Coding in the Geoscience Classroom

Shelley E. Olds[1] Amy Pallant[2] , Kalo Haslem[3] , and Becky Reid[4]

[1]UNAVCO, [2]Concord Consortium, [3]Capitol Encore Academy, [4]Cuesta College)

Abstract

» Many disciplines within the geosciences require computational skills to access, analyze, and visualize data. These are skills students need to be competitive in the work environment. Applying computational thinking and basic coding into the classroom can diversify student learning, develop 21st century skills, and demonstrate real world applications through project based learning. Teaching students to have a broad base of knowledge and a range of skills is paramount in developing career ready-students.

» Working in collaboration with Concord Consortium and members of the Earth Science Information Partners (ESIP) Education committee, education professionals from UNAVCO, NOAA, Cooperative Institute for Mesoscale Meteorological Studies (CIMMS) and teachers from schools around the country are exploring the use of basic coding and programmable robots as a springboard to learn computational thinking and skills within an Earth science context. By encouraging teachers to learn how to code, we help them to encourage their students to be creators, more than just consumers, of the technology around us and to foster curiosity that whets their appetites to learn more!

» This presentation will elaborate upon coding in the classroom initiatives these partners are facilitating from workshops, learning materials, and insights from workshop feedback.

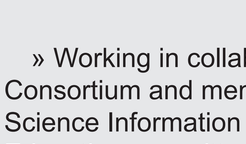
Computing in the Classroom Coding, Gadgets, and STEM

July 2018 | Educators Workshop | ESIP Summer Meeting | Tucson, Arizona

» Goal: To familiarize science teachers with computer tools that facilitate data exploration through coding and coding gadgets.

» Sessions: Scratch coding to model wind blowing dust & sand; Ozobots & Makey Makey

» Participants 13 teachers & 20 researchers



Pre-workshop

Post workshop

» "Outstanding, took away apprehension, I can teach this!"

» "Great emphasis on how to implement in the class-room at any level."

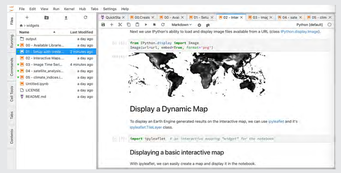
» "Exciting, can immediately use in the classroom."

»"I loved this and am full of ideas on how to use scratch to teach content."

Learn to Code Initiative for Teachers: Jupyter Notebooks with ESIPhub

FY2019| ESIP Education Committee | Jupyter-driven coding activities

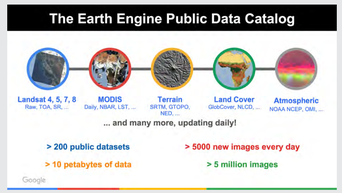
» Goal: Provide teachers geoscience coding examples within a Jupyter environment that they and their student can modify and enhance to foster their curiosity and whets their appetites to experiment further.



Project objectives:

» Remix/ develop Jupyter notebooks that illustrate geoscience visualizations or Earth science process.

» Share Jupyter-driven activities during ESIP Summer meeting workshop for instructors.



Partners:

Visualizing Geohazards and Risks with Code

FY19-21 | NSF STEM+Computing | Geoscience & Computational Thinking

» Goal: To develop a pedagogical model for integrating science practices with computational thinking practices germane to geoscientists' inquiry into geohazards.

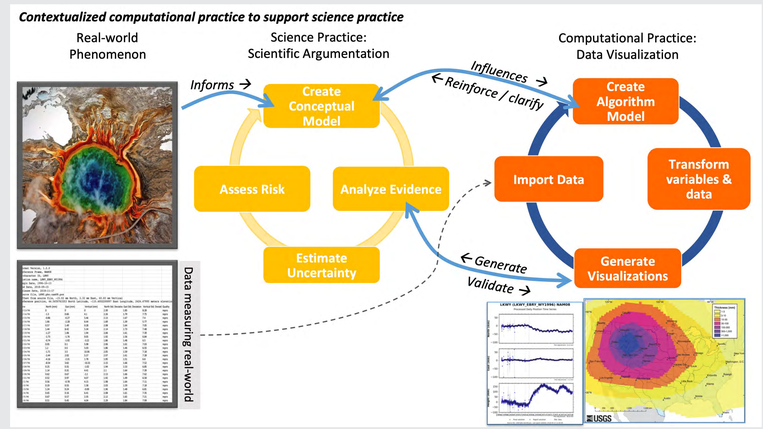
Project objectives:

» Develop a Scaffolded Visualization Programming (SVP) tool.

» Create & test NGSS-aligned science curriculum materials.

» Conduct targeted research on student learning.

» Disseminate project products and research findings.



Scientific Practice

» Create a conceptual model understanding of geohazard systems

» Analyze the evidence based on computational visualizations & validate

» Estimate uncertainty by comparing the strengths and weaknesses of arguments

» Make claims about risks

Computational Practice

» Define variables from conceptual model & import data

» Model the variables & data through algorithms to describe the phenomena

» Transform data & variables

» Generate visualizations to explain the geoscience concepts

Partners

Acknowledgments

This work is based on materials provided by the UNAVCO Education and Community Engagement Program with support from the National Science Foundation (NSF) and National Aeronautics and Space Administration (NASA) under NSF Award EAR-1261833 and EHR DRL-1841928.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.