Supporting K-12 Teachers’ Instruction about Water using Scientific Modeling: A View Across Programs

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Overview of Projects

**MoHSES**
- 3rd Grade Teachers using Foss Curriculum
- 3 year professional development
- Co-created and iteratively designed curriculum supplements integrating and supporting elementary students’ water-related phenomena

**Nebraska WETS**
- 1st - 6th Grade Elementary Teachers
- 18 month professional development
- A focus on leveraging scientific modeling and formative assessment to support teaching about water

Supporting Teacher’s Modeling Instruction about Water

**WELS²**
- Middle School & High School Teachers
- 13 month professional development
- Providing Middle and High school teachers science modeling and research experiences around natural resource management, specifically water

**TEAC 315**
- Preservice Elementary Teachers
- 16 week semester course
- Allowing students opportunities to learn more about water systems and developing lesson plans that incorporate science modeling and technology

Types of Educational Supports

**MoHSES**
- Content supplements for teachers specific to their curriculum focused existing models
- Teacher reflection and assessment of their personal classroom needs
- Modeling experiences specifically tailored to teachers’ curriculum and needs, developed iteratively through teacher researcher dialogs

**Nebraska WETS**
- General content supplements for teachers ranging multiple hydrologic concepts
- Integrated activities, readings, and discussion around formative assessment and modeling
- Focused guidance on developing coherent models and discussions

**WELS²**
- Research experiences focused on natural resource systems
- Opportunity to present/write up the research they conduct to science audiences

**TEAC 315**
- Multi-week project focused on developing lesson plans about water phenomena
- Readings, activities, and discussion focused on scientific modeling, technology, and water
- Multiple rounds of peer and instructor feedback focused content and modeling
- Written reflections focused on students’ conceptions about modeling different aspects of water systems

Avenues of Research

Currently, research is being conducted in each of these projects attempting to answer a myriad of questions focused on both teaching and learning. This research is guided by multiple sources including learning progressions focused on elementary students’ learning about water systems (Gunckel et al., 2012) and scientific modeling (Schwarz et al., 2009) which identified levels of knowledge elementary students would likely progress through as they develop conceptual knowledge around modeling hydrological phenomena. Some research questions focus on ascertaining teachers’ conceptualizations and practices around using models in their classroom and this work is guided by previous teacher work (Vo, Forgan, Zangori, Schwarz, 2015). Other questions being explored outline students’ use of models and modeling. This area of our research has focused on student learning gains, model-based explanations, and comparing ideas across groups of students who do and do not use modeling supplements. Another area of research looks into assessing the fidelity of teachers’ modeling implementations in their classroom. Finally, we look into the intersection of content, technology, and scientific modeling and is guided by literature investigating preservice teachers’ ability to model (Braaten & Windschitl, 2011).

Implications

These projects contribute to students’ engagement in scientific modeling by supporting preservice and inservice teachers’ conceptualization and enactment. While model-based curriculum can help bolster and support teachers to provide modeling opportunities other avenues also exist to support teachers and preservice teachers to engage in modeling opportunities for their students. These projects begin exploring different ways to support the plethora of needs teachers across K-12 have which would be of interest to curriculum designers, teacher trainers, and professional development providers who want to align with NGSS’s ideas on scientific modeling within elementary contexts. It is important that elementary teachers understand and incorporate scientific modeling into their classrooms, leveraging this information to provide opportunities for students to engage in complex scientific ideas. To that end, we must acknowledge the supports needed for teachers can be exhibited very differently.

References


