Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-141

Proposal Title: ESTEEM (Earth Science Teachers Environmental Education Matters)

Project Manager Information

Name: Lee Schmitt

Organization: Minnesota Science Teachers Association

Office Telephone: (952) 435-1879

Email: lee.m.schmitt@gmail.com

Project Basic Information

Project Summary: Earth Science Teachers Environmental Education Matters (ESTEEM) will provide statewide professional development for science teachers in Earth and Environmental Science content and pedagogy to strengthen environmental education in Minnesota schools.

Funds Requested: $582,000

Proposed Project Completion: 2023-08-31

LCCMR Funding Category: Environmental Education (C)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

With adoption of the new 2019 Minnesota Academic Standards in Science, all 6th grade teachers in Minnesota will now be asked to teach earth/environmental science to their students using a new phenomenon-based approach to instruction. Sixth-grade teachers are being asked to teach science subject matter in which most have little or no background. In addition, high schools will need to develop and implement new earth/environmental science courses. These high school teachers of science, especially in rural districts, will need to find graduate-level earth/environmental science courses to procure a 9-12 Earth and Space Science teaching license.

Now is the opportune time for a statewide initiative to prioritize and strengthen earth/environmental education in all our schools. Environmental education in Minnesota needs stimulus, focus and rejuvenation; teachers need earth/environmental science training; and the implementation of the new 2019 science standards provides the impetus. All the quality work and successes of LCCMR-funded programs will have little longevity if we do not develop and maintain a citizenry educated in the richness, value and fragility of Minnesota's natural resources.

The ESTEEM program will meet this challenge and enhance earth/environmental education in schools throughout Minnesota.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

Solving this urgent need for statewide professional development in Earth and Environmental Sciences for Minnesota teachers requires an experienced team of educators and scientists. Organized and led by MnSTA, geologists from MSU-Moorhead, Mankato, St. Cloud, Winona, and the University of Minnesota will team with experienced Earth Science educators to provide 13 ESTEEM Institutes over three summers (2021-2023) in four different regions of the state, serving up to 310 Minnesota 6th grade and high school science teachers. Five content-focused online courses offered during the same timeframe can serve another 840 teachers, together serving up to 1150 teachers and enriching earth/environmental education for an estimated 56,000 Minnesota students.

Institutes will include review of key earth/environmental science concepts addressed in the standards, the new phenomenon-based approach to teaching science, lab and fieldwork, sharing resources, and collegial planning for classroom implementation.

Understanding the detail and complexity of Earth's systems is crucial to the future of our economy and our planet, and having teachers knowledgeable and confident in Earth and Environmental Science topics is essential for quality earth/environmental education.

ESTEEM will create a statewide emphasis in environment education in 6th grade and high school earth science classrooms across Minnesota.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

We cannot protect what we do not understand. Preserving Minnesota's natural resources cannot be accomplished without fundamental knowledge of geology, hydrology and climate taught in our schools by informed, confident science educators.

To improve the quality of earth/environmental education, ESTEEM will:

1) Increase teacher content knowledge in earth/environmental sciences with direct emphasis on Minnesota's water, air,

land, minerals, and climate.
2) Increase teacher skills in designing and facilitating phenomenon-based instruction.
3) Increase curriculum time devoted to science and student-directed investigations.
4) Increase teacher confidence and enthusiasm for teaching science.
5) Increase outdoor learning experiences for students.

Activities and Milestones

Activity 1: ESTEEM Planning and Coordination

Activity Budget: $2,000

Activity Description:
Objective: Design and market three teacher institutes for July/August 2021, the summers of 2022-23, and five online courses.

MnSTA and our five university partners have been discussing elements of the ESTEEM program for over a year. For Activity 1, planning will move aggressively to setting specific course content that directly targets benchmarks in the new state science standards, finalizing course syllabi, assigning co-instructors, determining phenomenon-based teaching strategies to be modeled for teachers, designing evaluation instruments, choosing field sites, finalizing locations and dates, and detailing/confirming logistics for the institutes and online courses.

Due to the urgent need for this professional development, the ESTEEM Project Team has agreed to complete planning and waive any expenses so institutes can begin in mid-July and August of 2021. Continual planning for modifications in years two and three is budgeted at $2000.

Marketing during the 2020-21 school year will be done at no cost by MnSTA and MESTA through their listservs and webpages. District science leaders in all Minnesota schools will be contacted to direct market ESTEEM to their science teachers. MnSTA will handle online registrations.

When funding becomes available on July 1, 2021, ESTEEM will be ready to go.

Activity Milestones:

Description	Completion Date
Complete detailed agendas for summer institutes.	2020-10-31
Locations/instructors determined, contacted and confirmed for one high school and two 6th grade institutes in July/August 2021.	2020-11-30
Marketing and application designed, tested and posted online.	2020-12-31
Online course syllabi completed and reviewed. Online platforms ready.	2021-03-31
Logistics, participants and supplies confirmed.	2021-05-31

Activity 2: Fulfillment of ESTEEM Professional Development Summer Institutes and Fall/Spring Online Courses

Activity Budget: $571,000

Activity Description:
Objective: Deliver 13 high-quality, environmentally-focused summer professional development institutes and up to 21 fall/spring online courses over three years.

In July 2021, one cohort of 20 high school science teachers will attend an 8-day institute at MSU-Moorhead while two, 5-day 6th grade teacher institutes, serving 30 teachers each, will run concurrently in two different regions of the state.

In fall 2021-23 and spring 2022-23, five online courses – Earth Essentials, ES/EE Advanced Topics, Minnesota Geology and Resources, Meteorology, and Astronomy – will be available for up to 240 teacher participants each year.

In early summer 2022, the first high school cohort will return to MSU-Moorhead for a final eight days of content and pedagogical training. Later that summer a new cohort of 20 high school teachers will begin their two-year program at MSU-Mankato. ESTEEM will also host three 6th grade institutes (30 participants each) in three different regions of the state.

In summer 2023, the second high school cohort will finish their program, and ESTEEM will host four 6th grade institutes in four regions.

ESTEEM will serve as many as 310 teachers in 13 programs in summers 2021-23 and up to 840 teachers in online courses.

Activity Milestones:

Description	Completion Date
Complete three, first-year summer programs for up to 80 teachers of science.	2021-08-31
Complete five summer programs for up to 110 additional teachers.	2022-08-31
Complete 21 online sections, serving 40 teachers each, during the falls and springs of 2021-23.	2023-05-31
Complete five summer programs for up to 120 additional teachers.	2023-08-31

Activity 3: Evaluation and Reporting

Activity Budget: $9,000

Activity Description:
Objective: Collect data from ESTEEM participants and their students to determine the effectiveness of the program and its impact on earth/environmental education in Minnesota.

Teacher Tests: Standards-based evaluative instruments will be developed to gauge teacher learning of earth/environmental concepts. Pre/post institute score analysis will determine the number that show statistically significant (t test) knowledge gains.

Teacher Survey: This will be a project-specific, Likert-type instrument to assess changes in attitude and classroom practice to be completed by teachers online in late spring and again at the end of the following school year. Items will be compared pre versus post to determine statistically significant differences (z tests) in responses related to confidence in teaching science/environmental topics, amount of instructional time devoted to science and phenomenon-based teaching, and areas of professional growth.

Student Tests: Project-developed student content knowledge tests will be constructed. Achievement in earth/environmental content will be gauged by comparing scores of the teacher participants' students before the teachers attended the institutes with those after attendance using z tests for independent samples. Teachers who teach the same standards and did not attend ESTEEM will be solicited to administer the same tests to their students for comparison.

Activity Milestones:

Description	Completion Date
Construct and test ESTEEM Teacher Survey instrument.	2021-01-31
Complete the design of content tests for gauging teacher learning.	2021-03-31

Administer online survey instrument to teachers registered for summer 2021 institutes.	2021-04-30
Administer online survey again to teachers after one year of teaching post-ESTEEM training.	2022-05-31
Analyze/report findings on teacher/student achievement and classroom advances in Minnesota earth/environmental education.	2022-06-30
Repeat data collecting, analysis and reporting for 2022 and 2023 programs.	2023-08-31

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Russell Colson, Professor of Geology	Department of Anthropology and Earth Science; Minnesota State University, Moorhead	Dr. Colson will serve as lead instructor for one cohort of 20 high school science teachers seeking additional licensure in 9-12 Earth Science. Colson will lead two, 8-day summer institutes at MSU-Moorhead plus facilitate two online courses in fall and spring over the three years of the project.	Yes
Dr, Bryce Hoppie, P.G. (Mn), Professor of Geology	Department of Chemistry and Geology; Minnesota State University, Mankato	Dr. Hoppie will be the lead earth/environmental science instructor for three, 5-day, 6th grade science teacher summer institutes in southern Minnesota and one cohort of 20 high school science teachers at MSU-Mankato.	Yes
Dr. Kent C. Kirkby, Professor of Geology	School of Earth and Environmental Sciences; University of Minnesota Twin Cities	Dr. Kirkby will serve as lead earth/environmental science instructor for three, 5-day, 6th grade science teacher summer institutes provided in the Metro area.	Yes
Dr. Hillary A. Barron, Research Associate	Biology Teaching and Learning Department; University of Minnesota Twin Cities	Dr. Barron will be a guest presenter in teaching toward equity in environmental education at all summer institutes.	Yes
Dr. Kate S. Pound, Geology Professor	Atmospheric & Hydrologic Sciences Department; St. Cloud State University	Dr. Pound will be the lead earth/environmental science instructor for three, 5-day, 6th grade science teacher summer institutes hosted at St. Cloud State, Bemidji State, and UM-Crookston.	Yes
Kate Rosok, MESTA President	Minnesota Earth Science Teachers Association (MESTA)	MESTA - a statewide organization serving Minnesota earth science teachers - will provide co-instructors for each ESTEEM summer institute, help with statewide coordination, identify regional field sites, and provide teaching resources and networking for ESTEEM participants.	No
Larry Mascotti, Community Faculty	Metropolitan State University	Mr. Masotti will instruct the online Introductory Astronomy course for teachers offering the course once per year over the three years of the project.	Yes
Rachel Humphrey, Assistant Professor	St. Cloud State University	Ms. Humphrey (completing her PhD in May 2021) will instruct the online introductory Meteorology course for teachers offering one course per year over the three years of the project.	Yes
Dr. Jennifer L.B. Anderson, Professor of Geoscience	Geoscience Department; Winona State University	Dr. Anderson will serve a guest presenter on Minnesota climate for all ESTEEM summer institutes.	Yes

Dr. Donna Whitney, Geology/Environmental Science Professor	School of Earth and Environmental Sciences; University of Minnesota Twin Cities	Dr. Whitney will serve as a guest presenter focusing on Minnesota geo-habitats and petrology for all summer institutes.	Yes

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

The ultimate result of ESTEEM will be a cohort of science teachers confident in their content understanding and pedagogical skills in addressing the new Earth/Environmental Science standards. Implementation of a more vibrant, environmentally- and Minnesota-focused approach to teaching science will be immediate in classrooms across the state. Pre/post testing of teachers and students plus pre/post attitudinal surveys will be used to gauge the success of ESTEEM.

Resources and strategies will be distributed statewide through MnSTA conferences and website. All expenses in maintaining communication and sharing best practices and resources will be funded by MnSTA.

Project Manager and Organization Qualifications

Project Manager Name: Lee Schmitt

Job Title: ESTEEM Project Manager

Provide description of the project manager's qualifications to manage the proposed project.

Lee Schmitt served as Associate Director for Professional Development and faculty in the Hamline University School of Education. His work involved developing and implementing large-scale programs for Minnesota teachers of science in the areas of science content, licensure, environmental education, practice-based instruction, and STEM education. Schmitt designed and managed statewide teacher programs in geology, biotechnology, chemistry/physics, drinking water, and three regional Science Academies funded by the state Math Science Partnership (MSP). Schmitt was project director for the nationally-recognized, $2.3 million, Minnesota Science Teachers Education Project (MnSTEP) serving nearly 1000 K-12 teachers of science throughout Minnesota. He has served as president of the Minnesota Science Teachers Association (MnSTA) and Minnesota Earth Science Teachers Association (MESTA), and was Co-PI/lead writer for Science and Engineering Practices in Action (SEPA) – a series of online professional development modules for K-12 teachers of science funded by a state MSP grant. Over his 22 years in teacher education, Schmitt has managed over 20 large-scale professional development projects serving thousands of Minnesota science teachers.

Organization: Minnesota Science Teachers Association

Organization Description:

The Minnesota Science Teachers Association (MnSTA) is a statewide, non-profit, 501(c)(3) organization dedicated to improving the quality of science and environmental education for ALL Minnesota students by providing K-16 science educators a platform for the exchange of ideas and materials, current research in science and environmental education, a statewide leadership and communication network, and needed professional development in all science disciplines. Established in 1964, MnSTA is governed by a 32-member board of directors representing all science disciplines, 11 regions of the state, universities, urban and rural districts, public/private schools, as well as informal and alternative science education. MnSTA has partnered, led, and/or contributed to numerous, statewide professional development programs for Minnesota teachers of science.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
							Sub Total	-
Contracts and Services								
Dr. Bryce Hoppie	Professional or Technical Service Contract	Dr. Hoppie will serve as lead instructor for three 6th grade summer institutes and one high school cohort totaling 31 days of instruction over three years. The $800/day stipend matches NSF grant guidelines for PhD instructors and includes all preparation, course instruction, assessment, mileage, and per diem.				0.69		$24,800
Dr. Russell Colson	Professional or Technical Service Contract	Dr. Colson will be lead instructor for one cohort of high school teachers totaling 16 days of instruction at $800 per day (NSF PhD daily rate) plus instruct six online courses at $3000 per course. (Normal reimbursement would be $9348.) Colson will also design one new online course for $3000.				1.14		$33,800
Dr. Kate Pound	Professional or Technical Service Contract	Dr. Pound will serve as lead instructor for three, 5-day, 6th grade teacher summer institutes to be held in northern regions of the state. The $800/day stipend is based on NSF grant guidelines for PhD instructors and includes all preparation, course instruction, assessment, mileage, and per diem.				0.39		$12,000
Dr. Kent Kirkby	Professional or Technical Service Contract	Dr. Kirkby will serve as lead instructor for three, 5-day, 6th grade teacher summer institutes to be held in the Metro area. The $800/day stipend is based on NSF grant guidelines for PhD instructors and includes all preparation, course instruction, assessment, mileage, and per diem.				0.39		$12,000
Larry Mascotti	Professional or Technical Service Contract	Mr. Mascotti will instruct three online courses in Astronomy, one per year, over three years. The instructor rate of $3000 per online course is based on one-third of the standard university rate for teaching a three-credit online course for up to 40 students.				0.15		$9,000

Rachel Humphrey	Professional or Technical Service Contract	Ms. Humphrey will instruct three online courses in Meteorology, one per year, over three years. The instructor rate of $3000 per online course is based on one-third of the standard university rate for teaching a three-credit online course for up to 40 students.				0.15		$9,000
Dr. Jennifer Anderson	Professional or Technical Service Contract	Dr. Anderson will present on Minnesota climate for one-half day for 11 programs over three years. $400 is one-half of the $800 per day afforded PhD instructors based on NSF grant guidelines and includes all preparation, presentation, mileage, and per diem.				0.54		$4,400
Dr. Hillary Barron	Professional or Technical Service Contract	Dr. Barron will present on achieving equity in science/environmental education for one-half day for 11 programs over three years. $400 is one-half of the $800 per day afforded PhD instructors based on NSF grant guidelines and includes all preparation, presentation, mileage, and per diem.				0.54		$4,400
Dana Smith	Professional or Technical Service Contract	Ms. Smith will co-instruct for two, 8-day programs focusing on environmental education. $400 per day is based on NSF grant guidelines for non-PhD instructors and is inclusive of all expenses. She will also guest present on environmental topics for five institutes and develop one online class for $3000.				0.66		$11,400
Marlene Schoeneck	Professional or Technical Service Contract	Ms. Schoeneck, a high school science teacher, will guest present for one day in each of 11 programs focusing on environmental education and pedagogy. $400 per day is based on NSF grant guidelines for non-PhD instructors and includes all preparation, presentation, mileage, and per diem.				0.54		$4,400
Mary Ann Colson	Professional or Technical Service Contract	Ms. Colson, a middle school science teacher, will co-instruct with Dr. Colson at MSU-Moorhead for two, 8-day programs focusing on environmental education and pedagogy. $400 per day is based on NSF grant guidelines for non-PhD instructors and includes all expenses. She will also guest present five days at other institutes.				0.54		$8,400
Joseph Reymann	Professional or Technical Service Contract	Mr. Reymann will manage the ESTEEM budget for MnSTA and be responsible for all budget-related transactions. $3000 per year is based on an estimated 200 hours per year at $15/hour.				0.3		$9,000

Lee Schmitt	Professional or Technical Service Contract	Mr. Schmitt will manage project evaluation and reporting by collecting data from ESTEEM participants and their students to determine the effectiveness of the program and its impact on earth/environmental education in Minnesota. $3000 per year is based on an estimated 200 hours per year at $15/hour.				0.3		$9,000
High School Teacher Co-instructors TBD	Professional or Technical Service Contract	Nine experienced high school earth/environmental teachers will be selected to co-teach each of the nine, 5-day, 6th grade summer institutes to provide direct classroom focus and teaching strategies. $400 per day is based on NSF grant guidelines for non-PhD instructors and includes all preparation, presentation, mileage, and per diem.				1.17		$18,000
Regional Coordinators TBD	Professional or Technical Service Contract	Four teachers will be selected to lead the coordination of summer institutes in four different regions of the state. Coordinators will be responsible for all institute logistics including location, set-up, supplies, attendance, etc. $1500 per coordinator per year is based on 100 hours of work at $15/hour.				0.6		$18,000
Course Credits for High School Teacher Participants	Professional or Technical Service Contract	Amount is based on 80% of 40 possible teachers in the high school program choosing to receive credits vs stipend for their participation in ESTEEM. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 12-credit licensure preparation program x $120/credit x 30 participants.		X		1.8		$43,200
Course Credits for 6th grade Teacher Participants	Professional or Technical Service Contract	Amount is based on 80% of 270 possible teachers in the nine, 5-day summer programs choosing to receive credits vs stipend for their participation in ESTEEM. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 2 credits x $120/credit x 216 participants.		X		4.8		$51,840
Online Course Credits for Teachers	Professional or Technical Service Contract	Amount is based on 75% of a possible 840 teachers that could participate in ESTEEM online courses if every section were filled. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 3 credits x $120/credit x 630 teachers.		X		18.9		$226,800
Stipends for High School	Professional or Technical	Amount based on 20% of 40 possible teachers in the high school program choosing to receive a stipend vs credits. $60/day for attending professional				0.6		$9,600

Teacher Participants	Service Contract	development is 33% of the average teacher stipend rate of $180/day. 8 days x $60/day x 2 summers x 10 teachers.						
Stipends for 6th grade Participating Teachers	Professional or Technical Service Contract	Amount based on 20% of 270 possible teachers in the 6th grade program choosing to receive a stipend vs credits. $60/day for attending professional development is 33% of the average teacher stipend rate of $180/day. 5 days x $60/day x 54 teachers.				1.2		$16,200
Dr. Donna Whitney	Professional or Technical Service Contract	Dr. Whitney will present on Minnesota geo-habitats and petrology for one-half day for 11 programs over three years. $400 is one-half of the $800 per day afforded PhD instructors based on NSF grant guidelines and includes all preparation, presentation, mileage, and per diem.				0.54		$4,400
ESTEEM Planning Team	Professional or Technical Service Contract	Planning for year one will be completed in kind. In years two and three, five members of planning team (R. Colson, M. Colson, D. Smith, L. Schmitt, & B. Hoppie) will receive a $200 stipend per year. ($20/hour x 10 hours x 2 years x 5 planners)				0.06		$2,000
							Sub Total	**$541,640**
Equipment, Tools, and Supplies								
	Tools and Supplies	Field Notebooks for Teachers (310 teachers x $21.95)	Recording data and notes from field and lab investigations plus outstanding scales and information for processing soil and rock data in the field.					$6,805
	Tools and Supplies	Field lens. (310 teachers x $13.50)	Essential tool for magnification in the field.					$4,185
	Tools and Supplies	MGS County Atlases (310 teachers x $12.50)	Detailed geologic maps of each teacher's county including bedrock, habitats and mineral resources.					$3,875
	Tools and Supplies	Assorted MGS Geology/Hydrology Maps of Minnesota (310 teachers x $25)	Observation and investigation of Minnesota soils, water, habitats, and mineral resources.					$7,750
	Tools and Supplies	Learning to Read the Earth and Sky: Explorations Supporting the NGSS, Grades 6–12. (310 teachers x $28.32)	Outstanding introduction to phenomenon-based teaching in earth and environmental sciences.					$8,780

	Tools and Supplies	General field/lab supplies TBD based on final curricula in each region. Supply amount is based on MSU-recommended $125/student for instructional supplies in a science class.	Tools, lab equipment, chemicals needed for field and lab investigations TBD.					$7,477
							Sub Total	**$38,872**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
							Sub Total	**-**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	Duplicating of handouts (40 pages/teacher x .12/page x 310 participants).	Printouts will be needed for teachers to use in processing data, gaining insight into lesson design, and to highlight pertinent earth/environmental science content.					$1,488
							Sub Total	**$1,488**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$582,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Contracts and Services - Course Credits for High School Teacher Participants	Professional or Technical Service Contract	Amount is based on 80% of 40 possible teachers in the high school program choosing to receive credits vs stipend for their participation in ESTEEM. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 12-credit licensure preparation program x $120/credit x 30 participants.	Educational professional development grants typically fund a teacher credit or stipend option. MSP, ITQ, 3M, Medtronic, and NSF grants all allow for payment of credits or stipend to teachers. Participation in ESTEEM requires a large commitment of time, and teachers deserve some form of compensation. MnSTA has negotiated with Minnesota State University, Moorhead to provide a "co-sponsored rate" for graduate credits at $120 per credit. This pays for administration of the credit only (recording, posting grades, transcripts, etc.) and provides no "profit" or overhead for the university. MSU-Moorhead would normally charge $460/credit, so $120 is a real bargain. Course credits will be consolidated and all payments for credits will be made to MSU-Moorhead. **This is a single source contract.**
Contracts and Services - Course Credits for 6th grade Teacher Participants	Professional or Technical Service Contract	Amount is based on 80% of 270 possible teachers in the nine, 5-day summer programs choosing to receive credits vs stipend for their participation in ESTEEM. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 2 credits x $120/credit x 216 participants.	Educational professional development grants typically fund a teacher credit or stipend option. MSP, ITQ, 3M, Medtronic, and NSF grants all allow for payment of credits or stipend to teachers. Participation in ESTEEM requires a large commitment of time, and teachers deserve some form of compensation. MnSTA has negotiated with Minnesota State University, Moorhead to provide a "co-sponsored rate" for graduate credits at $120 per credit. This pays for administration of the credit only (recording, posting grades, transcripts, etc.) and provides no "profit" or overhead for the university. MSU-Moorhead would normally charge $460/credit, so $120 is a real bargain. Course credits will be consolidated and all payments for credits will be made to MSU-Moorhead. **This is a single source contract.**
Contracts and Services - Online Course Credits for Teachers	Professional or Technical Service Contract	Amount is based on 75% of a possible 840 teachers that could participate in ESTEEM online courses if every section were filled. $120/credit is a negotiated fee from MSU-Moorhead (see justification). 3 credits x $120/credit x 630 teachers.	Educational professional development grants typically fund a teacher credit or stipend option. MSP, ITQ, 3M, Medtronic, and NSF grants all allow for payment of credits or stipend to teachers. Participation in ESTEEM requires a large commitment of time, and teachers deserve some form of compensation. Also note that there may be fewer teachers participating in online courses than projected. MnSTA has negotiated with Minnesota State University, Moorhead to provide a "co-sponsored rate" for graduate credits at $120 per credit. This pays for administration of the credit only (recording, posting grades, transcripts, etc.) and provides no "profit" or overhead for the university. MSU-Moorhead would normally charge $460/credit, so $120 is a real bargain. Course credits will be consolidated and all payments for credits will be made to MSU-Moorhead. **This is a single source contract.**

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	Project Summer Instructors and Presenters	Instructors' summer mileage for travel to and from summer institute locations will be waived. (200 miles/year x .575/mile x 12 instructors/presenters x 3 years = $4140 in kind.)	Secured	$4,140
In-Kind	ESTEEM Summer Teacher Participants	Program bus/van mileage to transport teachers to field sites will be replaced with carpooling. (4 vehicles/summer x 300 miles/day x 0.58/mile x 21 days = $14,616 in program savings.)	Secured	$14,616
In-Kind	ESTEEM Lead Instructors	Mileage for Drs. Colson, Kirkby, Hoppie, and Pound to visit and select field sites for investigation will be waived. (300 miles x .575/mile x 4 instructors = $2,070 in kind.)	Secured	$2,070
In-Kind	Minnesota Universities and School Districts	Rental fees for use of university facilities and school sites for summer institutes will be waived. (Estimated $500/week x 17 weeks = $8500 in program savings.)	Secured	$8,500
In-Kind	Minnesota Science Teachers Association (MnSTA)	A one-year membership in MnSTA/MESTA will be provided in kind for summer teacher participants. (310 participants x $25 = $7750 in kind.)	Secured	$7,750
In-Kind	Minnesota Science Teachers Association (MnSTA)	MnSTA website marketing, registration, and statewide online distribution of resources will be provided in kind. ($600/year x 3 years = $1800)	Secured	$1,800
In-Kind	ESTEEM Planning Team	The six-member ESTEEM Planning Team will complete first-year planning without stipend or travel. Budget expenses for the one-year of planning was calculated at $9,500.	Secured	$9,500
In-Kind	Minnesota School Districts	Minnesota school districts will be asked to reimburse teacher travel expenses to ESTEEM summer institutes using their available ESSA funding. Room and board amount is based on 50% need for 6th grade teachers and 100% need for high school teachers staying in university dorms.	Potential	$42,320
			Non State Sub Total	**$90,696**
			Funds Total	**$90,696**

Attachments

Required Attachments

Visual Component

File: 749318c6-234.pdf

Alternate Text for Visual Component

The new 2019 Minnesota Science Benchmarks for 6th grade and high school students only are presented here. Benchmarks which represent a strong Minnesota environmental focus are highlighted. These new standard benchmarks are the motivation and purpose of our ESTEEM proposal - to help teachers teach earth/environmental science across Minnesota with new knowledge, confidence and energy.

Financial Capacity

File: fe990d63-730.pdf

Board Resolution or Letter

Title	File
MnSTA Letter of Resolution for ESTEEM Project	f0c0bb4d-5a7.pdf

Optional Attachments

Support Letter or Other

Title	File
Intro & 2019 Minnesota Academic Standards in Science	d255a287-566.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

No

Does the organization have a fiscal agent for this project?

No

6E.1.1.1.1 Ask questions that arise from observations of patterns in the movement of night sky objects to test the limitations of a solar system model. (P: 1, CC: 1, CI: ESS1) *Emphasis is on students questioning the limitations of their own models and questioning the kinds of revisions needed to account for new data. Examples of observations may include the student's own observations or observations made by others. Examples of night sky objects include the Moon, constellations, and planets.*
6E.1.1.1.2 Ask questions to examine an interpretation about the relative ages of different rock layers within a sequence of several rock layers. (P: 1, CC: 1, CI: ESS1) *Emphasis is on the interpretation of rock layers using geologic principles like superposition and cross-cutting relationships* .
6E.1.1.1.3 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (P: 1, CC: 7, CI: ESS3) *Emphasis is on the major role that human activities play in causing the rise in global temperatures. Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities.*

6E.1.2.1.1 Collect data and use digital data analysis tools to identify patterns to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** (P: 3, CC: 2, CI: ESS2) *Emphasis is on how weather at a fixed location changes in response to moving air masses and to interactions at frontal boundaries between air masses. Examples of weather data may include temperature, air pressure, precipitation, and wind. Examples of data analysis may include weather maps, diagrams, and visualizations or may be obtained through laboratory experiments (such as with condensation).*

6E.2.1.1.1 Analyze and interpret data to determine similarities and differences among features and processes occurring on solar system objects. (P: 4, CC: 3, CI: ESS1) *Examples of objects may include moons, planets, comets or asteroids. Example features may include characteristics of an object's atmosphere, surface or interior. Examples of processes may include erosion, deposition, cratering, or volcanism.*

6E.2.1.1.2 Analyze and interpret data on the distribution of fossils, rocks, continental shapes, and seafloor structures to provide evidence of past plate motions. (P: 4, CC: 1, CI: ESS2) *Examples of data may include similarities of rock and fossil types on different continents, the shapes of the continents (including the continental shelves), and the locations of ocean floor features such as ridges and trenches.*

6E.2.1.1.3 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.* (P: 4, CC: 1, CI: ESS3, ETS1) *Examples of natural hazards may be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events. Examples of data may include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies may include building tornado shelters or barriers to protect from flooding.*
6E.3.1.1.1 Develop and use scale models of solar system objects to describe the sizes of objects, the location of objects, and the motion of the objects; and include the role that gravity and inertia play in controlling that motion. (P: 2, CC: 3, CI: ESS1) *Emphasis is on the regularity of the motion and accounting for Earth-based visual observations of the motion of these objects in our sky. Emphasis is also on recognizing the limitations of any of the models. Examples may include physical models (such as the analogy of distance along a football field or computer visualizations of orbits) or conceptual models (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Not included are Kepler's Laws and retrograde motion of planets.*
6E.3.1.1.2 Develop a model, based on observational evidence, to describe the cycling and movement of Earth's rock material and the energy that drives these processes. (P: 2, CC: 5, CI: ESS2) *Emphasis of the practice is on using observations of processes like weathering and erosion of soil and rock, deposition of sediment, and crystallization of lava to inform model development. Emphasis of the core idea is on how these processes operate over geologic time to form rocks and minerals through the cycling of Earth's materials. Examples of models may be conceptual or physical.*
6E.3.1.1.3 Develop a model, based on observational and experimental evidence, to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (P: 2, CC: 5, CI: ESS2) *Emphasis of the practice is on developing a way to represent the mechanisms of water changing state, the global movements of water and energy, and on how the observational and experimental evidence supports the model. Examples of models may be conceptual or physical.*

6E.3.2.1.1 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. (P: 6, CC: 3, CI: ESS1) *Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of major events may include the evolution or extinction of particular organisms, the formation of mountain chains and the formation of ocean basins. Not included is using radioactive decay to age date rocks.*
6E.3.2.1.2 Construct a scientific explanation based on evidence for how the uneven distribution of Earth's mineral, energy, or groundwater resources is the result of past geological processes. (P: 6, CC: 2, CI: ESS3) *Emphasis is on how these resources are limited and typically non-renewable on a human timeframe. Examples of uneven distribution of resources may include petroleum (like in the North Dakota Bakken Shale), metal ores (like iron in the rocks of Minnesota's Iron Range), or groundwater in the different regions of Minnesota.*
6E.3.2.1.3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* (P: 6, CC: 2, CI: ESS3, ETS1) *Emphasis of the practice is on applying scientific principles about Earth's natural processes (like how water moves through the ground and air) to designing solutions to problems caused by human activity. Emphasis of the core idea is on how human activity impacts Earth's environments. Examples of parts of the design process may include assessing the kinds of solutions that are feasible, and designing and evaluating solutions that may reduce those impacts. Examples of human activities that impact the environment may include withdrawing too much water from aquifers, altering stream flow by building dams or levees, increasing runoff caused by impermeable surfaces like parking lots, or adding undesirable materials to the air, water or land.*
6E.4.1.1.1 Construct an argument, supported by evidence, for how geoscience processes have changed Earth's surface at varying time and spatial scales. (P: 7, CC: 3, CI: ESS2) *Emphasis is on how processes like erosion, deposition, mountain building, and volcanism affect the surface of Earth. Some processes, like mountain building take a long time. Other processes, like landslides, happen quickly. Examples may include how weathering, erosion and glacial activity have shaped the surface of Minnesota.*

6E.4.2.2.1 Communicate how a series of models, including those used by Minnesota American Indian Tribes and communities and other cultures, are used to explain how motion in the Earth-Sun-Moon system causes the cyclic patterns of lunar phases, eclipses and seasons. (P: 8, CC: 1, CI: ESS1) *Examples of cultures may include those within the local context of the learning community and within the context of Minnesota. Emphasis is on students questioning the limitations of their models and revising them to account for new observations. Models may be physical, graphical or conceptual.*

9E.1.1.1.1 Ask questions to clarify how seismic energy traveling through Earth's interior can provide evidence for Earth's internal structure. (P: 1, CC: 6,CI: ESS2) *Emphasis is on how wave propagation depends on the density of the medium through which the wave travels and how seismic data is used to support the idea of a layered earth.*
9E.1.2.1.1 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. (P: 3, CC: 6, CI: ESS2) *Emphasis is on physical and chemical investigations with water and a variety of solid materials to provide the evidence for how processes in the water cycle and rock cycle interact. Examples of physical investigations may include transportation and deposition of various sediment types and sizes, erosion of surfaces with varying amounts of soil moisture content and/or ground cover, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations may include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids). Examples specific to Minnesota may include chemical weathering of limestone to create karst topography.*
9E.1.2.1.2 Plan and conduct an investigation of the properties of soils to model the effects of human activity on soil resources. (P: 3, CC: 2, CI: ESS3, ETS2) *Emphasis is on identifying variables to test, developing a workable experimental design, and identifying limitations of the data. Examples of variables may include soil type and composition (particularly those found in Minnesota), erosion rate, water infiltration rates, nutrient profiles, soil conservation practices, or specific crop requirements.*

9E.2.1.1.1 Analyze data to make a valid scientific claim about the way stars, over their life cycle, produce elements. (P: 4, CC: 5, CI: ESS1) *Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.*
9E.2.1.1.2 Analyze geoscience data to make a claim that one change to the Earth's surface can create feedbacks that cause changes to other Earth systems. (P: 4, CC: 7, CI: ESS2, ETS2) *Emphasis is on using data analysis tools and techniques in order to make valid scientific claims. Examples may include climate feedback mechanisms, such as how an increase in greenhouse gases causes a rise in global temperatures that melt glaciers and sea ice, which reduces the amount of sunlight reflected from the Earth's surface (albedo), increasing surface temperatures and further reducing the amount of ice. Examples may also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent and longevity.*

9E.2.1.1.3 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems and human infrastructure.* (P: 4, CC: 7, ESS3, ETS1) *Examples of evidence (for both data and climate model outputs) may include precipitation and temperature and their associated impacts on sea level, glacial ice volumes, and atmosphere and ocean composition. Engineering examples may include using climate change data (rising sea levels) to evaluate the impact on the ability of sewer system to handle runoff or of existing wells to produce potable water.*
9E.2.2.1.1 Use mathematical and computational representations to predict the motion of natural and human-made objects that are in orbit in the solar system.** (P: 5, CC: 3, CI: ESS1, ETS2) *Emphasis is on Kepler’s laws of planetary motion and Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.*

9E.2.2.1.2 Develop a computational model, based on observational data, experimental evidence, and chemical theory, to describe the cycling of carbon among Earth's systems.** (P: 2, CC: 5, CI: ESS2) *Emphasis is on quantitative modeling of carbon as it cycles through the ocean, air, rock (particularly limestone), soil, and organisms. Emphasis is also on using empirical evidence and scientific reasoning to inform the algorithmic thinking about the conservation and cycling of matter.*
9E.2.2.1.3 Develop or use an algorithmic representation, based on investigations of causes and effects in complex Earth systems, to illustrate the relationships within some part of the Earth system and how human activity might affect those relationships. (P: 5, CC: 4, CI: ESS3, ETS2) *Emphasis is on students identifying the interacting components of a system, mathematically modeling how those factors interact and accounting for the effects of human activity on the system. Examples may include local systems in which natural and human-influenced variables impact the amount of runoff.*
9E.3.1.1.1 Develop and use a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. (P: 2, CC: 3, CI: ESS1) *Emphasis is on showing the relationships among the fuel, products and the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach the Earth. Examples of evidence that students might use include the masses and life times of other stars, as well as the ways that the sun's radiation varies due to sudden solar flares, sunspot cycles, and non-cyclic variations over the centuries.*

9E.3.1.1.2 Develop and use a model based on evidence to explain how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. (P: 2, CC: 7, CI: ESS2) *Emphasis is on how the appearance of land features (such as mountains, and valleys), and seafloor features (such as trenches and ridges) are a result of both constructive mechanisms (such as volcanism, and tectonic motion) and destructive mechanisms (such as weathering, and coastal erosion). Examples specific to Minnesota may include features formed relatively recently during continental glaciation and volcanic features that have long since been eroded away.*

9E.3.1.1.3 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. (P: 2, CC: 4, CI: ESS2) *Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean currents, which is constrained by the Coriolis effect and the outlines of continents. Examples of models may be diagrams, maps and globes, or digital representations* .
9E.3.1.1.4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. (P: 2, CC: 2, CI: ESS2). *Emphasis is on using a model to describe the mechanism for how energy flow affects changes in climate. Examples of the causes of climate change differ by timescale and may include: 1 - 10 years: large volcanic eruptions, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10 - 100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10 - 100s of millions of years: long term changes in atmospheric composition.*
9E.3.2.1.1 Construct an explanation that links astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe to the Big Bang. (P: 6, CC: 5, CI: ESS1, ETS2) *Emphasis is on how the redshift of light from galaxies is an indication of cosmic expansion, on how the cosmic microwave background radiation is a remnant of the Big Bang, and on how the observed composition of ordinary matter, primarily found in stars and interstellar gases, matches that predicted by the Big Bang.*
9E.3.2.1.2 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. (P: 6, CC: 7, CI: ESS1) *Emphasis of the practice is on linking the evidence to the claims about Earth's formation. Emphasis of the core idea is on using available evidence within the solar system to reconstruct the early history of Earth. Examples of evidence include the absolute ages of ancient materials, the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.*

9E.3.2.2.1 Evaluate or refine a technological solution to reduce the human impacts on a natural system and base the evaluations or refinements on evidence and analysis of pertinent data.* (P: 6, CC: 7, CI: ESS3, ETS1, ETS2) *Emphasis is on prioritizing identified criteria and constraints related to social and environmental considerations. Examples of data for the impacts of human activities may include the quantities and types of pollutants released into air or groundwater, changes to biomass and species diversity, or areal changes in land surface use (for surface mining, urban development, or agriculture). Examples for limiting impacts may range from local efforts (such as reducing, reusing, and recycling resources) to largescale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean)* .
9E.4.1.1.1 Evaluate the evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. (P: 7, CC: 1, CI: ESS1) *Emphasis is on evaluating the strengths, weaknesses and reliability of the given evidence along with its ability to support logical and reasonable arguments about the motion and age of crustal plates. Examples of evidence may include the ages of oceanic crust which increase with distance from mid-ocean ridges (a result of seafloor spreading), the ages of North American continental crust decreasing with distance away from a central ancient core (a result of past plate interactions).*
9E.4.1.1.2 Evaluate the evidence and reasoning for the explanatory model that Earth's interior is layered and that thermal convection drives the cycling of matter. (P: 7, CC: 5, CI: ESS2) *Emphasis is on how plate tectonics is controlled by mantle convection (due to the outward flow of energy from the decay of radioactive isotopes and the gravitational movement of denser materials toward the interior).*
9E.4.1.1.3 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* (P: 7, CC: 5, CI: ESS3, ETS1) *Emphasis is on the conservation, recycling, and reuse of resources (such as minerals, metals or soils) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for fracking sand, iron ore, and rare metals), and pumping (for oil and natural gas).*

9E.4.2.1.1 Compare, integrate and evaluate sources of information in order to determine how specific factors, including human activity, impact the groundwater system of a region. (P: 8, CC: 2, CI: ESS2, ETS2) *Emphasis is on the making sense of technical information presented in a variety of formats (graphs, diagrams and words). Example of sources of information may include student experimental data. Examples of factors may include porosity, permeability, sediment or rock type, recharge or discharge factors, and potential energy. Examples of human factors may include usage rates, run-off, agricultural practices, and loss of wetlands.*

9E.4.2.2.1 Apply place-based evidence, including those from Minnesota American Indian Tribes and communities and other cultures, to construct an explanation of how a warming climate impacts the hydrosphere, geosphere, biosphere, or atmosphere. (P: 8, CC: 4, CI: ESS3) *Examples of cultures may include those within the local context of the learning community and within the context of Minnesota . Emphasis is on understanding and using American Indian knowledge systems to describe regional impacts of climate change to Minnesota. Examples may include the water cycle and how precipitation change over time impacts cultural practices related to nibi ("water" in the Ojibwe language); or the decline/species loss of wiigwaas ("paper birch" in the Ojibwe language and an important tree in Anishinaabe culture) due to climate stressors like drought or changes in snow cover.*