An invitation:

Bowdoin | Gulf of Maine Research Institute (Science. Education. Community.) | Vanderbilt University | The Concord Consortium

Our project focuses on supporting students and teachers to develop "a modeling orientation" to science. We invite you to contribute your thoughts **here**. (Link not working? Type **bit.ly/DMOSQuestions** in your browser.)

- What does it mean to have "a modeling orientation" to science?
- Can you describe it? Do you know it when you see it or hear it?
- How might you measure its presence/absence/extent?
- To what degree is its expression by professional scientists a model for students and teachers?

Need inspiration? See our two videos in the Files section of this project poster site or at **bit.ly/DMOSCalhoun** and **bit.ly/DMOSNye**.

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What is the context for the work?

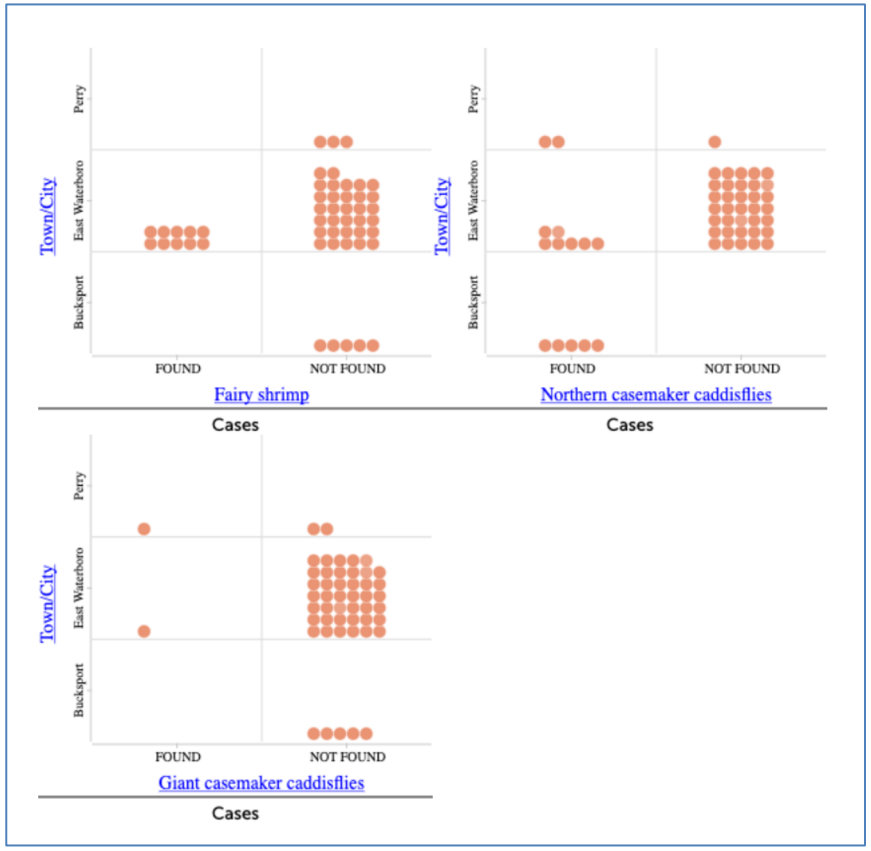
Since 2009, GMRI's Ecosystem Investigation Network has partnered with teachers and scientists to design and support classroom-based **citizen science investigations** of the impacts of climate change on key ecosystems across the state of Maine. These investigations are the context for our research.

DMOS will attend to the divide between how scientists use models and how teachers and students use them by situating inquiry with models within *context-embedded*, *purpose-driven* citizen science investigations.

We posit that as students develop a greater repertoire of models of change and variability, both their questions about and their understanding of ecological systems will expand in complexity and power.

What is the context for the work?

An example is the Vernal Pool Macroinvertebrate Investigation. Vernal pools fill up with melting snow and springtime rain and dry out in hot, dry summer and fall weather. The species that live in and around these pools rely on this cycle for food, protection from predators, and to reproduce. As the climate warms, scientists predict spring in the Gulf of Maine will get warmer and wetter. How will these changes affect vernal pools?



See the video (in the Files section of this project poster site) to listen in on a segment of conversation with Vernal Pool scientist, Dr. Aram Calhoun. Video can also be found at: bit.ly/DMOSCalhoun

Sample data collected by youth using the vernal pool protocol – presence/absence of key species.

What is the context for the work?

The research location is the classrooms of 12 collaborating teachers (grade 5-8) drawn from 7 communities across Maine.

Participating schools' FRPL rates range from 8% to 75%. School populations range from 297 to 775 students. Student demographics range from <1% to 44% minority students and from <1% to 27% English Language Learners.

Demographics for the study populations are representative of shifting demographics in Maine, which includes large areas of rural poverty, more affluent suburban areas, and growing urban centers with rapidly increasing immigrant and refugee populations.

What questions are examined in the work?

- How does student participation in different forms of modeling (physical microcosms, data modeling, dynamic system modeling) influence their understandings of variability and change in ecosystems? How are these understandings related to their participation in field investigations?
- How do students conceive of and exploit relations among these forms of modeling?
- How and to what extent does teachers' engagement in a PLC around modeling situated in the context of citizen science affect their comfort and proficiency with modeling ecosystems and with how they support student efforts to model?

What are your research design, data collection, and data analysis methods?

The project uses a design-based research (DBR) approach to provide evidence regarding the learning environments, tools, and teacher professional learning experiences that support the development of students' and teachers' practices and conceptions of modeling.

Cycles of DBR will support iteration of two aspects of the program:

- Classroom supports (curriculum, tools) for engaging in multiple forms of modeling (physical microcosms, data models, system dynamics models)
- Teacher professional learning experiences including multi-day institutes and a professional learning community

What are your research design, data collection, and data analysis methods?

The project was intended to launch in September 2020 with a long period of baseline research conducted in classrooms. The pandemic forced a more flexible approach to building the team's understanding of students' and teachers' current conceptions regarding models and modeling.

Going forward, primary data collection methods include:

- Observation and video records aimed at capturing student invention/ appropriation of models, model critique, and intersections of forms of modeling (e.g., data modeling of behavior of physical microcosms and of larger scale datasets distributed in space and time)
- Individual, flexible student interviews to probe elements of modeling practice, such as constructing visualizations of data in response to questions
- Classroom observations, teacher surveys, and individual teacher interviews exploring teachers' conception of modeling and pedagogical content knowledge regarding models and modeling
- Classroom artifacts of both student and teacher work will support all strands of research

Thanks for visiting!

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