Enhancing scientists’ skills for providing standards-based K-8 teacher professional development

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RATIONAL END

Current national science teaching standards require teachers to incorporate the knowledge and practices of science and engineering into their classroom teaching of core content. These expectations present challenges for teacher professional development providers working with elementary teachers and middle school teachers who were prepared as generalists with only limited coursework or experience with science research.

At the Center for Science and the Schools (CSATS) at Penn State, we have been addressing these challenges through a collaboratively developed teacher professional development program for K-8 teachers called Saturday Science Workshops. A series of 5-7 one-day workshops offered over the course of each academic year.

CHANGING UNDERSTANDING

One goal of this teacher-scientist partnership is to move both teachers and scientists away from a transmission approach to teaching, to reform-oriented practices such as inquiry-based teaching.

Traditional Researcher Workshop
- Lecture based
- Demonstrations
- Few hands-on activities if time
- Little, if any, reflection time

CSATS Supported Researcher Workshop
- Small group learning
- Learner centered
- Mini lectures to introduce or reinforce concepts
- Inquiry-based to replicate the practices of science
- Embedded reflection time

HELPING SCIENTISTS UNDERSTAND BEST PRACTICES IN TEACHER PROFESSIONAL DEVELOPMENT

Teaching and Learning
Teaching and learning theory discussions help researchers understand the importance of:
- Teaching science as practices through inquiry-based activities vs content lectures
- Allowing learners to actively participate in construction of their scientific knowledge
- Providing group learning activities to support the socio-cultural nature of learning

Designing Inquiry-Based Lessons
Together, CSATS and scientists create workshop activities that parallel the scientific practices used by researchers including:
- Designing and implementing investigations
- Evaluating data and looking for patterns
- Developing explanations and solutions
- Communicating and justifying solutions (scientific discourse)

Incorporating Teacher PD Best Practices
Designing effective teacher professional development workshops requires incorporating the following elements:
- Designing a coherent workshop storyline
- Providing active learning opportunities
- Working in teams
- Collaborative problem solving opportunities
- Providing opportunities for learning science content
- Developing a community of learners with multiple workshop offerings
- Providing sufficient reflection time

Implementing Inquiry-Based Strategies
Various strategies can be utilized in the design of inquiry-based lessons. They include:
- Using science notebooking
- Incorporating claims, evidence, and reasoning
- Providing background information via mini-lectures
- Collecting, analyzing and presenting data

OUR COLLABORATIVE WORKSHOP DESIGN PROCESS WITH SCIENTSISTS

Communicate with non-technical audiences

CSATS developed the Modeling Authentic Science, Technology, and Engineering Research (MASTER) Model, informed by their work with STEM Researchers. The MASTER model provides a scaffold for helping scientists translate the complexities of their own funded research projects to teachers, who can in turn use this scaffold to work with students to design and implement classroom research projects.

Integrating Next Generation Science Standards

The Framework for K-12 Science Education (NRC, 2012) advocates teaching that actively engages students in science and engineering practices and applies crosscutting concepts to deepen understanding of disciplinary core ideas. As providers of teacher professional development, we include inquiry-based learning activities throughout the workshop enabling teachers to experience how incorporation of those practices and crosscutting concepts can lead to depth of content knowledge.

Utilizing the NRC Framework in conversations with scientists helps familiarize them with reform oriented science education goals. Relevant Next Generation Science Standards (NGSS) and state standards are identified, which inform the workshop design and learning goals.

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COMMUNICATE WITH NON-TECHNICAL AUDIENCES

TESTIMONIALS

1. "We loved having you visit our classrooms and present. Very enjoyable. The ideas were exciting and feasible. They truly helped us improve the instruction in our classrooms. Thank you!!"
   - Grade K-5 Science Teacher

2. "They remind us that we are not alone, that this is a shared struggle. We need to keep pushing the boundaries of what we can do in the classroom. Thank you!"
   - Grade 6-8 Science Teacher

3. "I recommend you to another; you provided great ideas. Still challenging our team, even after three years. Thank you for the amazing work you do!"
   - Grade K-5 Science Teacher