Developing Earth Science Data Tools for Educators: A Guidebook

Project Details

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Proposed start and end date: April 1, 2020-September 30, 2020

Budget Requested: $9989.50

Budget Summary		
	Stipends	$1,000.00
	Travel	$3,487.50
	Lodging & Meals	$4,398.00
	Supplies	$0.00
	Reporting & Presentation	$1,104.00
	Total	**$9,989.50**

Summary: This project will bring together teachers, educational tool designers, and project partners for a one-day meeting. Our goal is to create a resource guide for use by educational tool developers, allowing them to create tools that consider the needs and constraints of teachers, school districts, and students. **Therefore, the majority of our requested budget expenditures are travel-related.** To keep costs down, we will leverage the available resources of ESIP members in the Washington D.C. area by asking ESIP to help us identify a member or partner willing to contribute the necessary meeting space for one day (The office space of AUI has already been identified as a potential contributor). In addition, the teachers involved will be those from the D.C. area who participated in the 2020 ESIP Winter Meeting, allowing us to minimize the impacts and cost of participant travel. With the exception of stipends for participating teachers, there are no salaries included in our budget, as the outcomes are in alignment with the goals of everyone involved. Donations of supplies will be requested from partners and/or venue.

Project Outline

Project description: In order to build a workforce with data savvy skills, we need to encourage secondary education teachers to involve their students in data-rich investigations. A variety of tools and evidence-based curricula have been developed to address the lack of data literacy through the use of statistical modeling and inference to bring data skills to learners [1,2,3,4,5]. However, through focused

discussion with a small group of K-12 Earth science teachers, a clearly defined set of barriers to using Earth science data in their classrooms has emerged. These barriers include such parameters as safety, privacy and security issues; the available amount of school bandwidth; data storage needs; and ports and protocols. This project brings together science education experts, educators, and tool developers for a participatory design workshop to identify best practices for the development of Earth science data tools to overcome the privacy, security, financial, and other barriers faced by K-12 classroom implementation. It leverages the recommendations and successes over the past 20 years to improve data access, metadata quality, file formats, and subsetting due to earlier efforts by ESIP, Data Access Working Group, Digital Library for Earth Systems Education, *On the Cutting Edge,* and Science Education Resource Center efforts [6, 7, 8].

The goal of this multi-organizational and multi-role workshop is to produce a guidebook that can be used by tool developers in the design of tools that educators and students will find useful, engaging and practical as well as successfully usable in a variety of educational settings.

This project is a direct outcome from the ESIP 2020 Winter Meeting education-focused sessions in which a small group of local educators were invited into a participatory design process focused on tool development. Together, we considered what kinds of Earth science teaching tools educators want, need, and more importantly, are *unable to utilize*. In two 90-minute working sessions, teachers verbally expressed what worked for them, what didn't, and why. They cited everything from tool instructions, student safety, school technology constraints, and district policies. The proposed project builds on the momentum and enthusiasm of the educators in continuing to work with ESIP, and specifically to address the challenges the educators experience in working with Earth science data in their classrooms.

Project objectives, significance, and impact: The need for identification of educator and student requirements for using Earth science data tools in the classroom and for the communication of these requirements to tool developers is clearly established. The publication, dissemination and use of this guidebook will result in a significant increase in the use and understanding of Earth science and other STEM subjects in K-12 settings, which in turn will positively impact our urgent workforce needs.

Project Objectives:
- Develop a guidebook for data tool developers for the K-12 classroom
- Promote participatory design best practices and team science principles to encourage equal-partner voices in a supportive and contributing environment
- Identify a suite of specific actions for tool developers
- Encourage data tool developers to remove the barriers to entry for K-12 educators and their students to engage their students in data exploration, analysis, and visualization
- Identify gaps and opportunities to evaluate further avenues for continued collaboration

Project Significance: The next generation of Earth scientists need to be fluent in data use, and this starts in the K-12 classroom. This project will greatly improve students' ability to access and use data in their Earth science explorations, thus providing pathways to greater engagement.

Project Impact: As future tools are developed and existing tools updated, best practices identified by the guidebook will be integrated into educational tool development, thus improving educator and student experiences and allowing educational tools to actually be used in K-12 classrooms and achieving their intended impact.

Description of key project steps and timeline:

Step 1: Planning, April 1, 2020-meeting date (May 2020)
The organizers will work with educators and tool developers to schedule the meeting, ideally in May 2020. Venue, catering and travel logistics will be arranged. One or two calls will be held with educators to draft the agenda for the meeting. The educators have already been identified as they attended the ESIP 2020 Winter Meeting. Project partners will work with ESIP to identify tool developers who are ESIP members and who wish to collaborate on this project.

Step 2: Full-day meeting and drafting of guidebook. (May 2020)
A Washington, DC location will be needed to include and involve the educators who inspired this project. Although we have not determined the exact location, we will request in-kind donations of meeting space from D.C. area ESIP members in order to secure a meeting space at no cost to the project.

Step 3: Writing (June -August 2020)
The project partners will write the white paper, in the form of a guidebook, with input from educators, tool developers, and other ESIP members.

Step 4: Publication and dissemination
The guidebook will be published online and the project partners will work to disseminate it widely through the ESIP network and additional data tools developer networks, including the ESIP GitHub organizational account. Within a year of project completion, project leaders will present the results of this project at a ESIP meeting.

Description of additional funding currently supporting this work: Associated Universities Incorporated (AUI) supports the work of NEREID, which allows Catherine Cramer and Stephen Uzzo to participate in ESIP activities such as the 2020 Winter Meeting Education session.ESIP supported the initial recruitment and involvement of the teachers who will participate in this project by funding their participation in the 2020 Winter Meeting.

Outreach

What groups/audiences will be engaged in the project?
The ESIP Education Committee, local K-12 Earth science educators and ESIP member tool developers will be engaged in the project.

How will you judge the project's impact?
Impact will be assessed through distribution of the final guide, which will be made available for download and promoted through ESIP at the 2021 Winter Meeting, as well as at other Earth and data science and software developer events, and by educational software developers at educator conferences (such as NSTA). Longer term impacts include working with tool developers to improve their tools, and continuing to work with educators to assess and improve data tool use in their Earth science teaching.

How will you share the knowledge generated by the project?
The project will generate an updated detailed guide for Earth science online-tool/software developers, scientists and educators. The guide will be disseminated through an ESIP highlight, winter meeting session, ESIP GitHub organizational account and social media.

Who (agencies/individuals) should be aware of this project, i.e. potential outreach targets?
Earth science researchers, educators and tool developers via conferences and online networks.

Project Partners

Description of project partners (agencies/individuals) and their involvement:
Catherine Cramer is Lead Facilitator for NEREID (*Network for Earth-space Research Education and Innovation with Data),* the purpose of which is to catalyze a network of practitioners across academia, education, industry and research to identify, leverage, amplify, and scale efforts to conduct research, develop tools, and engage communities of learners and policymakers at the intersection of Earth and space science. As Project Lead she will plan and execute the project goals and outcomes in collaboration with the Project Partners. Stephen Uzzo, PhD. is co-facilitator for NEREID (and Chief Scientist for the New York Hall of Science), and will collaborate in all project activities and help author the guide. Becky Reid, M.S.Ed, is ESIP's current Education Committee Chair, science educator, and independent consultant. Shelley Olds, PhD Candidate in Natural Resources and M.S.Ed Instructional Systems Development, ESIP Education Committee member, science education expert, and data tool advocate, is currently collaborating with Concord Consortium to bring coding and geoscience together for secondary students and detailed part-time to USGS ShakeAlert Program from UNAVCO as their Geodetic Education Resource Coordinator. Both Becky and Shelley will coordinate educator involvement and help author the guide.

How will this project engage members of the ESIP community:
ESIP community members are already engaged! As stated above, this project was inspired by conversations that took place between local educators and ESIP members at the 2020 ESIP Winter Meeting. Both during and after the meeting sessions involving educators, ESIP members in attendance related how valuable it was to hear from teachers themselves. This project will *broaden* ESIP member engagement, not only by including ESIP members in the development of the guide, but by making teacher experiences and insights available to all interested ESIP members. ESIP Education Committee members and ESIP member tool developers are integral to the success of this project, and will continue to be engaged over time. In addition, ESIP membership will be called upon to review the guidebook, as well as to disseminate it in its final form.

References
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[6] Ledley, T. S., Prakash, A., Manduca, C. A., and Fox, S. (2008), Recommendations for Making Geoscience Data Accessible and Usable in Education, Eos Trans. AGU, 89(32), 291– 291, doi:10.1029/2008EO320003.
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[8] Data Access Working Group: https://serc.carleton.edu/usingdata/dawg/index.html