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K-12 PER I

Committee on Physics in High Schools | **Co-Sponsor:** Committee on Research in Physics Education | **Type:** Inv/Con | **Organizer:** Dan Crowe

Description:

Call for Papers: If you conduct research on how K-12 students learn physics concepts, please submit a presentation to this session.

Abstracts Submitted (# 7)

Abstract Title: Consensus Paragraphs to Promote Connections Between Inference and Physics Principles

Paper Type: Contributed

Author: Nicole B. Schrode
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Speaker Order: CA03

Students often have difficulty integrating what they observe and infer in high school physics class with more formal scientific principles. Our Teacher Research Team is using "consensus paragraphs" in the form of Claim, Evidence, Reasoning (CER) writing assignments to assess how students integrate evidence and inference with more general principles and abstract, conceptual ideas. After each Physics and Everyday Thinking-High School learning cycle (Initial Ideas, Collecting and Interpreting Evidence, Consensus Discussion, Scientists Ideas, and Math concepts) our students write consensus paragraphs in a CER format. We then apply a rubric to assess how well they use each of the CER elements and compared our CER data to data from a more traditional physics class. We will discuss observed differences in students' use of evidence and what type of evidence students use to support scientific claims.

Footnotes: Additional authors Luke Degregori--University of Colorado--undergraduate Valerie Otero--Katherine Eason--University of Colorado--undergraduate

Conflicts: Additional authors Luke Degregori--University of Colorado--undergraduate Valerie Otero--Katherine Eason--University of Colorado--undergraduate

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Abstract Title: Contributing to Meaning Making: Facilitating Science Discourse

Paper Type: Invited

Author: Scot Hovan
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Speaker Order: CA02

The Next Generation Science Standards (NGSS) identify eight practices as essential to science and engineering, and several of these practices expect students to engage in scientific discourse. Modeling Instruction is one movement in physics education that organizes high school physics content around a small number of student-derived scientific models, and it relies on student discourse for the design, development, and deployment of these models. This presentation shares the findings of a self-study of one high school physics teacher's experience facilitating large group discourse in the high school modeling physics classroom. The analytical framework by Mortimer and Scott (2003) was used to characterize the classroom talk and the discourse facilitation moves that were employed, and elements of discourse analysis were used to examine some of the tensions that were experienced in the facilitation of this discourse.

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Abstract Title: Investigating STEM Beliefs and Practices of Physical Science Teachers

Paper Type: Invited

Author: Emily A. Dare
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Speaker Order: CA01

Recent national documents call for improvements in K-12 STEM education to increase STEM literacy and motivate students to pursue STEM fields (National Research Council, 2013). However, there is a lack of opportunities for teachers to participate in integrated STEM-related professional development and develop their own STEM-integrated practices. Further, there is little research devoted to understanding teacher perceptions of the nature of STEM integration. By examining classroom practices and understanding teachers' experiences, we can learn how to prepare these teachers to bring scientific and engineering practices to their classrooms. This presentation focuses on two studies that examine the integration of STEM in middle and high school physical science classes, where the four disciplines represented by STEM frequently intersect. Through analyzing data from both observer and participant perspectives, our work aims to better understand the successes and challenges that science teachers face as they work to bring integrated STEM to their classrooms.

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Abstract Title: Modeling Physics in Urban High Poverty High Schools

Paper Type: Contributed

Author: M Colleen Megowan-Romanowicz
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Speaker Order: CA07

We worry about diversity in the physics community, and a number of programs have been developed at the undergraduate and graduate levels to support women and minority students who major in physics. There is less support for these students at the pre-college level. It is left to individual teachers to find ways to connect with students, to ignite their interest and to encourage them to pursue a college degree. Teaching high school physics in an urban high poverty setting entails a number of unique challenges (e.g., attendance, turnover, ELL, resources, school counselor biases, culture) that are not encountered in the suburban middle class schools. I will report on the results of a survey of Modeling physics teachers who work in urban poor schools and illustrate findings with case studies that reveal both the barriers and the affordances they encounter and how teachers navigate them.

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Abstract Title: Professional Development of Physics Teacher Leaders in a Professional Learning Community (PLC)

Paper Type: Contributed

Author: Smadar Levy
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Speaker Order: CA06

A physics teaching team at WIS enacts a PLC of physics teacher-leaders leading 10 regional PLCs of high school physics teachers (200 teachers) all over Israel. The PLCs aim to develop student-centered and engaging teaching. Using a "fan model" led by the WIS team, 25 physics teacher-leaders meet every two weeks for four hours throughout the year preparing the consecutive meetings of their PLCs. Prior to these meetings, the teacher-leaders engage as learners in research-based teaching strategies; implement customized-versions in their classes; reflect collaboratively with peers on evidences from their practice; and conceptualize the learning process. These stages act as a model for running their own PLCs and are supported there by insights gained in the previously described process. Research indicates that the teacher-leaders develop a strong sense of community; deepen physics knowledge (CK) and pedagogical content knowledge (PCK); and acquire leading skills. The rational and the model will be elaborated.

Footnotes: Bat Sheva Eylon

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Abstract Title: Professional Development Promotes Deeper Understanding by Teachers Analyzing Teacher Responses

Paper Type: Contributed

Author: Carolina Alvarado
University of Maine

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Speaker Order: CA05

In the Maine Physical Science Partnership (NSF #0962805) we held a collaborative pedagogical development session where K-12 science teachers analyzed their own responses to open-ended questions regarding a specific energy scenario. Teachers were not aware that the data included two teachers' responses from two consecutive years. The second year teachers' responses showed a refinement in the understanding of energy compared to the first year responses. After analyzing each of the four responses, teachers expressed a stronger preference for the second year responses, consistent with the researchers' observation of growth. At the same time, teachers moved from an evaluative mindset to the recognition of the useful ideas shown in all the teachers' answers, including those which first were evaluated negatively. In addition, during this discussion, teachers created a collective answer that they noted was far richer than what any of them had individually stated before.

Conflicts: I am part of the International committee, I would appreciate if it can be scheduled not during the committee meetings.

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Abstract Title: Teacher Growth in Pedagogical Knowledge of Energy in the MainePSP

Paper Type: Contributed

Author: Michael Carl Wittmann
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Speaker Order: CA04

As part of the Maine Physical Sciences Partnership (NSF #0962805), we have studied middle school teachers' growth in their knowledge of both energy concepts and students' ideas. A subset of the teachers in our partnership have answered multiple survey questions over several years, allowing us to compare their responses over time. We analyze two questions from our survey in terms of both content knowledge (what their answers are) and knowledge of student ideas (what they think the most common incorrect answer will be). We find improvement in all teachers' responses over time. We believe that these improvements are due at least in part to the professional development activities of our project: use of hands-on learning materials with teachers to promote content understanding, engagement in student data from the energy survey, and a culture of community-building and shared professional expertise.

Conflicts: I would like this talk to be scheduled separately from the talks by Alex Axthelm, Greg Kranich, and Carolina Alvarado. Thank you.

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Date Last Updated: February 4, 2011