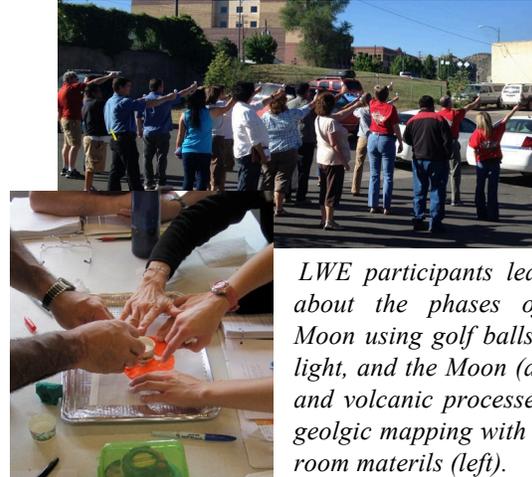


**LUNAR WORKSHOPS FOR EDUCATORS: EVALUATION RESULTS FROM YEAR THREE.** A. J. P. Jones<sup>1,2</sup>, B. C. Hsu<sup>1,2</sup>, K. Hessen<sup>1,2</sup>, S. Buxner<sup>3</sup>, and M. Canipe<sup>3</sup>, <sup>1</sup>NASA Goddard Space Flight Center (8800 Greenbelt Road, Greenbelt MD 20771; andrea.j.jones@nasa.gov), <sup>2</sup>Lunar and Planetary Institute (3600 Bay Area Blvd., Houston TX 77058), <sup>3</sup>Planetary Science Institute (1700 East Fort Lowell Road Suite 106, Tucson AZ 85719).

**Introduction:** The Lunar Workshops for Educators (LWEs) is a series of weeklong professional development workshops designed to educate and inspire grade 6–12 science teachers, sponsored by the Lunar Reconnaissance Orbiter (LRO) and conducted by the LRO Education and Public Outreach (E/PO) Team [1]. Participants learn about lunar science and exploration, gain tools to help address common student misconceptions about the Moon, find out about the latest research results from LRO scientists, work with data from LRO and other lunar missions, and learn how to bring these data to their students using hands-on activities aligned with grade 6–12 National Science Education Standards and Benchmarks. The LWEs are designed based on best practices outlined in pedagogical research of science education [e.g. 2, 3, 4], and facilitators model instructional best practices throughout the trainings. The teacher trainings take place in the summer, and the LRO E/PO team follows up with the participants throughout the following school year to keep participants informed of new science results and activities, answer questions, provide opportunities for participant discussions, and monitor progress as participants incorporate workshop information and materials into their classrooms. LWEs have been held around the country, primarily in locations underserved with respect to NASA workshops and at LRO team member institutions. Where possible, workshops also include tours of science facilities or field trips intended to help participants better understand mission operations or geologic processes relevant to the Moon.

**Evaluation Overview:** The LWEs are evaluated by an external evaluation team from the Planetary Science Institute. The LWE facilitators worked with the evaluation team to develop survey instruments to assess participants' content knowledge before and after the workshops, their motivations for attending the workshop, resources they gained from the workshop, and ways they intended to use workshop materials. Daily surveys at the end of workshop days 1–4 formatively assessed participants' knowledge and were used to monitor participant progress during the weeklong training. Information from the daily surveys allowed facilitators to address lingering questions or make other changes as needed during the workshop. Survey results and lessons learned from each summer workshop allowed for workshop modifications throughout the summer workshop series.



*LWE participants learning about the phases of the Moon using golf balls, sunlight, and the Moon (above) and volcanic processes and geologic mapping with classroom materials (left).*

In 2012, 71 educators participated in one of the four LWEs that were held in Durango, CO; Morehead, KY; Greenbelt, MD; and Fairbanks, AK.

**Data Collection Tools.** Evaluation data were collected using the following tools: Pre-Workshop Survey, Pre-Workshop Assessment, Daily Surveys (end of days 1–4), Post-Workshop Survey, Post-Workshop Assessment, and LWE Follow-Up Survey (fall 2012).

**Evaluation Questions.** The evaluation of the LWEs was framed by the following evaluation questions: 1. What was the overall quality of the workshop? 2. In what way and to what extent did participation in the workshop change participants' knowledge about lunar science and exploration? 3. In what way and to what extent did participation in the workshop change participants' knowledge about student misconceptions about the Moon and ways to address those misconceptions? 4. In what way and to what extent did participation in the workshop contribute to changes in participants' teaching practice?

**Example Evaluation Results:** A selection of LWE evaluation results are included below.

**Changes in Participants' Lunar Content Knowledge:** Participants' knowledge about lunar science, exploration, and LRO were assessed using nine open-ended questions on the Pre- and Post-Workshop Assessments. Questions were developed by workshop facilitators to include target content knowledge that was essential to the workshop and revised with the evaluation team. Every participant who completed the Pre- and Post-Workshop Assessment increased his or her overall score from pre- to post-workshop.

Overall, teachers' self-reported changes and assessed change in knowledge about lunar science and exploration showed gains from pre- to post-workshop aligned with both what they had hoped to learn as well as what facilitators had hoped they would learn. The biggest changes in participants' knowledge were related to current discoveries and exploration of the Moon. Teachers learned about their own misconceptions about the Moon and new ways to teach about lunar science and exploration.

*Overall Workshop Feedback:* At the conclusion of the weeklong summer workshop, participants were asked to rate their satisfaction with the workshop as a professional development opportunity for teachers on a scale from 1 (not at all satisfied) to 10 (this was one of the most outstanding workshops I have ever experienced). 92% of participants rated it an "8" or above. Participants appreciated the excellent quality of the workshop facilitators, information, presentations, and activities. The critiques from the 8% who rated it between a "5" and "7" indicated the workshop was too elementary for those participants. The workshops overall were rated very highly and participants were extremely satisfied with their experience.

*Follow-Up Survey Feedback:* A total of 45 educator completed a follow-up survey in the fall of 2012, for a completion rate of 64%. Survey respondents represented participants from all four 2012 LWEs.

Survey respondents reported that every workshop activity had been used by at least one teacher already, and every activity was also planned for use by additional teachers. Overall, the workshop activities were well received and valued by the participants. One of the main concerns related to using the activities related to getting access to the required materials either due to availability or cost.

80% of survey respondents indicated they had shared and/or activities from the workshop with other teachers, colleagues, or administrators. Teachers reported that their workshop experience was a positive one that helped them in their classroom through increased enthusiasm, improved knowledge about the Moon, real world examples to use with students, and new teaching strategies.

**Summary of Findings:** 1. The workshop was an overall effective professional development experience in teaching educators about lunar science and exploration. Participants' feelings about the workshop and presenters were overwhelmingly positive. 2. Participants increased in their overall knowledge of lunar science and exploration including general lunar topics (e.g. the causes of Moon phases), formation and evolution of the Moon, and current exploration of the Moon specifically related to LRO. 3. Participants gained in

their overall knowledge of student misconceptions related to the Moon and ways to effectively address those misconceptions as well as other ways to teach about the Moon. Participants were able to use information and activities from the workshop in their descriptions of how to address students' misconceptions about the Moon. 4. The workshop gave participants resources to teach about the Moon including new activities, information, confidence in teaching the topics, and teaching techniques. In addition to giving participants resources to teach about the Moon, the workshop impacted the teaching practices of some participants more broadly to incorporate more inquiry and other teaching techniques.

**Future Workshops:** 2012 was the third and final year of the LWEs in their original format. LRO teacher trainings will continue during LRO's Extended Science Mission (FY13–14) in a modified version, incorporating recommendations from the NASA Education Design Team [7] and the evaluation team. The workshops will serve a slightly narrower audience, grade 6–9 certified and pre-service science teachers, and will leverage local, ongoing educational partnerships. Teacher trainings will take place at NASA Goddard Space Flight Center (GSFC) in Greenbelt, MD, where the LRO Project Office and E/PO Team are based. Teachers involved in GSFC Office of Education professional development programs will be preferentially accepted.

For more information about LRO teacher trainings, please visit <http://lunar.gsfc.nasa.gov/lwe/index.html>.

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