Understanding Weather Extremes with Big Data: Inspiring Rural Youth in Data Science

Challenge: As scientific discovery becomes ever more data-driven, there is a critical need to build a scientific workforce with robust skills in scientific modeling and large-scale data analysis. Nowhere is the need to strengthen learning opportunities greater than in rural areas, where a majority of the nation's school districts reside and where under-investment persists.

Strategy: The **WeatherX project** is developing and studying curriculum units for middle-school science to promote scientific modeling, data practices, and interest in data science among rural students. This early-stage design and development project aims to engage students with investigations of extreme weather events on Mount Washington (MW), NH, often called the "Home of the World's Worst Weather," as well as in their local communities. Students will use the online modeling and data visualization tools SageModeler and the Common Online Data Analysis Platform (CODAP), as well as large-scale data from MW and the National Center for Environmental Information (NCEI).

Research Questions

RQ1. What is the feasibility of using WeatherX units in participating classrooms?

RQ2. How do teachers enact WeatherX units?

RQ3. What are the mechanisms by which WeatherX units and their enacted components may have an impact on student learning and interests?

RQ4. To what extent do students who work through WeatherX units show improved understandings of, abilities in, and interest in scientific data analysis, modeling, and earth or data science careers?

Research Design

- Design-based and mixed-methods
- 2019/20: MW unit development & alpha testing
- 2020/21: Local unit development & alpha testing, MW revisions & beta testing
- 2021/22: Local unit revisions & beta testing, data analysis and dissemination

Participants

- 5-7 middle-school science teachers (targeting gr. 8) and over 300 students in rural districts in northern New Hampshire and Maine each year

Data

- Classroom observations
- Teacher implementation logs
- Teacher focus group & individual interviews
- Student focus group interviews
- Student work samples
- Student online screencast recordings
- Pre- and post-unit assessments
  - LOCUS (Jacobbe et al., 2014); Graph Understanding Test (Lai et al., 2016); Academic interest (Linnenbrink-Garcia et al., 201); STEM-CIS (Kier et al, 2014)

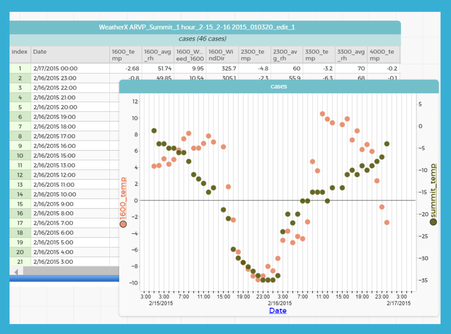
Analysis

- Qualitative data: *A priori* and open coding to explore how unit design features may be associated with student outcomes
- Quantitative pre/post assessments: Matched-pair dependent sample t-tests; OLS regression to explore association between post-test scores and unit implementation, controlling for pre-test

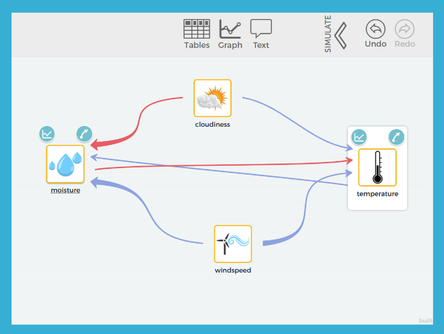
WeatherX is developing middle-school curriculum units that investigate extreme weather events to promote scientific modeling, data practices, and interest in data science careers among students in rural areas.

Extreme Weather

Rural Middle Schools



Big Data



Scientific Modeling

Key Curriculum Components

- Students create scientific models of extreme weather events and test and refine models with authentic weather data
- Use of visual, online, scientific modeling and data analysis tools (SageModeler and CODAP) to emphasize conceptual understanding over calculations
- Multi-week units based on a coherent storyline through which students discover and build on scientific ideas to explain extreme weather phenomena
- Students connect with community members who are deeply knowledgeable about the local weather to strengthen the cultural relevance of students' learning
- Units integrate a *Chat with a Scientist* component, where students interact with weather scientists from MW through online chats, video demonstrations, and video live sessions to build understanding of and interest in data science careers

Project Team

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Take a picture to view the full project overview

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