Poster 10:

Integrating NGSS Core Ideas and Practices: Supporting and Studying Teachers' Implementation

Authors: Jo Ellen Roseman, American Association for the Advancement of Science
Cari F. Herrmann-Abell, American Association for the Advancement of Science
Non-presenting author: Rebecca Kruse, National Science Foundation

Perspectives of the teacher-curriculum relationship and implications for the development of educative curriculum materials (Ball & Cohen, 1996; Davis & Krajcik, 2005; Remillard, 2005) suggest that curriculum materials can be powerful tools in supporting teachers implementation of the *Next Generation Science Standards* (NGSS Lead States, 2013), provided they (a) align with and support teachers' understanding of learning goals, (b) employ instructional strategies that support student learning and help teachers understand the pedagogical purpose(s) of each activity, and (c) include assessments to help teachers monitor their students' progress, provide students with feedback, and inform instructional decisions.

This poster describes a curriculum-focused research study and, specifically, our efforts to support and understand teachers' implementation of explanation writing with this NGSS-aligned curriculum. Over 5 years, we developed an 8th grade curriculum unit that (a) aligns to physical and life science core ideas and crosscutting concepts about atom rearrangement and conservation, and (among others) the science practice of explanation to make sense of phenomena involving chemical reactions in non-living and living systems; (b) supports teaching and learning through sequenced activities and scaffolded tasks that guide students' reasoning about phenomena and underlying molecular mechanisms; (c) includes embedded assessments requiring students to construct explanations of phenomena that allow teachers to elicit students' initial ideas and skills and monitor their progress; and (d) supports teacher learning through print and online teacher resources and professional development.

In Year 3, both teacher feedback from examining their students' written explanations and our own analysis of student explanations on pre- and post- test explanation items (Herrmann-Abell et al., 2014) indicated that additional scaffolding was needed. In Year 4 we increased explanation support and evaluated the effect on the quality of student explanations by comparing the scores for three explanation items that appeared on the pre- and post-tests in both Year 3 and Year 4. Teacher responses to surveys and examination of student notebooks indicated that teachers used the scaffolds, and results of small-scale studies indicated that the quality of student explanations increased more in Year 4 than in Year 3. However, student notebooks revealed that teachers were providing little or no written feedback to their students. In Year 5 professional development, teachers practiced scoring student explanations on embedded tasks and considered strategies for providing feedback efficiently. While teaching the unit, teachers were given financial incentives to evaluate explanations of a representative sample of their students, summarize findings across the responses they sampled, and provide feedback to students. A comparison of teacher ratings to ratings of experts was used to determine how well teachers used the rubrics. Consistency between teacher and expert ratings positively correlated with teachers' years of experience implementing the curriculum and number of exposures to our curriculum-based PD. As in Year 4, few teachers provided written

feedback to students on their explanations. However, teachers did report using more efficient strategies such as having students self-score some of their own explanations those of their classmates.

The significance of these findings suggest that realizing the vision of NGSS may exceed typical instruction in U.S. classrooms, and that high quality curricular supports, curriculum-based professional development, and other incentives may be needed to support teachers' effective implementation of this vision.

Note: This poster is one of ten presented as part of a structured poster session entitled Designing for Teacher Learning and Enduring Reform within Science Education *organized by Carrie D. Allen, University of Colorado Boulder, and Sara C Heredia, Exploratorium, San Francisco, CA, for the annual conference of the American Educational Research Association in Washington, DC, April 8 -12, 2016.*

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