Small Bodies, Big Concepts: Bringing Visual Analysis into the Middle School Classroom.

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Introduction: *Small Bodies, Big Concepts* is a multi-disciplinary, professional development project that engages 5th – 8th grade teachers in high end planetary science focusing on comets and asteroids using a research-based pedagogical framework, *Designing Effective Science Instruction*[1] (DESI). In addition to developing sound background knowledge in solar system astronomy with a focus on visual analysis, teachers' awareness of the process of learning new content is heightened, and they use that experience to deepen their science teaching practice. Culling from NASA E/PO educational materials, activities are sequenced to enhance conceptual understanding of big ideas in space science: what do we know, how do we know it, why is it relevant? Helping teachers develop a picture of the history and evolution of our understanding of the solar system, and honing in on the place of comets and asteroids in helping us answer old questions and discover new ones, teachers experience the power and excitement underlying planetary science as human endeavor.

NASA missions model science inquiry

Research indicates that science inquiry is powerful in the classroom and mission scientists are real-life models of science inquiry in action. Using guest scientist facilitators from the Planetary Science Institute, NASA Johnson Space Center, Lockheed Martin, and NASA E/PO professionals from McREL and NASA AESP, teachers practice framing scientific questions, using current visual data, and adapting NASA E/PO activities related to current exploration of asteroids and comets in our Solar System. Cross-curricular elements included examining research-based strategies for enhancing English language learners' ability to engage in higher order questions and a professional astronomy artist's insight into how visual analysis requires not just our eyes engaged, but our brains: comparing, synthesizing, questioning, evaluating, and wondering.

2012 Field Test, Tucson, AZ

In 2011 we pilot tested the SBBC curriculum with thirteen 5th–10th grade teachers in Denver, CO, modeling a variety of instructional approaches over eight days. Each teacher developed lesson plans that incorporate DESI strategies with new space science content to implement during the coming year in their classroom. Initial evaluation of the workshop showed that teachers left with an increased understanding of small bodies in the solar system, current exploration, and ways to integrate this exploration into their current curriculum. We will reconvene the teachers in the spring of 2012 to share their implementation experiences. The professional development is a year-long effort, supported both online and through future face-to-face workshops. Next summer a field test will be implemented in Tucson, AZ, with evaluation data from the pilot informing best steps for improvement. The result of the project will be a model for implementing professional development that integrates research-based instructional strategies and science findings from NASA missions to improve teacher practice as well as student engagement.

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References:

[1] Tweed, A. (2009). *Designing effective science instruction: What works in science classrooms.* Arlington, VA: National Science Teachers Association.