

Science and Mathematics Teaching Center (SMTC)
Annual Report June 1, 2011 to June 1, 2012

Section 1. Introduction: The University of Wyoming Science and Mathematics Teaching Center (SMTC) is an intercollegiate, interdisciplinary program committed to excellence in K-20 science, technology, engineering, and mathematics (STEM) teaching and learning. The SMTC is jointly governed by the College of Education and the College of Arts and Sciences, and has a Director, Coordinator and a Science Outreach Educator as full time faculty. The Center's programs, projects, and outreach are supported by 90+ SMTC Affiliate Faculty members drawn from throughout the university (especially Agriculture, Arts and Sciences, Education, and Engineering) and several community colleges. The SMTC pursues its mission of improving STEM teaching and learning through:

- **Master's Programs:** Master's of Science in Natural Science (MS NS) programs for Middle School Science (MS NS MSC), Middle School Mathematics (MS NS MMA), Natural Science Education (MS NS NED), and Master's of Science in Teaching (MST) for secondary STEM teachers
- **Endorsement Programs:** related to the master's programs are Wyoming Professional Teaching Standards Board (PTSB) sanctioned teaching endorsement programs in middle level science and mathematics and a collaborate with College of Education Office of Teacher Education for a secondary biology certificate
- **Grant Funded Collaborative Projects:** K-12 schools, community colleges, universities, and informal science education collaborative programs that provide content-based professional development for STEM teachers
- **Research:** on issues related to STEM education
- **Resource Center:** providing information on STEM teacher resources and professional development opportunities <http://www.uwyo.edu/smtc>

The SMTC has excelled in these five initiatives over the past year. The **Master's Programs** have maintained steady enrollments; we have made changes in the programs based on assessment information; and we have instituted new courses and support services to enable more students to successfully complete their Plan B projects and be graduated. **Grant funded collaborative projects** have expanded and involved over 50 UW faculty and graduate students from various UW colleges as well as community college faculty, in providing content-based professional development to STEM teachers or conducting research on STEM teaching. With this funding the SMTC has been able to provide more Energy-related professional development for Wyoming teachers as well as other high need areas such as secondary mathematics teaching and interdisciplinary teaching. The SMTC worked this year to develop relationships with more faculty (added 20+ new affiliates) and with other UW entities concerned with STEM education. We also spent more time reaching out to Wyoming school districts and improving relationships with them. The SMTC generated more than 550 hours of enrichment credit for teachers. **Research** funded by the NSF grants was conducted on effective distance mathematics education, and quantitative reasoning and professional development in ecological education. The SMTC website serves as a **resource center** for STEM teachers, providing information on teacher professional development opportunities and on-line teacher resources. Below is a list of SMTC key accomplishments over the last year:

- Continued two funded NSF MSP collaborative projects: MSP LTER collaborative for \$12,498,243 and Math TLC collaborative for \$4,999,744.
- Initiated and/or managed nine Mathematics and Science Partnership (MSP) state grants (\$643,289 for 3 that concluded fall 2011; \$668,078 for 3 that will conclude this fall; and \$651,999 for three that will conclude in the fall of 2013)
- Partnered on broader impacts on multiple new UW grants (EPSCoR, Cooperative Agriculture Program and Microbiology)
- Obtained three contracts with Wyoming school districts (\$49,700)
- Maintained strong MS NS programs with approximately 90 graduate students currently enrolled
- Established research program through NSF funding
- Hosted a two-part conference with national speakers on important STEM education issues
- Supported and promoted diversity, social justice and interdisciplinary initiatives at UW
- Provided support for 11 graduate students through assistantships or foundation funds to students in Ph.D. and Master's programs, in addition to supporting 36 teachers in MS NS master's programs through foundation funds and tuition waivers
- Expanded SMTC's capacity with the addition of a new Science Outreach Educator, the promise of a ¾ time Science Fair Coordinator and the successful search for a new Director

Section 2. Academic Planning Implementation: The following constitute action items for the 2009-2014 SMTC Academic Plan. These action items are drawn from SMTC initiatives related to the University Academic Plan motifs and action items from the yearly SMTC academic plan.

1. *Assessment:* Develop and implement an assessment plan for the MS NS programs that will measure impact of the program on teachers practice, provide data to improve programs, and indicate areas of need for teachers in Wyoming and the wider Rocky Mountain region
 - **State Needs:** Completed survey of state needs through web-based needs assessment and focus groups, and annual conference calls about professional development needs of Wyoming teachers regarding Science, Technology, Engineering and Mathematics (STEM). This information is used in developing new proposals.
 - **Program Evaluation:** Made adjustments in program planning in response to feedback from program participants in focus groups (greater collaboration and planning by faculty teaching in summer 2012 programs so that there is more coherence and consistency, and modeling of interdisciplinary teaching and learning).
 - *Anticipated Progress:* continue to work on MS NS program assessment using pre-post testing within classes, surveys, assessment rubrics, and focus groups. Develop a plan for bringing assessment of all programs to Level 1 over the next two years.
2. *Grants:* Seek grants to support professional development and research
 - **State MSP Grants:** Wyoming Department of Education Mathematics Science Partnership Grants: completed work on three funded projects; began work on three new projects; submitted proposals for 6 additional projects including three renewals and three of those were funded. The total value of these grants in this year alone was \$1,963,366. All of these grants are submitted and managed through the SMTC, involve faculty from the colleges of A&S, Education, Engineering, Agriculture and Natural Resources, community colleges, more than a dozen school districts and hundreds of teachers throughout WY.
 - **National Grants and Collaborative Proposals:** Submitted proposals in collaboration with other units at UW and with other universities (EPSCoR was funded; Coordinated

Agriculture Project is pending). SMTC previously achieved our goal of two funded, collaborative NSF grants (Math TLC with the University of Northern Colorado and Pathways to Ecological Literacy with Colorado State University, University of California Santa Barbara, Michigan State University and Towson State University) within the five year period of Academic Plan 3; we are currently in the fourth year of five for these two NSF grants described on page 9.

- **Other Broader Impact Proposals:** Having created modules/options for NSF grant proposals that provide for meaningful STEM education components that impact teacher practice and student learning, we have been able to use them as templates for additional proposals to NSF.
 - *Anticipated Progress:* We are reaching out to new faculty and encouraging them to partner with the SMTC to address the broader impact portion of their proposals (of the 20 new SMTC affiliate faculty members added this year more than half are relatively new in their careers here at UW and are being involved in projects through the SMTC); we will continue this expansion by building relationships and plan to be part of a STEM Broader Impacts Expo for faculty that the SMTC is organizing in the fall with SER, NWSC, CSI-WY, EPSCoR, Physics Department and others.
 - **Research:** SMTC is able to engage in research because of grant funds. Research on the characteristics of successful professional development and best practice for math in-service teachers is being conducted through the NSF Math TLC project. Research on learning progressions, quantitative reasoning in the sciences and professional development is being conducted through the NSF Pathways project in conjunction with graduate students and faculty from ten universities around the country. Our research agenda is expanding to include informal and non-formal science education; we are continuing to encourage faculty to conduct research on the educational components of their grant-funded projects and to seek funding for SMTC graduate students when possible (they can assist them in doing that research).
 - *Anticipated Progress:* SMTC plans to offer more support to faculty on developing and delivering effective professional development to teachers and on forming successful partnerships – these are both areas of need that have become more apparent in recent years through external evaluations of projects.
3. *Graduate Programs - MS NS:* Expand current and explore potential new graduate programs serving in-service STEM teachers
- **Improve Current Programs:** With the commitment of a fulltime faculty member to SMTC this year we offered two Plan B Support Seminars to teachers who had completed program course work in the MS NS graduate programs but were failing to make progress in completing their Plan B theses and graduating. All eight participants will have completed their Plan Bs and their master's degrees by the end of summer 2012.
 - ✓ *Anticipated Progress:* Continue to offer Plan B support classes so that more participants complete their degrees in a timely manner. Offer orientation sessions for faculty on SMTC student committees so they are more effective.
 - **Expand to Offer Regional Programs:** Piloted online STEM professional development courses both in the fall and spring meant to expand the MS NS Middle Level Science and Middle Level Mathematics programs into virtual regional programs.
 - ✓ *Anticipated Progress:* Actual expansion to regional programs is a long term goal which we will continue to pursue through development and piloting of online courses.

- Changes in the Outreach School funding model to charge out-of-state tuition will have to be taken into consideration and may preclude further expansion.
- **Maintain Size:** Maintained an enrollment of approximately 20 teachers in the MS NS MSC program and the MS NS MMA program.
 - ✓ *Anticipated Progress:* It takes extensive effort to maintain 20 teachers in the MS NS programs. Future action is to market the programs more strategically in Wyoming. We will also investigate possibly offering more targeted sequences of education courses for certificates in specific high-needs area such as three 3-hour courses in teaching elementary math to address Common Core Math Standards, or an After-school STEM Education credential. We will continue to explore expanding existing programs to serve the Rocky Mountain region but our priority will remain with serving Wyoming teachers well.
 - **Institutionalize Programs:** All of the courses in the MS NS programs have permanent course numbers (except the new Plan B Seminar that we added this year) and PTSB endorsement options are approved. The Master's of Science in Teaching concentration of Secondary Mathematics Education (MST – SME) was added and approved this year to better delineate the program offered in conjunction with the University of Northern Colorado (Math TLC program).
 - ✓ *Anticipated Progress:* Pursue approval of new course over the next academic year.
 - **Partnership with Teton Science School:** Exceeded minimal goal of 5 graduate students in MS NS NED program. Had 6 this year and will have 10 new TSS students for next year. Negotiating an expanded Teton Science Schools (TSS) partnership that enables students entering their graduate program to be enrolled as UW graduate students from the beginning. We anticipate that more students will come to UW for a second year of study to complete their master's degrees. We have also increased joint activities with TSS by partnering on state and regional environmental education and place-based learning efforts such as the Wyoming Youth Congress as well as other professional development and broader impact opportunities such as the new EPSCoR grant.
 - ✓ *Anticipated Progress:* Growth in the number of students is restricted in part by financial support issues created by extended support for Ph.D. programs in Science Education that reduces the amount available for the support of TSS graduate students. Continue developing relationships with donors for additional scholarship support and with TSS for tighter program coordination. Write in more support for graduate students in Broader Impact proposals; work more closely with affiliate faculty to identify support for TSS/NED graduate students. Finalize memorandum of understanding between UW and TSS to institutionalize the relationship between us.
 - **Virtual Programs to Serve Region:** Implemented a new graduate degree program for secondary mathematics teachers in collaboration with the University of Northern Colorado much of which is delivered virtually. Currently serving Colorado and Wyoming with possibilities of expanding to serve the Rocky Mountain West region. SMTC is offering more online courses during the school year to participants in our MSP grant-funded projects thus enabling them to continue their professional development without having to travel.
 - ✓ *Anticipated Progress:* Continue to work out recruitment processes and back office integration details with UNC so that the program can become operationally smooth and self-sustaining when the grant funding ends at the end of 2013.

- **Support PhD Programs:** Supported revitalization of the Ph.D. programs in science and mathematics education by securing full or partial funding through SMTC funding options for nine PhD students in math or science education this year (as well as additional master's degree students).
 - ✓ *Anticipated Progress:* continue to pursue goal of generating 10 graduate assistantships and/or other support over the next year.
4. *Research:* Establish a line of research for the SMTC
- **Professional Development for Teachers:** Conducting NSF-supported research into quality online professional development for teachers of mathematics and NSF-supported research into quantitative reasoning, learning progressions and professional development in environmental literacy (multidisciplinary K-12 teaching and learning).
 - ✓ *Anticipated Progress:* Over the next 3 years we will continue to conduct research in these areas with existing funding; a supplemental proposal for \$247,476 has been submitted to NSF to expand the research on professional development and includes funds for major UW involvement.
 - **Issues of Articulation:** This line of research has not been pursued since we have not found funding to support it.
 - ✓ *Anticipate Progress:* We expect the emergence of the new Common Core Math Standards and the Next Generation Science Standards to present new issues related to K-20 articulation and thoughtful research will be needed. At least two of the new MSP grant-funded projects are documenting school level impact and we will encourage the development of research in this area.
 - **New Research:** We are expanding areas of research to include research on the effects of scientist-student-teacher partnerships and their impact on each other, as well as research on effective informal and non-formal science education.
5. *Outreach:* The SMTC mission to improve STEM teaching and learning must expand beyond WY K-12 schools to include STEM learning for all Wyoming citizens in both formal and informal education settings.

Partner with UW Programs to Support Outreach

- Explored collaborative outreach projects with SER on energy education; and with ENR, TSS and the Berry Center on informal science, environmental and outdoor education.
- Consulting on STEM education outreach aspects of the Berry Biodiversity Center.
- Collaborating on NCAR-UW supercomputer project STEM outreach in mathematics and computational sciences.
- Assisted in planning and organizing the statewide STEM/CTE Summit in Casper.
 - ✓ *Anticipated Progress:* Continue supporting STEM outreach in the SER and NCAR projects, including creation of Mathematics and Computational Science Advisory Board, and collaborations with others especially ENR, TSS, the Berry Center, NASA Space Grant, CSI Wyoming.

Partner with Wyoming School Districts

- Organized and hosted a two-part conference on understanding and applying research in science education. Richard Duschl, professor at Penn State University and editor of Taking Science to School, focused on research from the National Research Council on how children learn science and how to align science curricula with the Next Generation Science Standards (35 participants). Jay McTighe, co-creator of Understanding by Design, led the second part and helped 47 teachers and administrators think about what

they are teaching; how they know if their students really understand it; and how to transform their science classrooms, instruction and assessment.

- Completed the third and final year on the following Math Science Partnership grant projects funded through the Wyoming Department of Education:
 - QR STEM project provided sustained content-based professional development to teachers throughout Wyoming focused on the use of quantitative reasoning to understand the science underlying global challenges and used a model based on the Understanding by Design (UbD) framework. (\$242,019)
 - Carbon County Mathematics Initiative developed a partnership between the two Carbon County school districts and UW to provide professional development for K-12 mathematics teachers in the districts. The Vermont Math Initiative was one of the models used. (\$228,499)
 - Engineering Approach to Teaching Science and Mathematics provided professional development to elementary, middle and high school science and mathematics teachers with a focus on engineering and energy. (\$172,771)
- Began work on the following new Math Science Partnership grant projects funded through the Wyoming Department of Education:
 - Place Learning and Civic Engagement (PLACE): Connecting elementary science to students' home places, Year 1= \$223,793. The focus of this program is elementary school science and making the science curriculum more connected to the places that the teachers and elementary age children call home. Year 1 science content is about Watersheds and Hydrology. Partners include the Teton Science Schools, Carbon CSD #2 (Saratoga), Laramie CSD #1 (Cheyenne), Natrona CSD #1 (Casper) and Casper College.
 - Flooding the Fields with Problem-based Learning (Flooding), Year 1= \$219,934. This is a collaborative professional development project between Converse CSD #1 (Douglas), the University of Wyoming, Casper College, and UW CC. It focuses on water in Year 1 and the use of problem based learning approaches to instruction.
 - Ready to Learn Math (RTL Math): Developing and Using Readiness Assessment Strategies to Improve Standards-based Mathematics Teaching and Learning, Year 1 = \$224,351. This partnership between UW and Hot Springs CSD#1 (Thermopolis) focuses on helping teachers develop and use assessment and teaching strategies to strengthen student knowledge and proficiency.
- Successfully competed in a new round of funding for Math Science Partnership grant projects through the Wyoming Department of Education:
 - PLACE grant was renewed for another year through 9/30/13 (\$230,762) and is expanding to include additional teachers and support leadership development in returning teachers in the same partner districts and is focusing on energy and the environment.
 - Flooding the Fields with Problem-based Learning was also renewed for another year through 9/30/13 (\$186,351) and is focusing on biodiversity.
 - A new project was funded, Science for the Future: Redesigning Science Education via the Energy-Water-Climate Nexus (\$234,886). 25 teachers and administrators from two small districts, Platte CSD #1 (Wheatland) and Fremont CSD #2 (Dubois) will participate in workshops on energy this summer, receive

online and in person support during the school year and develop and implement energy-related activities in their classrooms that also address the Next Generation Science Standards.

- ✓ *Anticipated Progress:* Continue pursuing these grants as long as funds are available. Conduct more research on the impact; publicize these stories more strategically on website, through social media, at conferences and through feature articles and virtual publications. Pursue contracts with districts for this kind of work; develop a cadre of consultants; offer more professional development virtually on an entrepreneurial basis through Outreach.

Grow SMTC Capacity

- Hired a new Science Outreach Educator. In one year this new faculty member developed and taught a class that enabled more teachers to complete their degrees; traveled the state and visited 21 districts and met with nearly 150 educators; secured two contracts with districts (Uintah CSD #1 and Campbell CSD #1) and is providing professional development and technical assistance on restructuring their science programs; made connections with national organizations that will enable 4 graduate students to earn stipends working on energy-related and informal science education projects this year; obtained a WDE MSP grant with faculty from Geology, Life Science and Education to provide professional development to teachers in Platte and Fremont counties (Nexus grant); developed a broader impact plan with a new faculty member in Microbiology and submitted a proposal to NSF as a co-principle investigator; and is carrying out the broader impact program for another faculty member in Microbiology who had already received an NSF grant in collaboration with the SMTC. This has proven to be a very productive hire and underscores the need for a similar position for a Math Outreach Educator. Much can be done through the SMTC if we have the personnel.
- Secured support from SER and numerous UW colleges and departments for a full time State Science Fair Coordinator to organize and host the Wyoming State Science Fair in 2012. Secured a ¾ time position from the state line for 2012 and beyond that will enable the fair to be expanded and projects improved by providing more support to teachers. The Science Fair had more than 300 participants in 2012; it allows the SMTC to promote STEM education and provide professional development to teachers mentoring students, which relates to the SMTC mission. This person will also be involved in STEM Pipeline initiatives at UW. In collaboration with the UW Foundation, SMTC submitted proposals to the Halliburton Foundation and Williams Energy for additional WSSF support.
 - ✓ *Anticipated Progress:* Continue efforts to secure from CPM a Mathematics Outreach Educator position in order to expand SMTC capacity and pursue new STEM education opportunities.

6. *Articulation – K-16 STEM Pipeline:*

- The SMTC is not pursuing the STEM Teacher Innovations Initiative since it has not received university support. This effort is currently on hold pending the arrival of the new SMTC director.

Section 3. Teaching Activities: Over the past year the SMTC has encouraged high quality teaching and curriculum development by working with affiliate faculty to tie course outcomes to program outcomes and met with affiliate faculty to discuss MS NS program goals and program assessment. Affiliate faculty are not assigned to the SMTC so providing a reward for high quality teaching is not feasible. The following is some data on the SMTC master's programs:

- The SMTC Master of Science in Natural Sciences – Middle Level Science (MSC) is designed for elementary, middle school, and general science teachers who want to deepen their understanding of science concepts and environments that support teaching and learning science. The 24 hours of courses designed for this program are offered on campus for the month of June sequenced over three years.
 - Active Students: 33; Students graduating in past year: 6
- The SMTC Master of Science in Natural Sciences – Middle Level Math (MMA) was developed to expand math content knowledge and knowledge of appropriate pedagogy for instruction at the middle-level grades. Courses are offered on-line during the school year and on campus in June over two summers.
 - Active Students: 36; Students graduating in past year: 7
- The SMTC Master of Science in Natural Sciences – Natural Science Education (NED) is limited to students accepted into the Teton Science Schools (TSS) Graduate Program. Fifteen designated credit hours are completed at the TSS. For the remaining 15 credit hours on the UW campus, students work with a 3-member faculty committee to design a program of study in selected science content, pedagogy, and related coursework. Most students also do a dual major through ENR. Students wanting teaching certification in secondary biology stay on one more year to take additional education classes and do their teaching residency.
 - Active Students: 21; Students graduating in past year: 6
 - Students completing certificate option: 0
- The SMTC Master of Science in Teaching (MST) was developed for secondary science and mathematics teachers. A program designed for one teaching area (for example, chemistry or biology) must include 18 hours in that area; a program designed for two teaching areas must include 12 hours in/or required by each area. The SMTC has expanded this program significantly by establishing the new Math TLC Master’s Program for Secondary Mathematics Teachers in conjunction with the University of Northern Colorado.
 - Active Students: 54 in the joint program, 18 from Wyoming
 - Students graduating in past year: 2
- Graduate Enrichment Courses (NASC 5959) are taught by faculty who meet the instructor requirements of the Outreach School. The courses count for teaching recertification (PTSB) but cannot be used toward graduate degrees. The courses provide professional development for teachers that expand their knowledge of science and mathematics teaching and learning.
 - Enrollments: 275; Enrichment Hours Generated: 550

Section 4. Research and/or Creative Activities:

Grants: SMTC courses and programs are created and supported largely with grant funding so this is a key creative activity for the center. The SMTC identifies funding opportunities in the area of STEM education, shares information on the opportunities with SMTC affiliate faculty, creates collaboratives of faculty from the Colleges of Arts and Sciences, Education, Agriculture, and Engineering to work on proposals, and assists in or takes a lead in submitting proposals. The SMTC also supports the broadening impacts and outreach components of grants submitted by UW faculty. The following grants in which the SMTC was either a lead or partner were submitted and/or funded and/or continued in the past year:

- NSF Mathematics and Science Partnership (MSP) program, Culturally Relevant Ecology, Learning Progressions, and Environmental Literacy (referred to as Pathways) for

\$12,498,243 (funded with UW subcontract of \$749,683 over 5 years). National partnership with Long Term Ecological Research (LTER) sites to conduct research on how students develop understanding of ecological concepts and then provide professional development for teachers focusing on using learning progressions in environmental literacy teaching/learning. UW leads the research on quantitative reasoning and on professional development and was included in a proposal for a supplement this year to expand the research on the effectiveness of the professional development being provided through the project (pending).

- NSF MSP program, Mathematics Teacher Leadership Center (Math TLC) for \$4,999,744 (funded with UW subcontract of \$1,403,147 over five years). Created a master's program for secondary math teachers and a mathematics teacher leadership program which are offered jointly by the University of Northern Colorado and UW. Faculty and students from both institutions are shared; most of the courses are offered virtually to better serve a largely rural contingent of teachers. We are in the 4th of 5 years and just beginning to offer classes to the 4th cohort moving through the program. We are working to systematize the recruitment and administrative processes so that the program will operate smoothly and be sustainable when the NSF funding ends at the end of 2013.
- New MSP state level grants funded and renewed: Flooding the Fields with Problem-based Learning, Year 1= \$219,934, renewed for Year 2= \$186,351; Place Learning and Civic Engagement (PLACE), Year 1= \$223,793, renewed for Year 2= \$230,762; Ready to Learn (RTL) Math, Year 1= \$224,351; and Science for the Future: Redesigning Science Education via the Energy-Water-Climate Nexus, Year 1= \$234,886.
- Fremont County Consortium funded by Teacher Leader Quality grant. SMTC continues for the 5th year to serve as the external evaluator for this professional development project through a subcontract with the Fremont CSD #25.
- Under a contract with Uintah CSD #1, the SMTC is providing technical assistance and professional development to teachers in Evanston to expand their instructional strategies and revise their science curriculum to meet the Next Generation Science Standards. A similar contract with Campbell CSD #1 to provide similar services to Gillette teachers and administrators will begin summer 2012.
- Contracted with the Illinois State Geologic Survey through a grant from the US Department of Energy to develop energy curriculum related to carbon sequestration (provides partial funding for three graduate students to do the work).
- Contracted with the National Park Service Advisory Board to conduct a literature review for them (provides partial funding for a graduate student to prepare the review).

The SMTC has collaborated on a number of grant submittals by supporting outreach and broadening impact components of the projects.

- NRE Agricultural Prosperity for Small and Medium Sized Farms Program for \$500,000 (funded), SAREC Agricultural Systems proposal submitted by Jay Norton with SMTC providing educational component (teacher workshop) in August 2012.
- National Institute of Food and Agriculture (NIFA), US Dept. of Agriculture, "Incorporating legumes into dryland cropping systems in semi-arid agriculture: economic and environmental benefits in the face of climate change," \$10,000,000 (pending). SMTC will oversee the Education Outreach and Diversity component for this 5-state collaborative if funded.

- Water in a Changing West: The Wyoming Center for Environmental Hydrology and Geophysics (EPSCoR grant submitted by UW), \$20,000,000 with a major role for SMTC in collaboration with the Teton Science Schools for Educational Outreach (funded).
- NSF MCB, Transcription and Translation in a Uniquely Compartmentalized Bacterial Cell (GET Cell), \$474,808 (funded), submitted by Naomi Ward in Microbiology, with SMTC providing educational component beginning summer 2012 through the 2012-13 school year.
- NSF MCB, LEARN (Learning Through Experimental Amphibian Research on the Nucleus), \$232,402 (pending), submitted by Daniel Levy in Microbiology with SMTC providing the educational component and SMTC Science Outreach Educator serving as co-PI.

Research: Two research studies are underway related to the national MSP projects; published articles on online teaching of mathematics; and collected interview data on quantitative reasoning in ecology which is currently being analyzed and articles being prepared for submission.

Publications, Presentations, and Curricular Materials: The SMTC actively contributed to the first WISDOM^c monograph sponsored by Endowed Chair Larry Hatfield and to the second monograph focusing on QR. The SMTC Director, Interim Director, Coordinator and Science Outreach Educator regularly present at the Wyoming School Improvement Conferences and the Mathematics and Science Teachers Conference every year as well as at international, national, and state conferences. Various projects have created curricular materials including QR assessments and professional development materials.

Other: The SMTC received a Service Learning grant this year and incorporated a service learning project into a graduate seminar on Place-based Learning. Students conducted research on the geology, ecology, history and services in the Laramie area and then organized and led tours for community members, international students and visiting students. A service component will continue in this class. The same class is collaborating with the Art Museum and visiting artist Margaret Cogswell to explore and represent the Laramie River in an interdisciplinary symposium in conjunction with her upcoming exhibit this fall.

Section 5. Service, Extension and Outreach Activities: Outreach to pursue excellence in the learning and teaching of science, mathematics, and technology is a primary mission of the SMTC. The following are the major SMTC service contributions for the past year.

- International Service: SMTC has developed a relationship with the Education Ministry of Bhutan and the Royal University of Bhutan. A site visit supported by UW took place in March 2011 with four UW faculty members visiting Bhutan to assist them in designing a framework for developing master's degree programs in science and mathematics education as well as exchange programs for UW students and faculty, and Wyoming teachers. We would like to continue to assist them in developing and implementing the master's degree programs but have not yet found funding. We are collaborating with the TSS on another possible visit to provide more direct services to teachers and schools and to work out further plans with the Royal University of Bhutan for supporting the master's degree programs.

The SMTC hosted a visiting scholar from Nigeria studying environmental education opportunities. Her visit was a result of connections made with faculty from Winston Salem State University during an exchange visit the previous year.

The interim director served as an official member of the US delegation to the 7th Biennial Meeting of the International Network of Teacher Education Institutions Associated with the UNESCO Chair on Reorienting Teacher Education to Address Sustainability at York University in Toronto, Canada. The SMTC will continue to develop capacity in Education for Sustainable Development and will offer a workshop with faculty from Western Washington University at the National Network for Educational Renewal (NNER) this fall.

- National Service: The NSF Pathways Project is a national collaboration with 9 universities and 4 Long Term Ecological Research (LTER) sites to study ecological education. The NSF Math TLC project is a collaborative master's program that impacts mathematics teachers across the region. Coordinator serves as a reviewer for the Rural Education Research Journal. The Science Outreach Educator serves on the National Park Service Advisory Board Education Committee and the Life-long Learning Subcommittee.
- College Service: the former and interim director served on the Department Heads Committee for both Arts and Sciences and Education, and the Leadership Council for Education. The interim director served on the hiring committee for the new SMTC Director, the College of Education Academic Council for Graduate Education (ACGE) and the Professional Development Task Force.
- University Service: the former and/or interim director served on the NCAR Super Computer Project, Environment and Natural Resources Advisory Board, NASA Space Grant Advisory Board, the Shepard Symposium on Social Justice Steering Committee, the ENR Advisory Board, the Grant Review Selection Committee for the ENR Student Research and Creative Activities Grants, and the Berry Center Advisory Board. The interim director serves on the UW Strategic Diversity Initiatives Committee and on the Marketing Subgroup and participated in the outreach visit to Hampton University, an HBCU.
- State Service: The interim director consults for Fremont County school districts on professional development for teachers, serves on the Board for the Wyoming Big Horn Basin Nature and Discovery Center, chairs the Wyoming Natural Resources Education Advisory Board, is a member of the Ellbogen Foundation Leadership and Advocacy Institute, and served on the Wyoming Presidential Awards in Science and Mathematics Selection Committee, and the Teton Science Schools Board of Directors. SMTC through affiliate faculty provides outreach to K-12 STEM teachers across Wyoming. The SMTC is viewed by the state, school districts, and teachers as a source of support and information for STEM teaching and learning.
- SMTC cosponsors the annual state conference for mathematics and science teachers, the state robotics competition, the women in science conference, the Wyoming State Science Fair and the Shepard Symposium on Social Justice.
- Outreach School: SMTC offers STEM content and education courses through the Outreach School for the MS NS master's programs and continuing education courses for Wyoming and regional teachers, as well as through MSP grant projects. The new MST program supported by the NSF Math TLC grant has courses offered through Outreach.
- Community Colleges: SMTC cosponsors the Biology and Math articulation meetings with high school, community college and college faculty. Three of the state-funded MSP projects involve community college faculty in providing professional development to WY teachers.

Section 6. Student Recruitment and Retention Activities and Enrollment Trends: The SMTC does not offer undergraduate programs. The MS NS master’s programs serve teachers who matriculate in the summer, so the OIA data may not coincide with the SMTC counts. Enrollment in the master’s program has remained strong.

- MS NS Middle Level Science program is near capacity.

Year	2000	01	02	03	04	05	06	07	08	09	10	11
Enrolled	20	22	20	19	15	18	16	19	20	20	18	18

- Summer 2012 Committed to attend: 15

- MS NS Middle Level Mathematics program was below capacity but enrollments have increased to near capacity.

Year	2002	03	04	05	06	07	08	09	10	11
Enrolled	22	23	26	16	9	23	20	17	18	16

- Summer 2012 Committed to attend: 11 plus 3 more in the fall

- MS NS Natural Science Education: The program enrollment goal is 5 to 10 per year.

Year	2003	04	05	06	07	08	09	10	11
Enrolled	3	1	7	3	8	5	4	4	6

- 2012 -2013 Committed to attend: 10

- MST program has very low numbers due to content courses being offered only Fall and Spring Semesters on campus, which does not serve the needs of many K-12 teachers. The new MST Mathematics program with the University of Northern Colorado has 54 total students in the joint program in 4 cohorts, 18 from Wyoming, 10 are getting UW degrees.

Year	06	07	08	09	10	11
Enrolled	1	1	1	1	2	5

- 2012 -2013 Committed to attend: 2

Current enrollment in the MS NS programs is strong, but we aren’t satisfied with the rate of completion of the degrees. Because the programs are primarily offered in the summer, teachers often find it difficult to assemble a committee and stay focused on their Plan B projects once they leave campus. So we have piloted a new Plan B Support Seminar to help them through the process. We’ve also developed clearer Plan B guidelines and instituted faculty orientations for those serving on SMTC graduate committees. The first round of this approach has been very successful and we expect to see an increase in peer referrals into the program.

The recent push to increase the Ph.D. program enrollment in Mathematics Education and Science Education is reducing the graduate assistantships available for recruiting TSS students. We have sought additional funding from donors to support the program and have succeed in securing an additional \$25,000 in scholarship support for the coming year. We have explored the possibility of moving the SMTC graduate programs to online programs that serve the Rocky Mountain West but the proposed changes in the Outreach tuition rates for non-resident students makes that less likely now. The new MSP Mathematics Master’s program for secondary teachers serves as a model for moving to regional programs, by moving to online platforms and developing collaborative programs with other universities. The SMTC has worked with UW

Outreach and WICHE ICE to explore options for a science program for secondary teachers but there's no progress to report this year.

Although the PhD programs in science and mathematics education reside in the College of Education, the SMTC has taken a strong role in expanding the Ph.D. programs by assisting in developing the program, recruiting students, and securing assistantships and part-time employment for PhD students through grants and projects. Increasing the enrollment in these Ph.D. programs benefits the SMTC by providing additional graduate students who can work on and contribute to SMTC professional development projects. Eleven graduate students received full or partial funding through SMTC grants and contracts this last year.

Student recruitment is conducted through the SMTC Website, the SMTC list serve, presentations at state conferences, visits to schools, phone calls to individual teachers and administrators and word of mouth by satisfied teachers and graduate students. Use of social media and incentives to reward peer-to-peer recruitment are being expanded. The SMTC actively recruits TSS graduate students through a face-to-face recruitment visit to Jackson in October followed by an invitation to visit campus.

Section 7. Development activities and public relations.

Development: Development activities include the following:

- **Readiness:** The SMTC researches grant opportunities with STEM education components within NSF and the Department of Education, and shares potential funding opportunities with departments across campus.
- **Identification:** done through the UW Foundation, we currently have two primary donors; future action is to construct a list of donors/foundations interested in STEM education.
- **Qualification:** all potential donors are run through the Foundation and the college contacts.
- **Cultivation:** in conjunction with our Foundation officer and TSS we have met with our primary donor for the TSS graduate program (MS NS NED), provided him with more extensive information on the impact of his gifts and are planning additional events this year. He committed an additional \$25,000 in scholarships for the coming year to support the increased number of graduate students enrolling at UW this year.
- **Solicitation:** on-line giving link on the SMTC website and brochures for the SMTC and its programs; will conduct visits to current donors again next year.
- **Stewardship:** all recipients of scholarships are required to write a thank you letter before receiving the funds; letters and phone calls with existing donors. One of our major donors was featured in the Foundation magazine this year.
- **Leadership:** the Director of the SMTC takes the leadership role in fund raising
- **Teamwork:** The SMTC collaborates with UW departments in submitting grant proposals.

Public Relations: The SMTC disseminates information about projects and opportunities through its webpage, brochures, presentations at state meetings, and e-mail alerts sent to K-12 contacts throughout the state. Other public relation events include:

- **Speakers:** The SMTC through MSP grant funding hosted conferences featuring Richard Duschl in August and Jay McTighe in September, 2011, two nationally known educators. Faculty, school administrators and teachers from throughout WY participated in these events.

- Newsletter: electronic newsletter distributed at least once a month and periodic announcements and updates are sent out via the list-serve.
- Website: provides project information, graduate program information including on-line applications, affiliated programs, opportunities for teachers and students, and an on-line teacher resource center. The website is in UW format allowing updates to be done by the SMTC Office Associate with the assistance of University Public Relations. Because of turnover in office staff in the last year, much work needs to be done to bring the website up to date and use its capacity more effectively. The SMTC Facebook page receives more visits than the website at this point.
- Annual reception for the WY Science Teachers Association during the State Science Fair.
- Annual picnic for the SMTC master's students, affiliate faculty, and Advisory Board.
- Sponsored events including: the NASA Women in Science Conference, the Biology and Mathematics State Articulation Meetings, the Wyoming Math and Science Teachers Conference, the WY State Science Fair, and the Shepard Symposium on Social Justice

Section 8. Classified and Professional Staffing: The current success in securing grants and growing enrollment in graduate programs would not have been possible without the dedicated efforts of a highly effective SMTC team. The new Science Outreach Educator who joined the SMTC this year greatly increased the capacity of the SMTC in pursuing grants and offering professional development for teachers. In addition, the full time Science Fair Coordinator position increased the quality of operations of the 2012 science fair. We anticipate that a permanently funded $\frac{3}{4}$ time Science Fair Coordinator will lead to better science fair projects, involvement by more students and teachers, and ultimately greater interest by K-12 students in STEM disciplines. Turnover in classified and part-time staffing during the last year made apparent the need for more cross-training and better documentation of responsibilities and procedures. The lack of knowledgeable staff and the loss of an experienced director plus the extra load of supporting a national search caused some work to fall by the wayside this year including the maintenance of a topnotch website and quality communications with the public. Steps are being taken to address them and more will be done in the coming year.

Section 9. Diversity: A search was successfully conducted this year to fill the SMTC Director position. Extensive efforts were made to recruit underrepresented groups into the pool and an African American woman has been hired. Graduate students for MS NS programs are recruited from existing teacher populations and TSS students, both of which have limited ethnic diversity but considerable economic diversity. SMTC is strongly committed to diversity and social justice and actively participates in initiatives that will increase opportunities in STEM for all. The interim director serves on the UW Strategic Diversity Initiatives Committee and the Marketing subgroup. The SMTC is currently working with Nell Russell and the newly created partnership with four HBCUs to improve minority recruiting efforts. The SMTC participated in a visit to Hampton University, an HBCU, and will host visitors on a return visit here this summer.

Section 10. Assessment of Student Learning: The SMTC has no undergraduate programs. Summer 2008 a pilot assessment program was implemented for the MS NS graduate programs, excluding the MS NS TSS program and has been modified since then. The MST program was not evaluated due to low enrollments. The new MST program for secondary mathematics education is assessed as part of evaluation for the NSF grant funding the program.

1. Identify **each undergraduate and graduate program** within your department, select the tier that best describes the current state of assessment for the program, provide an explanation of how you arrived at this particular conclusion and/or evidence to support your conclusion.

Master of Science in Natural Science (MS NS) programs

- Middle School Science (MS NS MSC)
Tier 2: Over the last five years the SMTC has worked to establish a vision and plan for assessment. After three years of piloting nationally-normed evaluation instruments to assess student learning we have abandoned that avenue since the assessments did not align well with the content of our courses. In response to student feedback we worked with the faculty teaching in our program this summer to develop more integrated content, instruction and means of assessment. Faculty will debrief after this summer's offerings and make recommendations for future changes to the SMTC Advisory Board in the fall.
- Middle School Mathematics (MS NS MMA)
Tier 2: The assessment program for this program parallels that of the MS NS MSC.
- Teton Science School (MS NS NED)
Tier 3: This program has small numbers and is a collection of courses from both TSS and UW. We conduct exit interviews with students and use the feedback to make changes in the program and improve services. We are coordinating with the TSS to collect more and better feedback from graduates of the program.

Master of Science in Teaching (MST) for secondary STEM teachers

- MST On Campus Program
Tier 3: This program has only 1 or 2 students a year and allows students to construct their own programs using existing courses with only minimal requirements for number of STEM content courses and education courses. This makes the program very difficult to assess and has not been a high priority.
- Mathematics TLC Master's for Secondary Mathematics Teachers
Tier 1: This program is in its fourth year. It is funded by an NSF grant and there is an entire research and project evaluation component dedicated to program assessment which is focused on using the findings to impact course and program development. Thus the program has multiple forms of direct and indirect data; careful analyses of results are shared with program constituencies and reviewers outside the program; assessment is a significant part of the program culture and is clearly documented. We anticipate that the assessment instruments that have been developed through the grant will be further refined this next year and enjoy continued use beyond grant funding after 2013.

2. What does your department need in terms of assistance over the next two years to develop more mature and successful assessment processes?
The SMTC actually knows a great deal about program evaluation and assessment of students. We have just been short on personnel to plan and implement better and more systematic assessment practices. We participated in assessment symposia and would be interested in one-on-one consultation to move forward. The SMTC plan is to distribute assessment responsibility for the MS NS MSC program to the new Science Outreach Educator, and the MS NS MMA to the new director of the SMTC who is a Mathematics Educator. The Coordinator will continue to work with UNC on the MST program and on the TSS/NED program. All three programs should be brought up to Tier 1 in the next two years.