

## STUDENTS RESEARCHING THE RED PLANET: RESULTS AND ONGOING ANALYSIS WITH THE MARS EXPLORATION STUDENT DATA TEAMS.

B. Grigsby<sup>1</sup>, D. Turney<sup>2</sup>, S. Murchie<sup>2</sup>, K. Seelos<sup>2</sup>, A. McGovern<sup>2</sup>, D. Buczkowski<sup>2</sup>, H. Nair<sup>2</sup>, R. Snyder<sup>3</sup>, <sup>1</sup>Arizona State University, Mars Space Flight Facility, Tempe, AZ, <sup>2</sup>Applied Physics Laboratory, Laurel, MD, <sup>3</sup>Kickapoo High School, Springfield, MO; bgrigsby@suhsd.net.

**Introduction:** The Mars Exploration Student Data Teams (MESDT) program, funded through NASA's CRISM instrument was created by Arizona State University's Mars Education Program, and Johns Hopkins University's Applied Physics Lab. MESDT trains teams of high school and undergraduate students to conduct data analysis from the Mars Reconnaissance Orbiter's CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) instrument. This program is in its 7<sup>th</sup> year of operation and encompasses the complete STEM (Science, Technology, Engineering and Mathematics) process. MESDT teams are trained to utilize multiple data sets, analyze surface morphology and ultimately conduct research using CRISM data from the CRISM Map (<http://crism-map.jhuapl.edu/>) website.

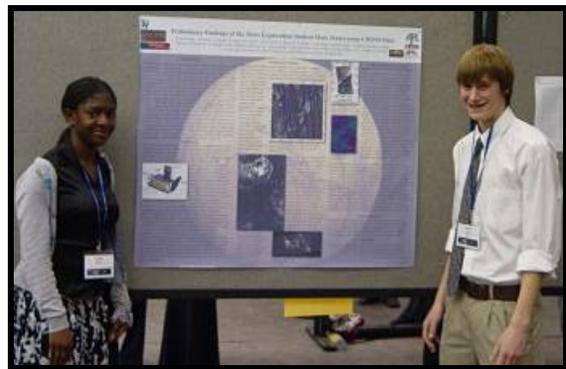
With teacher and scientist guidance, students are taken through a set curriculum modules and training in analysis of spectral data, in preparation for research challenges and ultimately their own research using CRISM data. Students communicate via an online moderated forum that is password protected. Through the forums, students can ask scientists questions, present their research and even communicate with other teams for collaboration research.

Because students are given the option to either conduct research on their own, or follow suggestions provided by the CRISM science team, students take ownership during each step of this process by making research choices, choosing image targets, working through data analysis, and determining results with the help of mentor scientists associated with the instrument.

The flexibility of being able to conduct training and meetings through distance learning methods, allows teams to implement the program within their school schedules as necessary. MESDT utilizes Blackboard's "Collaborate" online meeting system where live sessions can be archived and saved for future viewing by teams.

Initially, teachers present and lead students through various curriculum modules and activities, but the program soon hands over the reins of research to the students. Because MESDT is designed to be a student driven program, students develop a sense of ownership of the data they collect and the research they conduct. Along with this ownership comes the increased opportunity that students will retain valuable foundational knowledge of planetary sciences.

MESDT demonstrates the science process in a meaningful and concrete way and provides students opportunities to either present their research ideas, or exposes them to authentic research being done in planetary science. This approach helps to develop foundational abilities needed by all students, such as critical thinking, problem solving, cooperative group work, and analysis skills. Having students involved in the actual data analyses from an orbiting spacecraft include increased technical, critical thinking, problem solving, and teamwork skills. These skills are also modeled by the scientists as they work with the student teams to analyze the data, thus reinforcing the students' comprehension.



MESDT Students presenting their findings at LPSC

**Educational Impact:** Teachers have indicated in formative and summative assessments that they feel MESDT has shown to have an impact on their student's choices for post-secondary education and ultimately, their choice of a career. Teachers also credited MESDT as having a positive impact on their "at risk" students as well as increasing interest in STEM in the school body, and even in the community. Rick Snyder of Kickapoo High school has had more than 50 students go through the program. 75% have gone on to STEM related careers. He cites that MESDT had an important role in their choices. He also cites that his school has become known as "the Planetary Research School" in the Springfield Public School District. Because of this, they have noticed an increase in enrollment as many families want their children to have the opportunity to experience this program.

MESDT has also taught many of these students not only the content related to the geology of Mars, but

more importantly, how to design and conduct authentic scientific research projects and “do” science instead of listen about it being done.

In the summer of 2012, students involved in the MESDT program competed for a scholarship opportunity for teachers and their teams to attend the Planetary Geology Mappers meeting in Flagstaff, AZ. Two teams were able to attend the meeting, which gave several students and their teachers’ firsthand experience discussing their ideas in a conference setting. These types of experiences and opportunities allow students to expand their understanding of the real world of planetary exploration.



High school students present their research at the Planetary Geology Mappers meeting in Flagstaff, AZ

**Modifications:** Over the years, MESDT has been modified to accommodate the needs of mentors and teachers involved:

- Changed the online distance learning software to adjust for the various technical aspects of schools infrastructure, making it easier for teams to connect virtually.
- Increased announcements for participation in the program to include listservs such as, NSTA (National Science Teachers Association), DLESE, (the Digital Library for Earth System Education) and JPL’s Solar System Ambassador/Educator programs.
- Re-structured the learning cycle of the program to build on foundational principles of planetary science and included periodic assessments to gauge student understanding. Also included is a challenge for teams to put into practice this new knowledge and receive scientists’ feedback.
- Increased student exposure to multiple data sets of Mars exploration to increase student awareness of how scientists conduct research.

MESDT saw a ten-fold increase from 5 to over 50 teams in 2012. Continued development of the program will help to refine and assess educational impact as MESDT continues to be distributed to an increasingly wider audience across the country.

**Future Outcomes:** MESDT has been an important tool for teachers to emphasize Earth and Space Science principles and STEM content skills, as well as expose students to the foundations of the scientific process. The program will continue to adjust and modify to the needs of the teachers and continue to collect data on the effects of MESDT for students STEM career choices.

Through available funding resources the MESDT team will attempt to provide opportunities for teachers and students to observe, first hand, how scientist conduct research via planetary conferences.