eight new projects funded during the past year for a total of $4.65 million (some of these projects include multiple year funding). These grants provide support for graduate students, postdocs, and faculty summer salary, as well as some research equipment and facilities.

- With funding from the Maine Technology Asset Fund, RiSE Center Director Susan McKay and Physics faculty member Sam Hess have worked with University of Maine Facilities Management to create two offices and an image processing laboratory from unused space in Bennett Hall. The Image Processing Laboratory will be an invaluable research tool for high speed processing of interview and classroom
video. The grant also includes funding for state-of-the-art computer equipment for this laboratory, which will be used by researchers in biophysics, astrophysics, condensed matter physics and researchers into STEM teaching and learning. This project also includes a new elevator to improve equipment transport and handicap accessibility within the building.

- The RiSE Center hosted Associate Professor Paul Wlodkowski, an engineering faculty member from Maine Maritime Academy, as a sabbatical visitor in 2010-2011, supported in part by the Maine Academic Prominence Initiative. Paul worked with RiSE Center faculty members to expand knowledge and projects related to engineering education, and completed a project funded by the Maine Space Grant Consortium to bring engineering modules, including rocket design, into high school classrooms.

- RiSE Center faculty, staff, and students produced 18 accepted or published peer-reviewed papers and over 60 research presentations and invited colloquia during the year.

- The MST program has expanded its impact on Maine schools, with 21 students or graduates teaching full-time in the public schools (see map and table included) and four student teachers spending the spring semester in classroom internships. As part of the Center’s collaboration with the Jackson Laboratory (JAX), one sabbatical teacher spent the spring 2011 semester as a research intern at JAX and developed research-based curricula, which were implemented in local classrooms, with assistance from experienced mentor teachers. In this way, the program is bringing current research and the concepts underlying it into science and mathematics classes. This project receives funding from the Howard Hughes Medical Institute and, this year, received a renewal grant from the Lloyd G. Balfour Foundation.

- The RiSE Center hosted its fifth biennial conference “No Question Left Behind: Bringing Guided Inquiry into the Classroom” on June 23rd-24th at the University of Maine, which attracted over 90 participants. This conference brought together future teachers, postdoctoral research associates, STEM and STEM education faculty, and middle and high school science and mathematics teachers from
Maine.

- RiSE Center faculty, staff and students have worked with middle and high school teachers through three very active collaboratives during the past year: the Ninth Grade Earth Sciences Teachers Collaborative, which continues to develop, implement, and assess common units in their classes with active involvement by Chris Gerbi; the Maine Physical Sciences Partnership (PSP) Regional Collaboratives, led by Michael Wittmann, which assisted with PSP instructional resources selection and provided professional development for all interested middle and high school science and mathematics teachers; and the Penobscot Bay STEM Teachers Working Group, facilitated by Molly Schauffler and Troy Howard Middle School mathematics teacher Elizabeth Haynes and supported by a grant from the Sophron Foundation. These collaboratives build crucial professional learning communities among future and current teachers and contribute to the work of the Maine Physical Sciences Partnership.

- MST students continue to conduct research related to student learning in University courses. For their theses, MST students typically evaluate learning, and then sometimes work with faculty to make modifications guided by their data and previous research to try to improve student understanding. The courses in which MST students have conducted these types of investigations had a total enrollment of over 4000 students, including physics, astronomy, chemistry, biology, and marine sciences courses.

- As part of the Maine Physical Sciences Partnership, 24 science and mathematics teachers spent three days on campus during their April break observing University classes and laboratories taught by graduate teaching assistants, using the RiSE Center’s classroom observation protocol. These observations provide a snapshot of the types of teaching currently in use and will be helpful in documenting changes that occur during the five-year course of the grant. This series of observations was organized by RiSE Director Susan McKay, Postdoctoral Research Associate Brian Frank, and MST students Robert Blaisdell and Jason Bakelaar.

- RiSE Center faculty members Francois Amar and Mitchell Bruce and postdoctoral research and teaching associate Thomas Wemyss
developed and co-taught a new core course for Master of Science in Teaching students, emphasizing the fundamental concepts of introductory chemistry and research-guided and validated ways to teach them.

- As part of the Maine Physical Sciences Partnership, 23 middle schools in Hancock, Penobscot, and Waldo counties will be piloting common instructional resources selected by the PSP Middle School Curriculum Evaluation Task Force. The selection process was led by postdoctoral research and teaching associates Katrina Black and Brian Frank, with assistance from RiSE faculty members Michael Wittmann and Mitchell Bruce.

- As part of the Maine Physical Sciences Partnership, John Thompson and Natasha Speer organized and conducted professional development sessions for graduate teaching assistants in STEM disciplines, emphasizing research-guided practices to enhance student learning.
STUDENT AND FACULTY AWARDS AND HONORS

• The paper "Addressing Student Difficulties with Statistical Mechanics: The Boltzmann Factor", by Trevor Smith, John Thompson, and Don Mountcastle was a finalist in the competition for the first ever Physics Education Research Conference Proceedings Paper Award. The paper was cited as noteworthy in terms of the quality of research, readability, and impact on the Physics Education Research community.

• Eric Pandiscio serves on the editorial review board of the Journal for Research in Rural Education.

• Michael Wittmann serves on the editorial board for Physical Review Special Topics – Physics Education Research.

• John Thompson was elected to serve on the Physics Education Research Leadership and Organizing Council.

• Natasha Speer is a member of the editorial board of the Journal for Research in Mathematics Education Research and serves as coordinator of the Special Interest Group for Research in Undergraduate Mathematics Education of the Mathematical Association of America.

• Kate McCann Hayes, an MST student who graduated in August, 2009, holds a prestigious Knowles Science Teaching Foundation Fellowship. She is teaching physics at Bangor High School. Kate is a Maine native who completed her undergraduate degree in Biomedical Physics at Northeastern University and graduated as valedictorian of her class there.

• Michael Wittmann has served as the Chair of the Physics Education Research (PER) Leadership and Organizing Council of the PER Topical Group in the American Association of Physics Teachers. He is also the co-founder and lead organizer of the biennial Foundations and Frontiers of Physics Education Research conferences, held in Bar Harbor in 2005, 2007, 2009, and 2011.

• Milissa Knox was selected as the Outstanding MST Graduate in the Generalist Option for 2011. She will be defending her MST thesis in the fall and has accepted a science teaching position at Vinalhaven High School.

• Elizabeth Burroughs, an MST student, received a Trustee Tuition Waiver for 2010-2011. She also received special commendation from
Educational Testing Service for her outstanding score demonstrating mathematics content knowledge on the PRAXIS II exam.

- **John Thompson** was invited to serve on the Selection Committee for the Knowles Science Teaching Fellows.
- **Susan McKay** was invited to speak about the Maine Physical Sciences Partnership and the RiSE Center's work at the Maine Legislature's Academy.
ITEMS RELEVANT FOR RETURN ON INVESTMENT

Total new grants and contracts funded in FY2011: $4.65 million
(This total does not include continuing projects in which funding was granted as a single award.)
Peer-reviewed papers or conference proceedings accepted or published: 18
Presentations at national and international meetings and invited colloquia: 60

For FY11, the RiSE Center received ~$38,300 in MEIF funding. **Return on investment: ~121 times (as compared with ~39 times last year).** The MEIF funds make a huge difference in the RiSE Center's ability to support personnel. They support, in part, the Center's postdoctoral research associates and graduate students conducting research. This budget line enables the RiSE Center to provide continuing appointments as some grants end and new ones begin. Without these personnel, the research productivity of the RiSE Center would have been much lower. In particular, it would not have been possible for the RiSE Center to have prepared the $12.3 million Math-Science Partnership proposal funded by NSF without the MEIF support.

The Master of Science in Teaching Program is supported in part through E&G funding. This funding is allocated to support student teaching assistantships and costs associated with faculty teaching courses in the program, rather than research activities.

There are no University faculty members with salary lines through the RiSE Center at this time. In the fall, three new faculty members (Capps, Smith, and Stetzer) will begin with salary lines supported by the Maine Physical Sciences Partnership grant from the National Science Foundation. All other Center faculty members are supported by appointments through their home departments.
Additional measures of success for the Maine Center for Research in STEM Education:

Estimated number of K-12 students who had an MST graduate, sabbatical participant, or current MST student as a teacher in 2010-2011: more than 2,500 (figuring conservatively with approximately 80 students per teacher; most of these students are in Maine)

Total enrollments of UMaine courses in 2010-2011 that are part of Center research projects to guide course modifications to improve student learning: approximately 4000; including courses in mathematics, physics, astronomy, biology, chemistry, and marine sciences.

Total number of pre- and in-service teachers participating in Center conferences, collaboratives, and other outreach programs in 2010-2011: approximately 150.

GOALS FOR THE COMING YEAR:

- Continue to build research strength and attract external funding. This year has been a very successful one for grants and awards. We need to continue this level of research activity in order to continue to build our national and international reputation as a research center.
- Provide mentoring and support for the four new faculty members and new postdoctoral research and teaching associates who will be joining the RiSE Center during the coming year. Help them to contribute productively to the research of the Center and the work of the Maine Physical Sciences Partnership.
- Expand the areas of course offerings and research within the Center. Last year we offered, for the first time, a core course in Chemistry, which was very well received. We are exploring ways to become more involved in biological sciences, engineering, and marine sciences, all areas that would benefit STEM education and the RiSE Center. In particular, Dr. Michelle Smith, hired through the Maine Physical Sciences Partnership grant, brings expertise in research in the teaching and learning of genetics and other topics in the biological sciences. Her presence, combined with the active group in the School of Biology and
Ecology interested in educational innovation, assessment, and improvement, holds promise of strengthening the MST experience for life sciences students.

- **Continue to attract top quality students to the MST program.** The MST Program is becoming increasingly selective, with the PSP attracting more applicants than in previous years. RiSE faculty have decided to increase enrollment from 25 to 30 students, due to the increased advising capacity of new faculty hired. Some of this added capacity is being reserved for the formation of a new Ph.D. program in Science and Mathematics Teaching and Learning, which is under discussion.

- **Complete the space for the RiSE Center, required for the Maine Physical Sciences Partnership and promised by the University as part of its commitment to the project.** Part of the space needed has been provided through renovations, almost completed, in York Village. The current plan is that the rest of the space will be provided on the first floor of Estabrooke Hall.

**OPPORTUNITIES, CHALLENGES, AND SOLUTIONS FOR FY11**

**OPPORTUNITIES:**
1. The Center is unusual in its level of quality research collaboration among discipline departments and the College of Education and Human Development. With so much concern about STEM education in the United States, the time is right to grow strength in this research area at the University of Maine. We have an excellent start and are nationally competitive for grants and graduate students. In order to be in a position to take full advantage of increased federal funding in these areas and expand the Center's disciplines to include biological sciences, marine sciences, and engineering, additional faculty members are needed. The Maine Physical Sciences Curriculum Partnership and a new hire in science education in the College of Education and Human Development are providing an outstanding cohort of four incoming faculty members to support the Center's work. It is truly an excellent opportunity to be hiring in the current climate!

2. All aspects of the Maine Physical Sciences Curriculum Partnership Grant provide superb opportunities for the RiSE Center. This partnership will
truly make the University a leader in science and mathematics teacher preparation, and create an infrastructure for ongoing improvement in STEM education. During the past year, we have received visits and inquiries from several universities about how to start a similar center.

3. The RiSE Center is poised to meet the demand for a Ph.D. Program in Science and Mathematics Teaching and Learning. Graduates from the MST program and practicing teachers frequently inquire about the future availability of such a program. During the interview process for the four new faculty for the RiSE Center hired during the past year, the candidates expressed enthusiastic support for such a program. This type of offering would meet a need for the capacity in Maine to sustain and expand the work of the Maine Physical Sciences Partnership, including continual data-guided improvement of science and mathematics education.

4. The Hutchinson Center provides a very attractive location for expansion of the MST program. With its new wing equipped with science laboratories now completed and in use in the summer of 2009, there is a need for science and mathematics teaching assistants there. MST students could meet this need, while ensuring that instructional methods parallel those used at the University of Maine, to make courses more similar at both locations. An MST program at the Hutchinson Center would also meet the needs of many in-service and pre-service teachers out of reach of the Orono campus and provide additional quality teachers in science and mathematics in Waldo County. Additional faculty, who would also enlarge the Center’s research capabilities, would be needed for this expansion. Because RSU #20 (Belfast and Searsport) is part of the Maine Physical Sciences Partnership, we are now running collaboratives at the Hutchinson Center, which set the stage for recruiting teachers into the MST program.

**CHALLENGES AND SOLUTIONS:**

1. Urgent need for space for the Maine Physical Sciences Curriculum Partnership that supports the interdisciplinary work of the project. It has taken most of this first year of the project to identify the space required. Renovations for the space that will house many of the new staff involved in implementation of instructional resources and professional development are almost completed. Rapid authorization of funds for
furnishings and office equipment are needed. Recently part of the first floor of Estabrooke Hall was identified as the space designated for the PSP research team. Renovations for this space must move forward very rapidly, so that collaborative research within the project can move forward.

2. Earlier budget cuts, coupled with increases in tuition and graduate student stipends. The Center has taken three significant cuts in its MST budget at the same time that tuition and stipends are being increased for graduate students, including MST students. Earlier projections of cuts for the next three years would devastate the program. Fortunately, so far, these cuts have not been applied to the MST program. Since student costs (tuition, stipends, and health insurance) form a major part of the MST budget expenses, budget cuts, if they continue, are likely to necessitate the shrinking of the program's size. Fortunately, compensating money from both external and internal sources has enabled the program to retain its size of ~25 students so far and increase to ~30 students next year. Increased external funding, along with at least stable internal funding, is needed to maintain program size and quality. We are also working to continue strong connections with our alumni and build capability for major gifts in the future. (Making the program smaller does not make sense considering the crucial need nationally and locally for quality STEM education, the program's success in attracting strong students and graduating excellent teachers, and the MST students' contribution to educational quality on campus as teaching assistants in STEM classes.)

LONG-TERM PRIORITIES

- **Space and visibility.** We have need for a place where research collaborators, teachers in residence, and other visitors can work productively as part of our intellectual community. Facilities for student interviews, data analysis, student offices, and classroom video recordings are also needed. We hope that this problem will be solved, at least in the short-term, through space promised for the Maine Physical Sciences Partnership. Having space on campus will enhance visibility. RiSE faculty members are also working with RiSE Advisory Board members on strategies to build the center's visibility off campus.

- **Growth of our high quality research center.** We need to keep adding excellent faculty and postdoctoral research associates to
strengthen research in new areas and build collaborations across disciplines. The Maine Physical Sciences Curriculum Partnership grant provides three faculty positions and three postdoctoral research associate positions, which will give the RiSE Center a wonderful opportunity for growth.

- **Ongoing development and improvement of the MST program.** The MST Program is a niche program at the University and attracts excellent future science and mathematics teachers to Maine. Expansion of the areas of science teaching taught in the program to include chemistry, biology, marine sciences, and engineering education is a priority. Possible introduction of a middle school science concentration, coordinated with the Maine Physical Sciences Curriculum Partnership grant, would also be very beneficial and help sustain the work of the Maine Physical Sciences Partnership.
## FUNDED RESEARCH PROJECTS
(Investigators and co-investigators who are RiSE Center members are listed.)

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Project Title</th>
<th>Principal Investigator</th>
<th>Co-Investigators and Sr. Personnel</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Science Foundation</td>
<td>Maine Physical Sciences Curriculum Partnership: Research and Infrastructure National Science Foundation</td>
<td>S. McKay</td>
<td>F. Amar M. Bruce N. Speer J. Thompson M. Wittmann</td>
<td>$4,175,094 (for first 2 years; continuing grant totaling $12.3 million for 5 years)</td>
</tr>
<tr>
<td>San Diego State University Foundation (NSF)</td>
<td>Using Gesture Analysis to Explore Embodied Cognition in Chemistry</td>
<td>F. Amar</td>
<td>M. Bruce M. Wittmann</td>
<td>$5,000</td>
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<tr>
<td>Jackson Laboratory (Howard Hughes Medical Institute)</td>
<td>Biomedical Research Experiences for Students and Teachers Year III</td>
<td>S. McKay</td>
<td>M. Schauffler</td>
<td>$104,145</td>
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<tr>
<td>Lloyd G. Balfour Foundation</td>
<td>Mastering Science: Biomedical Research Experiences for Students and Teachers</td>
<td>S. McKay</td>
<td>M. Schauffler</td>
<td>$270,276</td>
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<tr>
<td>Challenger Learning Ctr. Of Maine (ME. Dept. of Education)</td>
<td>Collaborative Proposal: Connecting Climate to Curriculum Yr. 3</td>
<td></td>
<td>M. Schauffler</td>
<td>$24,531</td>
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<tr>
<td>Schoodic Education and Research Center Institute (US Dept. of Education)</td>
<td>Acadia Learning Phase II</td>
<td></td>
<td>M. Schauffler</td>
<td>$32,225</td>
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<tr>
<td>WestEd (US Dept. of Education)</td>
<td>Video Cases for Novice College Mathematics Instructors</td>
<td>N. Speer</td>
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<td>$30,850</td>
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<td>San Diego State University Foundation (National)</td>
<td>Investigating Mathematical Knowledge Using Physicsless Physics Questions</td>
<td>J. Thompson</td>
<td></td>
<td>$5,000</td>
</tr>
</tbody>
</table>
Total: $4.65 million

GRADUATE DEGREES AWARDED IN STEM TEACHING AND LEARNING
2010-2011

Please note: The MST degree is offered by the RiSE Center. PhD students in Physics doing physics education research have dissertation advisors who are members of the RiSE Center, but the degree is awarded by the Department of Physics and Astronomy.

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Thesis Title</th>
<th>Advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erik DaSilva</td>
<td>MST</td>
<td>Procedural Skills – The Missing Link in Ninth Graders’ Comprehension of Geography’s Influence</td>
<td>C. Gerbi</td>
</tr>
<tr>
<td>William Hall, Jr.</td>
<td>MST</td>
<td>Language and Area: Barriers to Student Understanding of Integration</td>
<td>N. Speer</td>
</tr>
<tr>
<td>Maggie Hutchinson</td>
<td>MST</td>
<td>College Chemistry Students’ Understanding And Application of the Relationship Between Algebra and Stoichiometry</td>
<td>F. Amar</td>
</tr>
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<td>Casey Murphy</td>
<td>MST</td>
<td>Answer-Seeking and Idea-Instructing During Collaborative Active-Learning in a Physics Laboratory</td>
<td>M. Wittmann</td>
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<tr>
<td>John Stahley</td>
<td>MST</td>
<td>Students’ Qualitative Understanding of the Relationship Between</td>
<td>R. Franzosa and N. Speer</td>
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<tr>
<td>Name</td>
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<td>Research Title</td>
<td>Authors</td>
</tr>
<tr>
<td>-----------------</td>
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<td>--------------------------------------------------------------------------------</td>
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<tr>
<td>Katrina Black</td>
<td>PhD in Physics</td>
<td>Multiple Perspectives on Student Solutions to Air Resistance Problems</td>
<td>M. Wittmann</td>
</tr>
<tr>
<td>Trevor Smith</td>
<td>PhD in Physics</td>
<td>Identifying and Addressing Specific Student Difficulties In Advanced Thermal Physics</td>
<td>J. Thompson</td>
</tr>
<tr>
<td>R. P. Springuel</td>
<td>PhD in Physics</td>
<td>Applying Cluster Analysis to Physics Education Research Data</td>
<td>M. Wittmann and J. Thompson</td>
</tr>
</tbody>
</table>
Please note: University of Maine faculty, postdoctoral research associates, current and former students are in bold font.

BOOK


BOOK CHAPTER

Preparing future teachers to anticipate student difficulties in physics in a graduate-level course in physics, pedagogy, and education research, J.R. Thompson, W.M. Christensen, and M.C. Wittmann, Physics Teacher Education Coalition, 2011.

ABSTRACTS, ARTICLES, and PROCEEDINGS (University of Maine faculty and students bolded)


Student understanding of integration in the context and notation of thermodynamics: Concepts, representations, and transfer, T. M. Wemyss, R.


**MST Courses Offered – 2010/2011**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Title</th>
<th>Professor</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>Summer 2010</td>
<td>SMT 699 – GRADUATE THESIS</td>
<td>S. MCKAY</td>
<td>12</td>
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<tr>
<td>Fall 2010</td>
<td>SMT 501 – INTEGRATED APPROACHES PHYSICS ED I</td>
<td>J. THOMPSON</td>
<td>5</td>
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<tr>
<td></td>
<td>SMT 503 – INTEGRATED APPROACHES EARTH SCIENCE ED I</td>
<td>C. GERBI</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>SMT 506 / SMT598 – INTEGRATED APPROACHES MATH ED I</td>
<td>N. SPEER</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>SMT 588 – SEM SCI &amp; MATH EDUCATION RESEARCH</td>
<td>M. WITTMANN</td>
<td>5</td>
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<td></td>
<td>SMT 699 – GRADUATE THESIS</td>
<td>S. MCKAY</td>
<td>17</td>
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<tr>
<td>Spring 2011</td>
<td>SMT 500 – ED. PSYCH W/APPL TO SCI &amp; MATH TEACHING AND LEARNING</td>
<td>M. WITTMANN</td>
<td>9</td>
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<td></td>
<td>SMT 507 – RSRCH-RELATED CURRICULUM DEVEL IN SCI &amp; MATH</td>
<td>M. SCHAUFFLER/ J. THOMPSON</td>
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<td>SMT 590 – SEMINAR FOR TEACHING INTERNS</td>
<td>S. MCKAY</td>
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<td>SMT 591 – SECONDARY STUDENT TEACHING</td>
<td>S. MCKAY</td>
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<td>SMT 598 – RESEARCH INTERNSHIP JAX LAB</td>
<td>S. MCKAY</td>
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<td>SMT598 – INTEGRATED APPROACHES CHEM ED I</td>
<td>F. AMAR/ M.BRUCE/ T. WEMYSS</td>
<td>6</td>
</tr>
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<td></td>
<td>SMT 699 – GRADUATE THESIS</td>
<td>S. MCKAY</td>
<td>13</td>
</tr>
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</table>
### GRADUATE AND 2011 MST STUDENT TEACHER PLACEMENTS AND JACkSON LABORATORY TEACHER SABBATICAL PARTICIPANTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>School Name &amp; Town</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbey, Karen (2008 Graduate)</td>
<td>Mathematics Teacher</td>
<td>Parish Hill Middle High School Chaplin, CT</td>
</tr>
<tr>
<td>Bajracharya, Rabindra Raj (MST Student)</td>
<td>Student Teacher</td>
<td>John Bapst Memorial High School Bangor, ME</td>
</tr>
<tr>
<td>Clegg, Katie (MST Student)</td>
<td>Science Teacher</td>
<td>Nute High School Milton, NH</td>
</tr>
<tr>
<td>Friant, Denise (JAX Teacher Intern 2007)</td>
<td>Science Teacher</td>
<td>Woolwich Central School Woolwich, ME</td>
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<tr>
<td>Graves, Ashley (2008 Graduate)</td>
<td>Mathematics Teacher</td>
<td>John Bapst Memorial High School Bangor, ME</td>
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<tr>
<td>Hutchinson, Maggie (2011 Graduate)</td>
<td>Mathematics Teacher</td>
<td>Denver Street School Lakewood, CO</td>
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<tr>
<td>Knight, Kathleen (2005 Graduate)</td>
<td>Mathematics Teacher</td>
<td>George Stevens Academy Blue Hill, ME</td>
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<td>Laroche, Raymond Bradford (JAX Teacher Intern 2009)</td>
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<td>Camden-Rockport Middle School Camden, ME</td>
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<td>Lincoln Academy Damariscotta, ME</td>
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<td>Foxcroft Academy Dover-Foxcroft, ME</td>
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