Supporting students' meaningful engagement in scientific modeling through epistemological messages: A case study of contrasting teaching approaches

Li Ke; Christina V. Schwarz

Tweet. *How teachers talk about the goals and purposes of scientific modeling influences students' modeling practice.*

AUDIENCE. Curriculum developers; Informal educators; Formal educators

KEY POINTS
- Scientific modeling is a key NGSS practice that should be enacted in a way that reflects the disciplinary norms and values.
- It is important for teachers to address the goals and purposes of scientific modeling to make it meaningful for students.
- How teachers frame the goals and purposes of scientific modeling influences how students take up the practice in turn.
- To support students' meaningful engagement in scientific modeling, teachers need to make explicit and prioritize the goals and purposes of modeling among other school-based goals they have to attend to.

INTRODUCTION. Scientific modeling is a critical practice identified in the Next Generation Science Standards that many argue should be the centerpiece of the curriculum. However, many teachers struggle with enacting modeling practice in classroom and do not know how to support the practice in a meaningful way. We argue that, in order to make the practice meaningful, teachers need to address the goals and purposes of scientific modeling. In this study, we examined two elementary teachers' talk about the goals and purposes of modeling in classrooms, and how that in turn influenced students' take up of the practice in group work.

FINDINGS. Each teacher was sharing complex messages about various aspects of the modeling practice ranging from procedural to epistemic. Further, those messages were then reflected in students' consensus modeling work. One teacher focused on supporting students within a community of practice to develop their understanding of 'how' and 'why' phenomena happen and how their models could be applied to other phenomena. In this teacher's classroom, students' group work reflected these messages. Conversely, the other teacher asked students to take turns including factual information in their models and finish the tasks so they could proceed with the unit. Students' group work indicated a largely procedural view of models as end products to reveal their accurate knowledge rather than sense-making tools.

TAKEWAYS. There are multiple messages about the goals and purposes of modeling that teachers need to be cognizant of attending to during model-based instruction. The extent to which teachers prioritize or background certain messages is likely to influence how students view the importance of different messages, thus have a profound impact on student practice in turn. Further, it is important for teachers to make explicit the epistemic goals of modeling and talk about them consistently across modeling contexts over time. In addition, it is crucial for teachers to unpack, contextualize, and scaffold the abstract goals into operationalizable actions so that they are accessible to students.