

**College of Arts and Sciences and College of Education
Deans' Program Review Memorandum**

DATE: September 13, 2016

TO: Dr. Kate Miller, Provost

FROM: Paula M. Lutz, Dean, College of Arts and Sciences
D. Ray Reutzler, Dean, College of Education

RE: Science Math Teaching Center (SMTC)

After reviewing the data presented in the Program Review Report forwarded to our offices on September 8th, 2016 and as per University regulation, we are providing you a memorandum of recommendation related to the above named program under joint review in the College of Arts and Sciences and College of Education. The Science Math Teaching Center (SMTC) housed on the UW Laramie campus has had a long and distinguished history of collaboration between two colleges, research and grant productivity, statewide service and engagement, graduate degree production, and leadership in policy and practice in math and science education nationally. Given this long and distinguished record, one might be prompted to ask why this program has come under academic program review, and rightfully so. For nearly fifty years, the SMTC has been nurtured by scores of visionary academics, who labored to bring into existence a center where the content fields of math and the life, earth, and physical sciences could engage productively with math and science educators to meet the needs of P-16 mathematics and science educators in the state of Wyoming and beyond. For many decades the SMTC enjoyed a national reputation attracting graduate students from across the U.S. to its programs and research projects. However, in the most recent decade, the SMTC has been in a gradual, sustained, and marked descent in terms of its research productivity, internal and external human relationships, national and state reputation and alignment of mission with the broader field of STEM education.

The SMTC at UW is dependent upon a core of strong leadership that promotes collaboration between and among internal office staff and among a group of affiliate faculty members from the Colleges of Arts and Sciences and Education. The program has graduated 78 master's degree students in the past 5 years in three graduate degree programs: Middle level science, Middle level math and Natural science education. Graduates acquire a wealth of knowledge and competencies in this program that are transferrable not only to classroom teaching but also to leadership roles in math and science education within Wyoming, regionally, and nationally. These same graduates

can, upon appropriate application, receive professional licensure endorsements through the Wyoming Professional Standards Teaching Board (PTSB) for mathematics and science education. Consequently, the degree programs housed in the SMTC are valuable assets to the Colleges of Arts and Sciences and Education. The SMTC also has an endowment of 1.3 million dollars and has generated over 10 million in external funding in the past six years. Consequently, using these indicators one would be convinced that the only rational recommendation would be to continue the SMTC and its programs well into the future.

The problems, however, with the SMTC aren't to be found in these surface level productivity statistics. Instead, the problems with the SMTC are composed of an inter-related set of internal issues that have led us to reconsider, even re-conceptualize, the potential of the SMTC if it were to be shuttered, reconfigured with a new and broader university role in STEM education, and integrated with three of the university's current initiatives, Science, Engineering, and Education. We cite three reasons why the SMTC as it now stands should be eliminated and slated for updating, re-visioning, and re-establishment as a university-wide P-16 STEM EDUCATION Center at UW.

The first reason for closing the SMTC is linked to highly dysfunctional relationships among personnel in and affiliated with the SMTC. The once vibrant relationships between the two colleges have all but evaporated. The SMTC has played little or no role in the university's Science Initiative. Negative relationships between the past leadership, staff, and affiliate faculty have necessitated multiple interventions from outside consultants, university administrators, and faculty conciliators to ameliorate the destructive and unhealthy human relationships manifested over time in this organization.

Second, there has been a decreasing number of affiliate faculty members who choose to run their grant applications or currently funded projects through the auspices of the SMTC. This substantiates the erosion of confidence and participation in the SMTC. Not only has the SMTC become known for its lack of capacity and basic expertise in grant administration, but also for its high turnover in SMTC staff, which has only exacerbated the SMTC's already sagging reputation.

Last, but not least, SMTC's mission lacks alignment with more current conceptualizations of science and mathematics education within the broader field of STEM or STEAM disciplines on and beyond the university campus. THE SMTC has failed to provide the necessary intellectual leadership across the university to modernize its mission and connect the disparate bits and pieces of faculty and staff interests in STEM disciplines into a broader university-based STEM focus. Furthermore, having failed to connect to the larger focus of STEM and provide university leadership in STEM related

interests on the campus, both the SMTC and the university have failed to build a coherent STEM organization on the campus that is prepared with the capacity to compete for large NSF, Department of Education, NIH, and other broader impact grants. This limits the amount of potential external funding available for research in STEM disciplines and in STEM education on the UW campus.

We believe that the original intent of the SMTC was to be a grant supported entity on the UW campus and not a state funded entity. Over time, financial support evolved to include a small amount of state funding to continue SMTC's functions in lean times and then expanded when additional duties were added. The Wyoming State Science Fair has become entangled with the SMTC for example. This is a major state-funded element for the SMTC and the event is immensely popular in Wyoming. We, however, ask why this state function is not found more reasonably within the purview of the Wyoming Department of Education (WDE) rather than in the SMTC at the University of Wyoming. Since this is primarily a P-12 endeavor, its placement in a university research, development, and service center is at the very least debatable. Although we vigorously support the need for a statewide science fair, we raise the question as to the rationale for the locus of control for this state function to be at UW rather than at the WDE.

The organization of the three master's degree programs into the SMTC is a somewhat aberrant organizational practice since degree programs are typically housed in academic units such as departments and colleges and not in centers, institutes or other academic units. The current masters degree programs offered in the SMTC, although productive, can be given departmental academic homes within current or even revised university college and departmental structures. As a result, the argument that the SMTC needs to continue in its current form to support existing graduate degree programs is also questionable.

Taken together, these subtle but important internal factors we have noted here, which are unrelated to the surface level statistics of program productivity, argue that the SMTC is in need of major transformation if not a complete overhaul of mission, personnel, physical location, etc. This realization is not to impugn the many past achievements of the SMTC leadership, faculty or staff—quite the contrary. **We believe the spirit and past functions of the SMTC should be retained, enhanced, and coalesced into a cogently designed university center or institute focused on P-16 STEM Education.** Consequently, we support immediate exploration by the Provost's Office into how the work of the three current university initiatives, Science, Engineering and Education, could be combined with the past work of the SMTC and its supporters, as well as other groups such as WYSTEM, to support a **University P-16 STEM Education Center**. This would allow UW to seek and obtain broader impact grants and contracts in STEM disciplines and to support improved STEM instruction within the P-16 educational community.

Consequently, after serious deliberation, it is our recommendation that the Science Math Teaching Center (SMTC) be eliminated at the University of Wyoming. As difficult as this decision is, it has been one that has been needed for several years now and will afford the University an opportunity to consciously design a vibrant new focus on P-16 STEM Education that involves and connects the many STEM interests on the UW campus and those of the P-16 educational community.

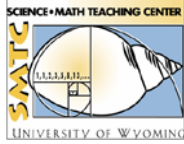
Sincerely yours,



Paula M. Lutz
Dean
College of Arts and Sciences



D. Ray Reutzel
Dean
College of Education



Academic Program and Unit Review
Science and Mathematics Teaching Center
University of Wyoming

Executive Summary

Background	The Science and Mathematics Teaching Center was established to provide high quality professional development for Wyoming teachers in 1970 by a group of scientists concerned about the quality of K-12 education. As a collaboration between the College of Arts and Sciences and the College of Education, SMTC currently offers three master's degree programs, engages in outreach throughout Wyoming, collaborates with faculty to expand their broader impacts by providing professional development to teachers, conducts research with external funding and coordinates the Wyoming State Science Fair.
Program Productivity	78 graduate students completed their degrees between 2011 and 2016 in SMTC graduate programs: Middle level Science - MSC (24), Middle level Math – MMA (15) and Natural Science Education – NED (39).
Program Quality & Reputation	SMTC graduate programs are well-known and highly regarded. The SMTC is often contacted as a reliable source on education-related issues. Students benefit greatly from the collaborative nature of the programs and frequently comment that their courses through the SMTC are the best that they've ever had.
Mission Centrality	In addition to serving STEM teachers by offering master's degree programs designed to fit their work schedules, SMTC engages in outreach efforts by providing professional development to Wyoming primarily through grant-funded outreach in collaboration with UW faculty. SMTC also puts on the Wyoming State Science Fair which brings more than 300 students and many teachers to campus each March. The event links teachers and students from throughout the West -- UW faculty too!
Financial Viability	Current endowments are valued at \$1,303,280 (not including gift annuities); between 2010-2016, \$308,988 in scholarships were awarded to 275 ¹ recipients in SMTC programs providing significant support and incentives for enrollment in the programs. Since 2010, External grant funding: \$9,863,020 ² ; Internal UW awards: \$69,792; and Contracts/Service Agreements:\$434,972. The SMTC receives only a small amount of state funds and the unit as a whole operates on very limited resources.

¹ Data provided by UW Foundation, 8/26/16, does not identify individual recipients; students in the MSC and MMA programs receive multiple scholarships throughout the program.

² Data provided by the UW Research Office, 9/2/16.

Academic Program and Unit Review
 Science and Mathematics Teaching Center
 University of Wyoming

Title of Program/Specialization:

Master of Science in Natural Science with concentrations in:

- Middle-level Science Teaching (MSC)
- Middle-level Mathematics Teaching (MMA)
- Natural Science Education (NED)

Master of Science Teaching – Mathematics (MST – Math) – discontinued when grant funding ended in 2015.

Indicate whether undergraduate or graduate program/specialization:

Graduate

Department and College:

Science and Mathematics Teaching Center, College of Education and College of Arts and Sciences

Department contact information (phone, email):

Sylvia Parker, Coordinator, 766-6671, sparker@uwyo.edu

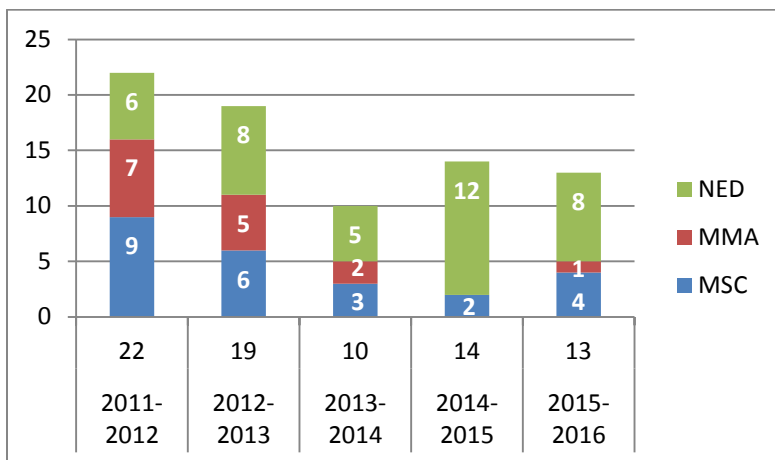
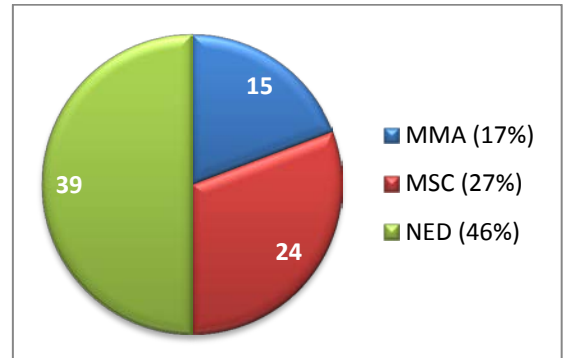
Part 1 – Program Review

1. Program Productivity/Demand:

a. 78 graduates over 5-year period³ (2011-2016):

- Middle-level Science Teaching (24)
- Middle-level Mathematics Teaching (15)
- Natural Science Education (39)

This chart represents the percentage of graduates from each program out of our total of 78 graduates. 46% (n=39) were from the NED program with Teton Science Schools, indicating this partnership has yielded excellent results.



This graph on the left shows the number of students who graduated from the three SMTC graduate programs each year over the past 5 years. On average, 16 students were graduated per year over this time period.

³ Report from UW Institutional Analysis, 8/24/16

- b. Enrollment in MS in Natural Science concentrations over the 5-year period averaged:
 - Middle level Science Teaching (14/yr)
 - Middle level Mathematics Teaching (11/yr)
 - Natural Science Education (9/yr)

- c. Opportunity: The demand for teachers in math and science remains high and the expectation that teachers need to improve their practice and impact is growing even higher. Science, Technology, Engineering and Math (STEM) education is a great example of an area where there is a growing demand for teachers. According to the Wyoming Department of Education⁴ there are 595 science and math teachers in Wyoming middle schools and high schools without master's degrees. In addition there are many elementary teachers who are interested in becoming certified to teach middle school. The course work in the SMTC middle level math and science programs meets the requirements of the Professional Teaching Standards Board (PTSB) for middle level endorsements and the federal definition of "highly qualified" to teach grades 5-9 thus opening employment opportunities for both elementary and high school teachers since many Wyoming schools are K-8 or 8-12. The master's programs in middle-level science and math are the only content-rich programs designed specifically for working teachers in Wyoming; generous financial support helps them decide to enroll in the program; a bump in salary when the degree is completed increases motivation too.

2. Program Quality: Is the program of high quality?

- a. Program accreditation
 - i. The MMA and MSC programs prepared for the National Council for Accreditation of Teacher Education (NCATE) accreditation review that was conducted in the College of Education in 2015. However, that cycle of reviews was focused on undergraduate programs rather than graduate programs. The two SMTC programs were referred back for evaluation to the Wyoming Professional Teaching Standards Board (PTSB), the organization that had previously evaluated both programs and recognized them. The PTSB uses nearly identical criteria as NCATE. Paperwork was revised and submitted and the MMA was accredited during AY 2015-16; the MSC program has been submitted for accreditation this year (FA16).
 - ii. There is no specific accreditation for the NED program through NCATE.
 - iii. The SMTC programs have not had previous Academic Program Reviews (APR)

- b. Credentials of faculty
 - i. Faculty. The SMTC has only two tenured or tenure track faculty and one Senior APL (extended term). The coordinator of the Wyoming State Science Fair (WSSF) is in a Temporary Assistant Lecturer position.

⁴ Report and mailing list from WDE to the SMTC on 11/16/15

Faculty	Highest Degree	Discipline of Highest Degree	Gender	Ethnicity
Jacqueline Leonard ⁵	PhD	Mathematics Education	F	African American
Ana Houseal	PhD	Secondary & Continuing Education – Science Educ	F	White
Sylvia Parker	MA	Technology in Education	F	White
Erin Stoesz	MS	Geology and Celtic Studies	F	White

- ii. 93 Affiliate Faculty members in the Colleges of Agriculture (5), A&S (37), Education (21), Engineering (5), Other UW (7), Community Colleges (3), and Emeritus (15). Affiliates assist with reviewing applications, teaching classes, mentoring students, serving on graduate committees, collaborating on grant-funded projects and providing professional development to teachers.
- iii. Grants awarded to academic personnel and/or managed by SMTC since 2010 (see Appendix)
 - External grant funding: \$9,863,020
 - Internal UW awards: \$69,792
 - Contracts/Service Agreements: \$434,972
- iv. Publications/presentations by academic personnel 2011-2016
 - Jacqueline Leonard, Professor: 13 Journals, 1 article, 5 chapters, 1 book; 36 presentations, 3 proceedings
 - Ana Houseal, Assistant Professor: 5 Journals, 2 articles, 3 reports, 2 curricula; 32 presentations
 - Sylvia Parker, Senior APL (extended term), 3 papers, 25 presentations
- c. Program reputation
 - i. The SMTC programs are not ranked. Information about their reputation is largely anecdotal. Many teacher leaders in the state are graduates; graduates refer their friends and colleagues. Those who are in the program are fiercely loyal.
- d. Curriculum of the Concentrations in the Natural Science Major

Middle Level Science (MSC)		Credits
Summer 1	NASC 5120 Earth Science in a Global Context	3
	ASTR 4000 Astronomy for Teachers	2
	NASC 5300 Natural Science Assessment	2
	NASC 5400 Spatial Data and Instructional Technology	1
Summer 2	NASC 5130 Life Science in Global Context	3
	ENTO 5601 Insects for Teachers	1
	SOC 4890 Global Populations & Environments	1
	NASC 5320 Science, Technology and Society & Plan B Research	2
	BOT 4790 Field Techniques	1

⁵ Dr. Leonard joined the SMTC as Director in the fall of 2012 and resigned on 7/31/16; her work is included in this report.

Summer 3	NASC 5110 Physical Science in Global Context	3
	NASC 5600 Math & Stats in Science Teaching	2
	NASC 5510 Integrated Instructional Strategies	2
	EE 4800 Energy Policies and Impacts	1
+ 6 additional credits for a total of 30 + a Plan B non-thesis		
Middle Level Mathematics (MMA)		
MATH 5160*	Social and Historical Issues	3
NASC 5205*	Methods for Teaching Middle Level Math	3
NASC 5170	Connecting Geometry	3
NASC 5225	Assessment for Middle-level Math	3
MATH 5190*	Mathematics of Change	3
MATH 5140*	Numbers and Operations	3
NASC 5215	Technology	3
NASC 5185	Analysis of Data	3
+ 6 additional credits for a total of 30 + a Plan B non-thesis		
*Taught online during the school year		
Natural Science Education (NED)		
ZOO 5430**	Ecology of Yellowstone Ecosystem	3
ZOO 5420**	Ecological Inquiry	3
NASC 5610**	Field Studies: Environmental Education	4
NASC 5620**	Field Ecology	5
NASC 5650	Place-based Learning	3
Graduate level	Research Class	3
+ 9 additional credits for a total of 30 + a Plan B non-thesis		
**Taught at the Teton Science Schools by UW Adjunct faculty during the school yr		

- e. Distance delivery of programs/major
- i. The MMA program is designed to serve the work schedule of teachers and enable them to complete the course work in two years. Six credits are offered in Laramie for 3 weeks in June each summer and a 3-credit synchronous course is offered online each fall and spring usually on Tuesday evenings.
 - ii. The MSC program requires more hands-on experiences and coursework is designed to be completed in three summers (4 weeks, on campus in June). Electives may be taken online.
 - iii. The NED program is offered in conjunction with the Teton Science Schools in Jackson. Students are admitted as UW students, take classes and work in field science education in the graduate program in year 1 in Jackson (classes are taught through the Outreach School by adjunct faculty and transcribed at UW). Those students who choose (and meet requirements) may come to UW on campus for the second year of the program to complete their master's degree.
 - iv. Most students complete their coursework, electives and Plan B projects within the established cohort program, but some find it challenging to finish their Plan B when they are working fulltime. The SMTC Outreach Educator created a 4-credit course offered each fall to provide the structure and skills to SMTC graduate students to design and complete their Plan B projects. It is an online synchronous course through

Outreach although some participants who live in the area choose to attend in person. Two intensive weekends conducted face-to-face enable students to form a professional learning community in which they plan, share, provide feedback and mentor each other establishing relationships across the state and across programs. Completion rates have increased dramatically since this course was implemented.

f. Quality of Assessment Plan/data

- i. The SMTC has a strong commitment to both assessment and evaluation. SMTC faculty members have extensive knowledge, skills and experience in this area and teach teachers how to do effective assessments. The SMTC has common student learning goals for all three of our programs.

SMTC Student Learner Outcomes

Upon successful completion of the MS NS program, a student will be able to:

- Engage in teacher research to transform STEM instruction:
 - Design and implement a research project that asks and answers a question using appropriate materials, concepts and methods, and ethical practices, and
 - Effectively communicate all aspects of the research project in both oral and written forms.
 - Use professional and academic standards to ensure high-quality interdisciplinary instruction (i.e., place-based, culturally relevant, and/or social justice pedagogy) to maximize student learning.
 - Engage in mathematical and/or scientific discourse and scientific thinking as active participants in communities of practice.
 - Use emerging technology and science investigations as tools to engage students.
- ii. The three MS Natural Science graduate programs are at assessment Tier 2 status. We will proceed in the coming year with the next steps in the SMTC Student Outcomes 5 Year Assessment Plan (2014-2019) asking a research question on which we will gather data and answer a question. Faculty who teach in the MMA and MSC programs meet together each year to plan the upcoming courses including the content, activities, assignments and a common performance assessment making sure that there are direct assessments of each standard required for accreditation. Data are being used to improve the programs but not yet for summative purposes that would move them to a Tier 1. The rubric and process developed for assessment of the research outcome in all SMTC programs is being modified by other departments for use in their programs. The rubric is distributed to all incoming graduate students and to their committee members so they are aware of the expectations from the beginning. Focus groups are held each summer by an interviewer from outside the SMTC and the anonymous comments also feed into the continuous improvement process.

g. Strategic Plan

- i. The SMTC developed a draft strategic plan related to UP4 in 2013-14. The SMTC as a unit is well-aligned with and continues to make progress in University Areas of Distinction including STEM; Energy; Environment, Agriculture and Natural Resources; and Education. Progress is reported here on three action items.

- Action Item 1: Maintain distinction in fields serving the State's critical needs in STEM and STEM education
 - *Maintain quality graduate programs*: implemented continuous improvement plan; modified courses and assessments; added a course and support group to enable students to complete their degrees; increased expectations and standardization of Plan B projects; published all Plan B papers on WY Scholars Repository (WySR) through which students reach an international audience.
 - *Provide professional development (and follow up support) to teachers related to STEM*: primarily achieved through grant-funded work such as the Engineering Initiative through which we worked with Electrical Engineering to conduct workshops with 65+ teachers this summer; a graduate student in the NED program will provide follow-up support to the teachers in this school year along with undergraduate engineering students. NOTE: **since 2011, 122 NASC professional development offerings have reached 1,393 students and generated 2,581 credits.** Almost no state funds are used to serve educators throughout the state this way.
 - *Increase the number and quality of STEM teachers in the state*: obtained a Noyce Scholarship grant from NSF to enable underrepresented and first generation college students majoring in STEM fields to also get elementary teaching certification.
 - *Expose underrepresented students, females, students with disabilities and minorities to pre-engineering skills*: obtained ITEST grant from NSF to provide opportunities for students to increase their interests in engineering through gaming and robotics, in order to create a diverse ICT/STEM workforce.
 - *Provide leadership in the development and implementation of Wyoming Science Standards*: served on State Standards Committee; obtained service agreements to provide professional development to districts on how to modify curriculum and instruction to meet the standards; added components to graduate classes and graduate committee advising to assure understanding and use of new standards; engaged in public outreach (PBS, WPR, Ed Week and others).
- Action Item 2: Enhance Educational Effectiveness and Cross-Discipline Integration
 - *Develop a capstone course* as an alternative to the Plan B requirement: a course has been developed and piloted and a CARF is being prepared for submission.
 - *Develop new and creative recruitment efforts* to reach teachers inside and outside of Wyoming and increase diversity: efforts have begun with initial funding from Academic Affairs but continued effort and a long-term plan in conjunction with other UW entities are needed.
 - *Develop certificate programs* to meet needs of teachers and schools (i.e., Teaching STEM, Incorporating Engineering and Design, Implementing the New Science Standards, Elementary Mathematics, Place-based Learning, Education for Sustainable Development): it will be necessary to

work with the College of Education to develop and offer any of these programs.

- *Develop interdisciplinary courses and collaborate with faculty in other departments:* the MS programs in Natural Science are interdisciplinary and we will renew our commitment to make sure that courses are taught by faculty from the designated department to ensure content-rich instruction.
- Action Item 3: Create New Research Opportunities
 - *Collaborate with and support the work of others engaged in STEM:* The SMTC collaborates with faculty throughout the university on Broader Impacts by helping them conceptualize timely and appropriate approaches for impacting broader audiences with their research work; assisting them in writing and budgeting for their proposals; writing letters of support/commitment; finding partners and recruiting participants; collaborating to develop and deliver professional development to teachers and programs to other audiences; assisting with evaluation and assessment; publishing articles together and publicizing efforts; making joint presentations. We also invite faculty from other departments to collaborate on projects the SMTC is proposing. Recent interactions have been with faculty in the following departments: Molecular Biology, Philosophy, Secondary Education, Literacy Education, Math, Computer Science, Botany, Mechanical Engineering, Electrical Engineering; and the College of Agriculture, College of Engineering, the Biodiversity Institute, WSGS, and SER.

3. Mission Centrality: Does the program advance the mission of UW including institutional strategy?

- a. The SMTC plays a distinct role at UW as a long-term unit committed to interdisciplinary collaborations that support the teaching and learning of science and mathematics, and more recently engineering, technology and the arts. Supported by both the Colleges of Education and Arts and Science, the SMTC plays a leadership role in providing high quality, timely professional development that is research-based and culturally relevant to teachers in Wyoming and across the western United States. That means that the SMTC does not engage in one-shot workshops but works to provide professional development and ongoing follow up support increasing the likelihood of successful implementation. SMTC is both a resource center for educators and a center for developing projects and grant proposals to fund collaborations between K-12 schools, the Wyoming Department of Education, community colleges and University of Wyoming faculty. The SMTC offers master's degree programs to experienced teachers; facilitates collaborations on campus and around the state with organizations such as the WY After School Alliance, the Wyoming Environmental Education Association, and the Teton Science Schools. The SMTC is a national leader in place-based education, culturally relevant pedagogy, and increasing diversity in mathematics education.
- b. Describe how the program contributes to other programs across campus. The SMTC works hard to build relationships within UW: we jointly sponsor and/or participate in planning and conducting events such as the SciArt Symposium this week with the Art

Museum, Biodiversity Institute, the Haub School, and the Visual Arts Department; the Saturday STEM Days and Women in Science with WY STEM and the NASA Space grant. We sponsor speakers and invite the entire campus and local educators (a good example is Chris Emden, a well-known science educator at Columbia University who uses hip hop to get kids to love science). We sit on boards and committees such as the NASA Space Grant Advisory Board, the Biodiversity Institute's Faculty Advisory Committee, the Committee on Women and People of Color, the Haub School's Innovation Grants selection committee. We are actively involved with WY STEM, the Engineering Initiative and SER. We show up, participate, collaborate and support the work of faculty and their students. We place graduate students with faculty and programs across campus and build relationships through them.

- c. The SMTC also conducts research – on effective practices in education; learning progressions; effective professional development for teachers; culturally relevant place-based education; and diversity especially as related to STEM areas. We have a special interest in collaborations, partnerships and relationships with community. We share our research and that of our students through publications, presentations, social media and the Wyoming Scholars Repository. We collaborate on major research projects both within UW and with other partners around the country.
- d. An informal survey of graduates of the NED program brought to our attention that all but 4 of the 39 graduates are gainfully employed in areas related to their degree. Three of the four are new mothers and one had no forwarding information. All of the students in the MSC and MMA programs are employed teachers so few of them change jobs although some take on leadership roles within their districts.
- e. The SMTC programs are unique at UW. The synergy between the academic programs, the outreach efforts, relationships with faculty and other UW interdisciplinary programs, and institutional support should not be underestimated. For example, last year a graduate student in the NED program worked as a halftime graduate assistant in the Biodiversity Institute. At their request, she developed a curricular unit on Sage Grouse ecosystems and piloted it in a fifth grade class in Baggs with a teacher in our MSC graduate program. Working with scientists (who are also SMTC affiliate faculty members) at the Berry Center to incorporate accurate science content, the graduate student based the unit on solid academic research she was doing for her Plan B project and grounded the activities in place-based education (an emphasis in the SMTC). Furthermore, our emphasis on social justice and her personal commitments from teaching in Latin America in the Peace Corps prompted her to minor in teaching English language learners (ELL). She incorporated ELL teaching principles in the unit in order to better serve all students and invited her ELL professor to serve on her graduate committee. Working closely with the Baggs teacher to make sure the unit addressed important science standards and that it was appropriate for 5th graders in her community, the graduate student also received valuable feedback from her during the pilot enabling her to revise, improve and finalize it before making it available to all teachers in Wyoming through the Biodiversity Institute. Her plan B paper and the curriculum (with a link from the Berry Center) reside on the UW libraries WySR site and have been downloaded 41 times since July. The impact of this graduate student's work extends well beyond a

single classroom. She has a full-time job teaching in Wyoming this fall. This single case study exemplifies the experience of many SMTC graduate students.

4. **Cost: Is the program financially viable?**

a. Ratio of student credit hours per FTE

The total program FTE is based on the assigned teaching load for the 3 SMTC faculty (Leonard: 25%; Houseal: 40%; and Parker: 30%).

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Total
Grad	589	844	713	877	698	751	4472
PD 5959 ⁶	553	495	429	311	360	433	2581
Total	1142	1339	1142	1188	1058	1184	7053
FTE	.95	.95	.95	.95	.95	.95	
Credit Hrs/FTE	1202	1409	1202	1114	1114	1246	Average 1214.5

b. Direct instructional expenditures:

- i. The state support budget does not include faculty pay; expenditures are not tracked to specific programs or individuals. SMTC faculty typically teach NASC courses on-load and receive no extra pay. Faculty from other departments who teach courses for SMTC students particularly during the summer are paid as instructors. This table shows the income as well as summer school and course fee inputs.

Year	State support budget*	Summer School & Course Fees	Summer Salaries Faculty Teaching
2010	\$11,403	\$29,472	\$21,224
2011	\$10,833	30,530	12,611
2012	\$11,403	25,594	14,123
2013	\$15,000	No distribution from College of Ed	17,639
2014	\$15,168	29,818	9,750
2015	\$14,423	14,149	11,100

*Does not include \$75,000 provided for WSSF Coordinator and fair or for faculty and support staff

c. Course enrollment

- i. Because the MMA and MSC programs each include 24 credits of mandatory courses that are offered on a rotating basis, it is our responsibility to offer the courses even if there is low enrollment so students don't have to wait 2 or 3 years until those particular classes are offered again. The only courses that appear to be under-enrolled are NASC 5959 professional development workshops – some participants might sign up for PTSB credit or none at all. A workshop might have 15 participants but if only 4 decided to take it for credit that class would show up on the report with an enrollment of only 4. All of our classes required for the degrees appear to have adequate enrollment numbers.

d. Other instructional cost drivers, N/A

⁶ NASC 5959 courses provide professional development for teachers. They are recorded on UW transcripts to indicate successful participation but can't be used towards a graduate degree. Instructors are not paid by UW but are typically covered by grants. SMTC reached 1393 teachers through 122 offerings between 2011 and 2016.

Appendix

External Grants awarded to SMTC faculty and/or managed by SMTC since 2010

Sponsor	Faculty PI	Co-PI	Total \$ Award	Award Period	Title of Grant Project
Inst for Global Environmental Strategies	Slater, Timothy		\$24,000	2008-2010	An Online Earth System Science Teacher Education Program at the University of Wyoming
NSF: EPSCoR	Leonard, Jacqueline (change to Sylvia Parker)		\$136,500	2012-2017	EPSCoR Subaward to SMTC for Assessment/Evaluation related to WY Water in the Classroom
NSF: Geosciences	Leonard, Jacqueline		\$149,962	2012-2014	Dinosaurs, Denver and Climate Change (D2C2): an ECO-Opportunity Project
NSF: ITEST	Leonard, Jacqueline	Slater, Tim; Hamann, Jerry; Jafari, Farhad	\$1,199,963	2013-2017	Visualization Basics: Using Gaming to Improve Computational Thinking (UGame-ICompute) Including Participant Support
NSF: Noyce	Burrows, Andrea	Dale, Daniel; Slater, Tim; Jafari, Farhad	\$1,186,365	2014-2018	Sustaining Wyoming's Advancing Reach in Mathematics and Science (SWARMS)
NSF: Noyce	Leonard, Jacqueline	Chamberlin, Scott; Chamberlin, Michelle; Clementz, Mark; Aryana, Saman	\$1,449,116	2014-2019	Collaborative Research: Wyoming Interns to Teacher Scholars (WITS) Program
NSF: MSP subaward through Colorado State University	Mayes, Robert (changed to Sylvia Parker)		\$681,113	2008-2015	Targeted Partnership: Culturally relevant ecology, learning progressions and environmental literacy (Pathways to Ecological Literacy)
NSF: MSP subaward through University of Northern Colorado	Mayes, Robert (changed to Sylvia Parker)	Shader, Bryan	\$1,187,918	2009-2015	Mathematics Teacher Leadership Center (Math TLC): A collaboration between UNC and UW to develop a virtual master's degree for secondary mathematics teachers in rural areas; also a mathematics teacher-leader program
University of California	Slater, Timothy		\$107,749	2009-2013	Advanced Mentor and Novice Teachers in Space Science
University of Illinois Urbana-Champaign	Houseal, Ana		\$62,050	2012-2014	ISGS-UW Energy Curriculum Development Project
University of North Dakota	Buss, Alan	Latchininsky, Alexandre; Sivanpillai, Ramesh	100,000	2008-2010	Development of an On-line database of K-12 Geospatial Learning Activities as a Tool for Deeper Penetration of Earth System Science into K-12 Education
University of North Dakota	Buss, Alan		\$85,009	2009-2011	EdPARC: Development of an On-line database of K-12 Geospatial Learning activities as a Tool for Deeper Penetration of Earth System

					Science into K-12 Education, Year 2
University of North Dakota	Buss, Alan	Latchininsky, Alexandre; Sivanpillai, Ramesh	\$67,982	2010-2013	EdPARC 10: Subcontract from the University of North Dakota
US Dept of Agri, NIFA: Subaward through Colorado State University to Botany to SParker	Parker, Sylvia	Tinker, Daniel; Geiger, Milton; Strauss, Sarah	\$31,722	2013-2016	Sustainable Biofuel Feedstocks from Beetle-killed Wood (BANR); professional development for teachers from WY, CO & MT
US Dept of Commerce: National Institute of Standards & Technology (NIST)	Cloud, Karen		\$20,000	2014-2015	Project Manager for Lesson Plan Development for the NIST Summer Institute for Middle School Science Teachers and Teacher Recruiter for Teachers of Native American Students for the Institute
US Dept of ED: subaward through University of CO, Denver	Leonard, Jacqueline		\$101,278	2012-2016	E-Learning Communities for Academic Language Learning in Math and Science (eCALLMS)
WY Dept of Ed, MSP	Buss, Alan		\$60,000	2000-2031	WDE Common Core of Knowledge-Science 00-01
WY Dept of Ed, MSP	Buss, Alan	Ellsworth, Judith	\$60,000	2002-2031	WDE Common Core of Knowledge-Science 02-04
WY Dept of Ed, MSP	Forrester, Jennifer	Flaherty, Elizabeth	\$397,457	2010-2012	Flooding the Fields with Problem Based Learning, Years 1 and 2
WY Dept of Ed, MSP	Hutchison, Linda		\$60,000	2000-2031	WDE Common Core of Knowledge-Math 00-01
WY Dept of Ed, MSP	Hutchison, Linda		\$60,000	2002-2031	WDE Common Core of Knowledge-Math 02-04
WY Dept of Ed, MSP	Hutchison, Linda	Hatfield, Larry; Chamberlin, Michelle	\$224,351	2010-2012	Ready to Learn Math (RTL Math)
WY Dept of Ed, MSP	Kansky, Robert		\$230,163	2009-2010	A Comprehensive Approach to Improving Mathematics Achievement in Carbon County
WY Dept of Ed, MSP	Kansky, Robert (changed to Sylvia Parker)		\$228,499	2010-2011	A Comprehensive Approach to Improving Mathematics Achievement in Carbon County
WY Dept of Ed, MSP	Mayes, Robert	Hutchison, Linda	\$231,073	2008-2009	Quantitative Reasoning in Science, Technology, Engineering and Mathematics Project (QR STEM Yr 1)
WY Dept of Ed, MSP	Mayes, Robert	Slater, Tim	\$214,408	2009-2010	Quantitative Reasoning in Science, Technology, Engineering and Mathematics Project (QR STEM Yr 2)
WY Dept of Ed,	Mayes, Robert	Myers, James; Lyford,	\$242,019	2010-	Quantitative Reasoning in Science, Technology, Engineering and

MSP		Mark		2011	Mathematics Project (QR STEM Yr 3)
WY Dept of Ed, MSP	Myers, James	Buss, Alan; Lyford, Mark; Houseal, Ana	\$234,886	2011-2013	Science for the Future: Redesigning Science Education via the Energy-Water-Climate Nexus
WY Dept of Ed, MSP	Ula, AHM Sadrul		\$173,581	2009-2010	An Engineering Approach to Science and Math Instruction
WY Dept of Ed, MSP	Ula, AHM Sadrul		\$172,771	2009-2011	An Engineering Approach to Science and Math Instruction
WY Dept of Ed, MSP	Welsh, Katherine		\$208,793	2010-2012	Place Learning and Civic Engagement - Year 1
WY Dept of Ed, MSP	Welsh, Katherine		\$230,762	2011-2013	Place Learning and Civic Engagement - Year 2
WY Dept of Ed, MSP	Welsh, Katherine		\$243,530	2012-2014	Place Learning and Civic Engagement - Year 3
TOTAL			\$9,863,020		

Internal UW Awards to SMTC faculty or managed by SMTC since 2010

Sponsor	Faculty PI	Co-PI	Total \$ Award	Award Period	Title of Project
Graduate Recruiting Initiative	Leonard, Jacqueline		\$10,000	2013-2014	Recruitment of underrepresented students to UW
Strategic Diversity Initiative	Chamberlin, Scott	Leonard, Jacqueline	\$12,840	2013-2014	
UW Presidential STEM Initiative	Leonard, Jacqueline		\$25,000	2013-2014	Tech Links
Engineering Initiative	Parker, Sylvia		\$9,952	2015-2016	Engineering Summer Program for Teachers (ESP4T) pilot and year 1; developing and conducting professional development workshops
Multiple: President's Office, International Programs, College of ED, SMTC	Parker, Sylvia	Aagard, Steve; Buss, Alan; Welsh, Katherine	\$12,000	2011	Travel to Bhutan to collaborate with the Ministry of Education and the Royal University of Bhutan on the development of M.Ed programs for teachers of science and mathematics (programs that are being implemented in 2016-17 in Bhutan)
TOTAL			\$69,792		

Contracts/Service Agreements/Awards to SMTC faculty or managed by SMTC since 2010

Sponsor	Faculty PI	Co-PI	Total \$ Award	Award Period	Title of Grant Project
Fremont Consortium (Fiscal Agent: Fremont CSD #25)	Parker, Sylvia		\$76,028	2010-2016	External evaluator of the Teacher/Leader Quality Partnership Grant from WY Dept of Education (WDE) that provides professional development for teachers and principals in Fremont County related to Language Arts and Math
Campbell CSD #1	Houseal, Ana	Buss, Alan	\$241,681	2013-2016	Implementing Next Generation Science Standards K-12, Math Science Partnership grants (4) from the WY Dept of Education (WDE)
Unita CSD #1	Houseal, Ana		\$18,640	2011-2013	Implementing Next Generation Science Standards K-12, consultant
Johnson CSD #1	Houseal, Ana		\$6,790	2013-2014	Implementing Next Generation Science Standards K-12, consultant
Sigma Aldrich	Burrows, Andrea	Leonard, Jacqueline	\$22,733	2013-2014	Save and Value Earth (SAVE)
Kinder Morgan Foundation			\$5,000		WY Energy Education
John P. Ellbogen Foundation			\$5,000		WY Energy Education
Verizon			\$4,100		Wyoming State Science Fair – outreach to teachers and students
Halliburton Foundation	Various		\$55,000	2011-2015	Wyoming State Science Fair (3 awards to support expansion of WSSF and improve student projects)
TOTAL			\$434,972		

Part II - Recommendations

Instructions: After the review is completed, the Dean in consultation with the Department Head will select one of the following recommendations. In the justification, address each of the items associated with the recommendation.

5) Terminate

- a. A college may request that a program be terminated due to limited graduate production, lack of student interest, shifts in a given field of study, or continued declines in major enrollments.
- b. If the exigency for termination results from the program productivity review process, then a brief justification to terminate a program should be included. Such a justification must include:
- c.

Explanation for the decline in graduate production in the degree program.

The SMTC houses several masters degree programs, some of which have healthy enrollments, Middle level Science and Natural Science Education, others that do not, Middle level Math. For a program or administrative unit to be considered mission central in the College of Education, the program or administrative unit must be 1) necessary to retain in order to maintain national accreditation for educator preparation programs; and 2) provide degrees and programs resulting in a state issued license, certificate, or endorsement from the Wyoming PTSB.

The SMTC, a valuable asset to the Colleges of Arts and Sciences and Education and the university, is not necessary for maintaining national accreditation, nor is it necessary to award the programs or degrees offered. Although advanced degrees currently awarded by the SMTC do qualify recipients for several PTSB endorsements to a teaching license, these degrees could be just as easily housed in other existing academic and administrative units in the Colleges of Arts and Sciences and Education.

The reasons for recommending program/unit elimination of the SMTC are not based upon graduate degree production alone. In the past five years, the SMTC has been in a sharp decline in terms of its influence, function, and reputation. The recommendation to eliminate the SMTC in its current form is based upon a combination of factors related to:

- ❖ Dysfunctional relationships among the Center's past leadership, staff, and affiliate faculty
- ❖ Decreasing participation in the essential functions of the SMTC by affiliate faculty including grant submission and administration
- ❖ An antiquated mission that isn't well connected to the University's science, engineering and education initiatives and the broader, more currently accepted, STEM educational emphasis in other colleges, universities, research institutes, and P-12 schools nationally.

Intended timeframe for submitting a program termination request to the Board of Trustees for their consideration

Given the potential elimination of the program due to the concerns previously expressed above, it is recommended that staff in the SMTC, including those associated with the Science Fair, be given FY 2017 year as a final grace year and the funding for this center be eliminated as part of

the university's overall FY 2018 budget reductions. Centers, such as the SMTC, should be self-supporting through grants and contracts funding rather than relying upon recurring state funding.

On the other hand, we do not recommend that the spirit and past functions of the SMTC be lost, quite the contrary. We believe the spirit and past functions of the SMTC should be retained and enhanced in the university. We support immediate exploration by the Provost's Office about how the work of the three current university initiatives, science, engineering and education, could be combined to support a University STEM P-16 Education Center to support seeking and obtaining broader impact grants and contracts in STEM disciplines and in the P-16 educational community.

Expected timeline to meet teach-out requirements established through the regional accrediting body.

The degree programs currently housed in the SMTC will be maintained by moving them to the most appropriately aligned university departments for future administration if the SMTC as an administrative unit is eliminated.

- d.** The College of Education will work with the College of Arts and Sciences to determine the appropriate locations for graduate degree programs currently housed in the SMTC in order to facilitate the degree progress of those students in these graduate degree programs.

APPENDIX A

“Low Productivity” Programs Excluded from Review Process

- 1) **Major Program Modifications**
 - a) Degree programs that have undergone recent program modifications that adversely impact graduate production for a college.
 - b) Modifications traditionally include programs that have undergone recent name changes during the reporting window that result in two equivalent degree programs.
- 2) **Program/Major Specializations**
 - a) Degree programs that have one or more specializations which reduce the total number of graduates.
 - b) The exclusion may apply only for those specializations where the combination results in graduate production that meets the established threshold for the degree.
- 3) **Terminated Programs**
 - a) Degree programs that have been inactivated during the reporting period, but still depict graduates that fall below the established thresholds.
 - b) Terminated programs will remain on the Program Productivity Report until inactive programs have completely cycled through the established reporting period.
- 4) **New Programs**
 - a) Degree programs that have been activated within the past 7 years resulting in limited graduate production due to program implementation.
 - b) Institutional review may be requested prior to the 7th year if graduate production is not scaling to the required thresholds for the degree level.