

STORI AND ORION: BRINGING INQUIRY INTO THE CLASSROOM. L. A. Lebofsky¹, N. R. Lebofsky², D. Sears³, and B. Schmitt⁴, ¹Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721, lebofsky@lpl.arizona.edu; ²The Science Center of Inquiry, 13225 North Verde River Drive, Fountain Hills, AZ 85268, lebofsky@comcast.net; ³Arkansas Center for Space and Planetary Sciences, MUSE 202, University of Arkansas, Fayetteville, AR 72701, dsears@uark.edu; ⁴The Science Center of Inquiry, 13225 North Verde River Drive, Fountain Hills, AZ 85268, bill@thesciencecenter.org.

As part of our ongoing professional development programs, we have developed two hands-on observing programs for teachers in Arizona, Arkansas, and Ohio. The highlight of these programs was providing each teacher with their own telescope to take back to their schools.

STORI (The Summer Triangle: Observing, Research and Inquiry) and ORION (Organizing Research, Inquiry, and Observing Nights) are multi-state efforts to bring both science inquiry, as well as Space Science content, into upper elementary and middle school classrooms in Arizona, Arkansas, and Ohio. ORION is a 2-year project supported by a NASA IDEAS grant, and STORI is an expansion of ORION supported by a grant from the University of Arkansas. ORION trained 18 teachers in the summer of 2004 and an additional 40 teachers in the summer of 2005. STORI trained 8 teachers in the summer of 2005 and will recruit 12-16 teachers for the summer of 2006.

STORI and ORION have created standards-driven and inquiry-based investigations for developing significant understanding of Space Science content that extends across the curriculum. Teachers were given reflecting telescopes that they assembled, aligned, and learned how to use for nighttime observations. They were expected to take these telescopes back to their classrooms and use them with their students, as well as to share their experiences with other teachers in their schools.

Thanks to *No Child Left Behind*, teachers now need to be “highly qualified” in the subjects that they are teaching. Many teachers now have to teach subjects that they may never have had any training in and, while most of their training was probably out of a book, they must now teach inquiry-based science. This deficiency can only be remedied with professional development training and continuing support beyond the training workshop.

Questionnaires covering space science knowledge, with an emphasis on concepts to be taught during the workshop, were administered to all groups at the beginning of their programs. Teachers answered the same questions on the last night allowing them to self-correct erroneous ideas. Program staff clarified any remaining questions. Participants were generally very proud of their content knowledge growth and their observing skills in the span of one week.

The impetus for STORI and ORION was the recently-released Arizona, Arkansas, and Ohio science standards that emphasize scientific inquiry, as well as science content. Both programs provided an innovative approach that was developed from the premise that regular and systemic observations of the day and night sky are an important component in the pursuit of personal observations, questions, and inquiry for constructing standards-based understandings. Thus, the central purpose guiding the implementation and evaluation of STORI and ORION is to infuse

regular sky watching by students into the curriculum in ways that lead to full student inquiry into Astronomy and Planetary Sciences questions that are developed by students themselves.

Examples of Arizona Science Standards (for reference) and the workshop activities that relate to the Standards are listed below:

- **Formulate relevant questions through observations:** watching sunset and the appearances of the Moon and planets, observing the daily and monthly motion of the Moon, identifying constellations
- **Demonstrate safe behavior and appropriate procedures:** *Safe Sun* observing
- **Measuring using appropriate tools:** building and using a telescope, determining the size of your fist
- **Describe the real motion of the Moon and planets:** Earth-Moon scale models, rotation and revolution of the Moon
- **Describe the apparent motion of the Sun, Moon, and stars:** Using a planisphere; *Never-ending Bear Hunt*, circumpolar stars
- **Explain the phases of the Moon in terms of the relative positions of the Earth, Sun, and Moon:** Phases of the Moon, Earth/Sun/Moon relationship
- **Identify the known planets of the Solar System:** Earth-Moon scale model, scale model of the Solar System

Both groups are part of a listserv that provides a forum for questions and comments from the teachers, as well as offering observing challenges formulated by the staff. A monthly newsletter provides tips for what to look for (e.g., prominent constellations in the morning and evening sky, planets, lunar phases, and other celestial events). The newsletter also provides myths and legends from around the world to enhance each month's viewing, as well as features such as tips on how to conduct a successful observing night for students.

Teachers from both programs participated as presenters in workshops at the Arizona and Arkansas state science teachers' conventions. Phoenix area teachers and their students participated in ORION observing nights during the fall of both 2004 and 2005. In addition, several teachers from the 2004 Arizona and Ohio programs returned in leadership roles for the 2005 workshops.