Project Director:
Heather Almquist, Ph.D.
Associate Researcher, College of Arts and Sciences
The University of Montana
heather.almquist@umontana.edu

Project Co-Director:
Lisa Blank, Ph.D.
Professor, PJW College of Education and Human Sciences
The University of Montana
lisa.blank@umontana.edu

Using Google Earth as a Transformative Data Analysis Tool

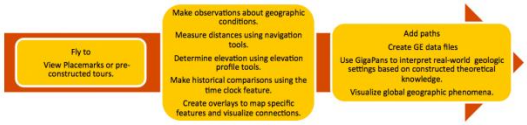
Digital tools such as Google Earth (GE) are revolutionizing the work of scientists, but the same cannot be said of teachers in the classroom. Many classroom applications of GE limit students' involvement to passive observation of pre-developed tours. The CE^3 project focuses on getting students to use GE as a geoscientist would – to view, explore, and create geospatial visualizations and employ model-based reasoning that advances scientific understanding.

In the first year of the project, the CE^3 team developed a 4-week unit entitled, "Does the Earth's structure affect you?" (Figure 1).

Figure 1: Curriculum Pathway

Students learned how to develop scientific explanations using a Claims, Evidence, and Reasoning strategy (McNeil, et al 2006). The GE curriculum pathway supported students as they progressed from making simple observations in the GE environment to creating their own data files and overlays to evaluate and visualize data (Figure 2).

Figure 2: GE Pathway



In year two, the curriculum was piloted in ten classrooms. Each student completed a pre- and post- assessment of earth science content, science identity, and scientific reasoning. Teachers completed a pre- and post- TPACK assessment and submitted teaching artifacts. As well, one classroom case study was completed employing a quasi-experimental design.

Two research questions were explored:

- To what extent does the implementation of the CE^3 curriculum increase teachers' knowledge, self-efficacy, skills, actions, and leadership potential related to the effective use of Google Earth as a transformative data collection and analysis tool.
- To what extent does the implementation of the CE^3 curriculum increase students' science identity, interest in and motivation for learning earth science, and understanding of volcanoes, earthquakes, and plate tectonics.

In year three we are analyzing data and revising the curriculum based on our findings. The student data show that the curriculum resulted in statistically significant gains in content knowledge, but retention was a challenge and similar improvements in the ability to create scientific explanations was not observed.

Teachers found the development of scientific reasoning skills takes significant time and intentional scaffolding. The data suggests proficiency in creating science explanations is highly dependent on students' reading ability. Students learned how to use the vast amount of data available on GE to ask and answer their own questions; those students with high math competencies were most likely to use GE to create their own data. Efforts to scale up the curriculum will require sustained teacher professional development and support, adequate classroom bandwidth, and flexible district firewalls.