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Purpose and Questions Investigated
The Next Generation Science Standards and Common Core State Standards emphasize literacy and inquiry practices that together position learners as producers, not merely consumers of science. For students to have opportunities to learn how to engage in the scientific and literacy practices, science teachers must first come to understand and value these practices as ways of engaging in and learning science. The Project READI Teacher Inquiry Network, a four-year teacher-researcher partnership, was convened to explore epistemologies and practices for reading to support evidence-based argumentation in the disciplines and to collectively design ways of implementing these practices in middle and high school classrooms. The inquiry network met six times per year and included observations in participants' classrooms. These observations uncovered competing conceptions of science models, none foregrounding explanation nor explanation development, fundamental purposes of science models. Furthermore, argumentation that focused on model construction and critique, ignored salient attributes such as extent to which models explained all of the information and evidence. In this paper, we analyze the science teacher-participants' shifting conceptions of reading, models and argumentation that emerged in the READI Teacher Inquiry Network meetings and explore the potential implications of these for students' opportunities to learn in science classrooms.

Research Context or Methodology
To uncover supports and scaffolds for reading and argumentation for model construction and critique, we enacted and unpacked a set of reading and model construction tasks with the inquiry network science teachers followed by collaborative planning. The reading and model construction tasks, including an initial discussion of science models, a reading and discussion about science models, a subsequent hands on investigation, reading to support theorizing, collaborative model construction and peer critique, and the collaborative planning were videotaped and transcribed. Drawing on grounded theory and a view of discourse as "a form of social action that plays a part in producing the social world – including knowledge, identities, and social relations", our initial analysis uncovered shifts in teacher conceptions of science models and instructional purposes for science models. Segments of talk and interaction featuring discussion of models were coded for conceptions of science models and conceptions about students' construction of science models. The discourse was analyzed for shifts in both codes throughout the reading and model construction tasks and planning.

General Statement of Findings

Analysis of the initial discussion of science models uncovered multiple conceptions of models: as *representations* of a phenomenon that can facilitate content learning, as *surrogates* for something of study that is too small to be seen or too big or dangerous to investigate directly, and as *analogies* for the target science concepts. Each of these conceptions align with a concept attainment framework rather than science practices and epistemology. Analysis of the discussion of an article on science models uncovered the conceptualization of models as conceptual understandings students may have of how phenomena work as well as competing conceptualizations of the affordances and pitfalls of students constructing their own models. This further conceptualization anticipated exploration of model construction as a way in which students build increasingly evidence-based understandings over time, an approach aligned with science practices and epistemology. Analysis of the discussions during collaborative planning uncovered consistent conceptualization of models as explanations of phenomena and model construction as the work of students, all well aligned with science practices and epistemology. The set of reading and modeling tasks and collaborative planning supported the clarification of the relationship between science modeling and explanation and the design of supports for students reading and argumentation for science modeling. As a caveat, the inquiry network teachers have extensive background in science and literacy. Their understandings of what teaching science to youth entails were more in harmony with the CCSS and NGSS than is probably typical of science teachers.

Implications

If we are to move beyond content literacy approaches that enable students to access content and acquire science knowledge, to disciplinary literacy practices that engage students in constructing and critiquing scientific explanations, we must find productive ways to engage and transform science teachers' understandings, values, and goals for science teaching. We believe our work suggests that collaborative design research to build interventions may be a powerful vehicle for teacher learning. More specifically, the reading and modeling tasks we enacted and unpacked together became a powerful vehicle for clarifying teachers' diverse conceptions, building their appreciation of the importance of explanation and model building, and resolving their skepticism. Enacting and unpacking the very pedagogies envisioned in the NGSS and CCSS with teachers may therefore, we claim, be both a vital and a powerful support for teacher uptake of the pedagogies and practices of the NGSS and CCSS.

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