RECOGNIZING EXCELLENCE

Chancellor's Award for Excellence in STEM Education

STUDENT AWARD Proposal Cover Sheet (Student Version)

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<th>Applicant Information</th>
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<td>Faculty Advisor:</td>
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<td>Proposal Title:</td>
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Fellow Expectations

By submitting this application, I confirm that, if selected to receive a Chancellor’s Award for Excellence in STEM Education, I will:

- Attend and be recognized at the annual Symposium on STEM Education.
- Give a brief introduction (~10-15 min) to my project at DBER.
- Actively engage in the CU STEM education community by attending quarterly Chancellor’s Fellow events.
- Present my work to the STEM education community by:
  - Giving at least one DBER seminar
  - OR, if that is an impossibility:
    - I will give a talk that the CU STEM education community is invited to attend
- Submit a one to three-page report detailing the outcomes of the project at the end of the funding period

I have read and understand this commitment: Alexandra Quim Mass (PDF electronic sig)
Signature
Enhancing Environmental Literacy and Interest in Polar Sciences for Primary School Children in the Boulder Valley School District and Beyond

Submitted by Alexandra Mass, doctoral student in Department of Civil, Environmental, & Architectural Engineering (CEAE)
Faculty Advisor: Dr. Diane McKnight, Professor in Department of CEAE

A. Program Description

*The Lost Seal* is an illustrated, science-education children’s book created by Diane McKnight which describes the true story of a group of scientists who encounter a seal in the polar desert of the remote McMurdo Dry Valleys of Antarctica, which was published as part of the Long Term Ecological Research (LTER) Schoolyard Children’s Book series. This educational story provides a framework for conveying how different Antarctica and the Dry Valleys are from the environments with which children are more familiar, while also including discussion/activities to keep classrooms more engaged by the scientific concepts addressed within its pages. The book also includes many illustrations drawn by children from participating school districts worldwide in order to enhance young students’ sense of involvement in science education through the art of their peers and make the remote fieldwork of Antarctic research more tangible to children. Due to the success of the book series, a formal Teacher’s Guide of lesson plans and laboratory experiments is currently being devised and reviewed to expand upon the science included in the book itself.

While *The Lost Seal* has been published and distributed to primary schools on both a local and global scale, many of the professional educators volunteering their time and respective expertise to this book series have voiced an interest in expanding the project and associated educational outreach in a number of ways. This proposal seeks to expand the role of *The Lost Seal* in an interactive framework involving the creation of supplementary learning materials for the book itself and educational outreach to primary schools on both a local and international scale in order to make the themes of environmental literacy and polar research more accessible to students of different grade level and linguistic backgrounds. These goals are summarized with the following project aims:

1. Work with participating educational professionals to complete a Teacher’s Guide to *The Lost Seal* including a series of lesson plans and laboratory experiments approved by the learning objectives for science and environmental education in the Boulder Valley School District (BVSD), and test-pilot/implement these activities in BVSD classrooms.

2. Coordinate the Spanish translation of *The Lost Seal* for use in bilingual schools.

3. Collaborate with Adrian Howkins on the projects and outreach associated with the Spanish-language edition of *The Lost Seal* on an international basis during his trip to primary schools in Argentina and Chile.
iv. Meet with participating classes in the Boulder Valley School District to complete activities from the Teacher’s Complement Guide and create a relationship and sense of involvement with students ahead of my anticipated return to Antarctica for fieldwork in the Dry Valleys in Fall 2013, enabling participating classes to track my progress as a student in Antarctica through visual media during my time abroad.

B. Methodology

i.) *Work with participating educational professionals to complete a Teacher’s Guide to The Lost Seal including a series of lesson plans and laboratory experiments approved by the learning objectives for science and environmental education in the Boulder Valley School District (BVSD), and test-pilot/implement these activities in BVSD classrooms.*

A rough copy of the proposed Teacher’s Complement Guide has been drafted by volunteering educators but needs to undergo revision, coordination and review before final publication. Working with Barbara Monday, Class Program Director of the University of Colorado Science Discovery Center, this lesson guide will be reviewed for compliance with the learning objectives of science and environmental education for each included grade level. Barbara Monday has spent a field season as part of the Stream Team in the Antarctic McMurdo Dry Valleys, while *The Lost Seal* recounts the encounter that the Stream Team had with the seal. Revisions to the lesson plans will then be reviewed by Brigid Moriarty, Amanda Demler, and other participating teachers in the Boulder Valley School District. I will participate in ‘pilot’ activities with Moriarty and Demler’s classrooms and the educational programs offered by the CU Science Discovery Center to help evaluate the effectiveness and feedback for each learning module, and the guide will then be edited and revised as needed before final layout, assembly, and graphic design. The BVSD has been actively using a curriculum developed for the first book in the LTER Schoolyard series (*My Water Comes from the Mountains*) called ‘My H₂O’, and that the success of that curriculum will be a basis for introducing the planned curriculum for *The Lost Seal*. An interactive component of data collection will also be incorporated into lessons for *The Lost Seal*, since stream flow data from the stream named after the encounter (‘Lost Seal’ creek) is being telemetered daily from the Antarctic. Students will be able to access this data as part of the curriculum and be able to see the flow increase and decrease with the intensity of sunlight and temperature as the glacial melt changes throughout each year.

ii.) *Coordinate the Spanish translation of The Lost Seal for use in bilingual schools.*

A Spanish-language translation will be completed and subsequently reviewed for use of age-appropriate scientific language for the grade 3-5 levels associated with the book. This translation will then be tested with the aid of participating bilingual teachers and include collaboration with the CU Science Discovery Center and Amanda Demler and Brigid Moriarty of the Boulder Valley School District. A final version will then be submitted for physical publication as a Spanish-language edition of the book.
iii.) **Collaborate with Adrian Howkins on the projects and outreach associated with the Spanish-language edition of The Lost Seal on an international basis during his trip to primary schools in Argentina and Chile.**

This project will offer logistical, linguistic, and planning support to coordinate with Prof. Adrian Howkins of Colorado State University, a co-investigator on the McMurdo Long-term Ecological Research project funded by NSF and based at INSTAAR (the Institute for Arctic and Alpine Research at CU). Prof. Howkins will travel on an outreach trip to bring a draft of the Spanish-language edition of *The Lost Seal* to primary schools in Argentina and Chile in the spring of 2013. During Fall 2012 the project will coordinate with Adrian, his wife Alison Hicks, librarian of Spanish language at CU, Barbara Monday of the CU Science Discovery Center, and Amanda Demler of the Boulder Valley School District to plan appropriate participatory Spanish-language activities to engage each respective age class. In Spring 2013 I will communicate with Adrian during his time abroad on the feedback and progress of the outreach activities, and incorporate the artwork Adrian collects from participating children in South America for the yet-unbuilt Spanish edition of The Lost Seal website. Part of the success of The Lost Seal’s English version has been the sense of interaction and participation children felt at having their artwork incorporated into the published book, while *all* contributed artwork can be browsed and accessed through the website at [http://www.mcmlter.org/lostseal](http://www.mcmlter.org/lostseal) The Spanish-language edition has the same goals of incorporating artwork from Spanish-speaking students around the world, while *all* contributed pictures will be posted online and made searchable by children’s names and locations around the world, creating a wider sense of community for the participating classes and readers alike.

iv.) **Meet with participating classes in the Boulder Valley School District to complete activities from the Teacher’s Complement Guide and create a relationship and sense of involvement with students ahead of my anticipated return to Antarctica for fieldwork in the Dry Valleys in Fall 2013, enabling participating classes to track my progress as a student in Antarctica through visual media during my time abroad.**

As a graduate student who completed my master’s research doing remote fieldwork in the sea ice fields of Antarctica, I have seen first-hand in my educational outreach experience through the University of Georgia how the presence of a student scientist who has *been* to Antarctica can engage young children and enable them to regard science, engineering, and remote fieldwork research as an actual, tangible possibility for their future. I believe that meeting with BVSD classrooms to discuss Antarctic fieldwork, in conjunction with participating in activities devised by the Teacher’s Complement Guide, would significantly enhance a sense of academic curiosity for young students interested STEM fields and the potential to study field environments farther away from home. Collaborating with participating BVSD classrooms and educational programs offered through the CU Science Discovery Center, I will discuss both topics from *The Lost Seal* and draw on my experience as a research scientist in Antarctica, discussing fieldwork at an age-appropriate level for younger children. This set of initial meetings and activities will be followed up by a series of updates to participating classes on life in Antarctica when I return to the continent in Fall 2013 for 5-6 months as part of the McMurdo Dry Valleys Long Term Ecological Research Stream Team. Updates from Antarctica will include photography, webcasts, or other visual media posted during my time in the field that enable students to envision the
experience of polar fieldwork and concepts of environmental and polar science. I believe the ability to follow the progress of a specific scientist (particularly a student scientist) that children have already met, developed a rapport with, and had the chance to relate to may enhance the sense of involvement primary students feel with the scientific research being conducted in a faraway environment. This contact will then include a follow-up meeting with interested classrooms upon my return to Colorado in Spring 2014.

C. September 2012-August 2013 Fellowship Timeline

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<td>Revise, format, and implement <em>The Lost Seal</em> Teacher’s Guide with approval of BVSD teachers, and pilot these activities in participating classrooms</td>
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<td>Coordinate Spanish translation of <em>The Lost Seal</em> for use in bilingual schools</td>
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<td>Meet with participating BVSD and bilingual classrooms with Adrian Howkins to plan appropriate educational activities for The Lost Seal’s Spanish edition outreach in South America</td>
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<td>Offer logistic and linguistic support for the outreach activities of The Lost Seal in Argentina and Chile during Adrian Howkins’ trip</td>
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<td>Update the Lost Seal website with artwork of participating students in South America and organize artwork for inclusion in Spanish-language book</td>
<td>X</td>
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<td>Use feedback and artwork from Adrian Howkin’s trip and input from bilingual CO classrooms to edit and coordinate final publication of the Spanish edition of <em>The Lost Seal</em></td>
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<td>Meet with participating BVSD classrooms to implement activities from the Teacher’s Guide and discuss my personal experience in Antarctica, establishing interest to track my progress in during my time in the field</td>
<td>X</td>
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<td>*Antarctic Fieldwork- use webcasts, updates, photography, and other media to discuss basic concepts of environmental/ polar sciences and life in the field, October 2013-March 2014</td>
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<tr>
<td>*Return to Colorado, touch base and discuss Antarctic experience from most recent expedition with interested classrooms in BVSD</td>
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*The final time periods Fall 2013-Spring 2014 are outside the timeline of this Fellowship grant, but contact with classrooms/ establishment of a rapport with primary school students through outreach in BVSD during the Fellowship timeline will lay the groundwork and communication with classrooms to enable students to track my later progress in Antarctica from October 2013-March 2014. Consequent updates/ ‘reunions’ with interested classrooms upon my return to Colorado in spring 2014 are an additional goal of this project.
D. Broader Impacts

This project will finalize the creation of a Teacher’s Guide collection of lesson plans and laboratory experiments to augment the scientific concepts discussed in *The Lost Seal*, participate in science activities in BVSD schools, coordinate the translation, review, and revisions necessary to publish a Spanish-language edition of *The Lost Seal* for use in bilingual schools, and offer support for *The Lost Seal* and associated educational activities to be used in outreach to schools in South America. This is a broad-ranging project including the cooperation of the CU Department of Civil and Environmental Engineering, the Institute for Arctic and Alpine Research, the Antarctic McMurdo Dry Valleys Long Term Ecological Research program, the CU Science Discovery Center, and the Boulder Valley School District. By establishing relationships with classrooms in the Boulder Valley School District and the University of Colorado Science & Discovery Center, I can participate in *The Lost Seal* activities with local students, discussing basic concepts of environmental/polar sciences and my life as an Antarctic research scientist, and establish a rapport to actively involve students in my subsequent return to Antarctica in the fall of 2013. The creation of supplementary materials, Spanish translations, and outreach activities in both the Boulder Valley School District and South America seek to make the themes of environmental literacy, polar research, and STEM careers more accessible to students of different grade level and linguistic backgrounds on both a local and international scale.

E. Participating Faculty/Professionals

Amanda Demler, bilingual teacher at Boulder County Day Elementary in the Boulder Valley School District

Alison Hicks, Librarian of Spanish Language at CU

Adrian Howkins, Professor at Colorado State University and co-Investigator for the McMurdo Dry Valleys Long Term Ecological Research site based out of the Institute for Arctic and Alpine Research at CU

Diane McKnight, Professor of Civil and Environmental Engineering at CU, Fellow at the Institute for Arctic and Alpine Research, and co-Principal Investigator for the McMurdo Dry Valleys Long Term Ecological Research site

Barbara Monday, Class Program Director at the CU Science Discovery Center and previous member of the McMurdo Dry Valleys LTER Stream Team

Brigid Moriarty, bilingual teacher at University Hill Elementary in the Boulder Valley School District
ALEXANDRA QUINN MASS
PhD Student- Civil and Environmental Engineering, University of Colorado
(631) 428-8889, email alexQmass@gmail.com

EDUCATION
Current PhD student, Civil and Environmental Engineering, University of Colorado.
Matriculated fall 2011, projected graduation 2015. Research interests include the distribution,
degradation, and environmental fate of pollutants in the cryosphere, including fieldwork in
the Colorado Rockies and McMurdo Dry Valleys of Antarctica.

M.S., Environmental Toxicology/ Marine Science, University of Georgia,
May 2010. Final GPA 3.44 in program of study. MS thesis Methyl Bromide Utilization in
Southern Ocean Sea Ice- identified the biological degradation and dehalogenation of methyl
bromide in sea ice and ocean water, and included austral season fieldwork in Antarctica and
onboard the Antarctic Icebreaker Oden.

B.S. Biology, Bucknell University, May 2007. 2nd major in Anthropology, minor in
Environmental Studies. Final GPA 3.30.

Current Graduate Assistantship: Educational Outreach Coordinator, McMurdo Dry Valleys
Long Term Ecological Research (LTER). Coordinate publicity for the LTER Schoolyard
book series and promote environmental literacy for elementary school children, working with
primary school teachers and classrooms in the Boulder Valley School District in conjunction
with the CU Science Discovery Center.

TEACHING EXPERIENCE: 14 courses 2005-2011
Primary instructor or lead lecturer for the following courses:
• Introduction to Marine Science. (University of Georgia MARS 1010/L laboratory instructor, 3
class sections, Fall 2009.) Responsibilities included independently leading laboratory classes and
demonstrating techniques, preparing lab set-up / clean up, meeting with / tutoring students,
writing weekly quizzes, and grading all papers and assignments for the laboratory grade.
• Introduction to Ecology- Field Based. (University of Georgia ECOL 1000H, May-August 2008
cross-country camping field program.) See description below.
• Ecology of North America- Field Based. (University of Georgia ECOL 4160, May-August 2008
cross-country camping field program.) Served as primary ecology lecturer and emergency
medical technician on an eight week field program for UGA undergraduates, camping and
traveling 11,826 miles throughout twenty one US states in a field-based, hiking environment.
Devised a syllabus, field-based lectures, assignments and exams.

Teaching assistant for the following courses:
• Graduate-level Applied Stream Ecology. (University of Colorado CVEN 5323, Fall 2011.)
Responsibilities include laboratory demonstrations, demonstrations of field methodology on
fieldtrips, organizing logistics and equipment for student-led field projects, meeting with students,
select grading and guest lectures.
• Introduction to Environmental Health Science. (University of Georgia EHSC 3060, 4 class
sections from Fall 2007- Spring 2008.)
• **Introduction to Anthropology- Field Based.** (University of Georgia ANTH 1102, May-August 2008 cross-country camping field program.) Assistant and guest lecturer. Additional guest lectures provided for the concurrently-running Honors Introduction to Anthropology- Field Based (ANTH 2120H), and North American Indians- Field Based (ANTH 4020).

• **Cellular and Genetic Biology lab.** (Bucknell University BIOL 121L, 2 class sections Fall 2005, 2006.) Responsibilities same as BIOL 122L below-

• **Ecology and Evolutionary Biology lab.** (Bucknell University BIOL 122L, Spring 2007.) Responsibilities included leading laboratory experiments and demonstrating techniques, preparing lab set-up / clean up, meeting with students, and grading all papers and assignments for the laboratory grade.

• **General biology tutor,** providing individual assistance to students referred by the Bucknell University biology department, including students with cognitive learning disorders. Reviewed lecture material, lab concepts and techniques, tests and lab reports August 2005- May 2007.

**ADDITIONAL ACCOMPLISHMENTS**


**Commercial Driver’s License (CDL) certified.** Licensed to operate commercial vehicles, trucks, and 15+ passenger transport.

**DISTINCTIONS**

• National Oceanic and Atmospheric Administration Pre-doctoral Fellow, Oceans and Human Health research program, 2008-2009

• Bucknell University Dean’s List 2005, 2006

• National Fish and Wildlife Foundation Undergraduate Fellow, 2006.

• Westinghouse / Intel Student Researcher, 2001-2003

**REFERENCES**

Diane McKnight, Professor and current PhD advisor at the University of Colorado. ([Diane.McKnight@colorado.edu](mailto:Diane.McKnight@colorado.edu), ph# 303-492-4687)

Dr. Paul Quick, Professor for the GRSC 7770 course on teaching methods for University of Georgia teaching assistants that I completed August-Dec 2009. ([pauquick@uga.edu](mailto:pauquick@uga.edu), ph# 706-542-0534)

Dr. Anne Marie Zimeri, Professor of Environmental Health, University of Georgia. Instructor for the EHSC 3060 courses I served as teaching assistant for August 2007- May 2008. ([zimeri@gmail.com](mailto:zimeri@gmail.com), ph# 706-542-2454)