Integrated Data Project: Leveraging Variable Data to Support Student-Generated Explanations of Weather

difference MAKERS | WOMACK EDUCATIONAL LEADERSHIP | MIDDLE TENNESSEE STATE UNIVERSITY

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CAREER: Supporting Model Based Inference as an Integrated Effort Between Mathematics and Science #1942770

Introduction & Background

Motivating Problem

Students need a coherent experience across mathematics and science when learning to make claims with data.

Project Goals

1) Design investigations that coordinate learning experiences across mathematics and science classes
2) Develop design principles and knowledge about students' data modeling practices

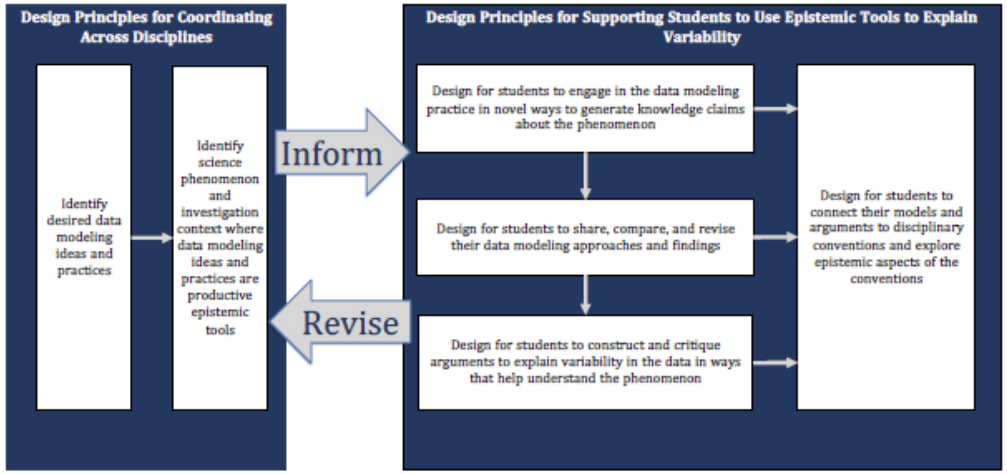
Context & Methods

We use Design Based Research methods in partnership with two middle schools in the south & south-central regions of the USA. The schools serve an ethnically, linguistically, and economically diverse population of students.

Motivating Literature & Theory

1) Data modeling is the practice of making claims in the midst of a ***variable world*** (Lehrer & Schauble, 2004; Lehrer & English, 2018; Petrosino et al., 2003; Bargagliotti et al., 2021).
2) This practice requires a coherent coordination of an ***interdisciplinary*** set of ideas (Cobb & Moore, 1997; Rodgers, 2010; Wild et al., 2018).
3) Students should be supported to see these ideas and practices as ***epistemic tools*** to generate claims and to use them in ways that are epistemically congruent with professional practices (Forman & Ford, 2014; Ford, 2015; Manz, 2015; Manz, 2020).

Integrated Data Project Design Framework



Tentative Findings

Students' explanations of variability create opportunities to learn about scientific phenomena.

1) Students drew upon their prior knowledge about weather phenomena to explain the variability of temperatures at a single moment in time. These explanations included ideas about wind, precipitation, clouds, angle of the sun, and environmental factors, such as the height of the weather station and the proximity of weather stations to roads.
2) Students noticed relationships between temperature data and other variables such as time of day, wind direction and humidity. Students used weather data to make claims about the movement of air masses, i.e. cold fronts, to explain variability in temperature data.

Students use and extend data visualization and statistical ideas and practices from their mathematics classes to generate claims about scientific phenomena.

1) Students used a variety of data visualization strategies from to make sense of their weather data including ordering the data, indicating frequency of values, using scale, and using color to communicate attributes of the data.
2) Students used mean, median, and mode to provide evidence for their claims. They often justified their choice of measure of center to support their claim.

Students need support to develop epistemic agency.

1) Students were hesitant to evaluate their peers' models and claims using data.
2) Students sometimes did not use data to justify their claims but relied on their ideas and explanatory models

Structuring Science Investigations to Explain Variability