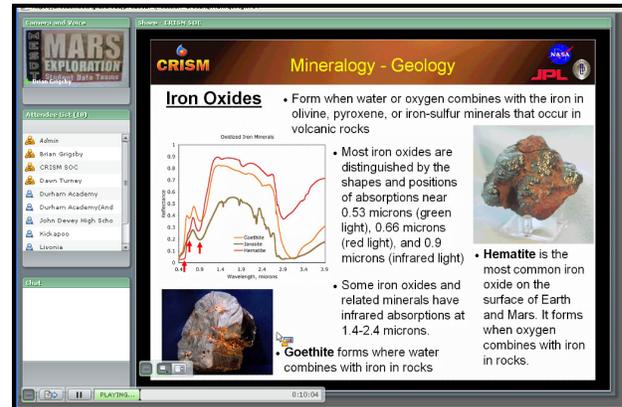


## INVOLVING STUDENTS IN AUTHENTIC RESEARCH: FIRST YEAR RESULTS FROM THE MARS EXPLORATION STUDENT DATA TEAMS PROJECT.

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**Introduction:** The Mars Exploration Student Data Teams (MESDT) program, created by Arizona State University's Mars Education Program, focuses on immersing teams of high school students in an authentic research Science, Technology, Engineering and Mathematics (STEM) based experience. MESDT is designed to allow the students to be direct participants in the scientific process. MESDT was created to work within the infrastructure of any planetary science mission, while providing a valuable resource for mission scientists as they analyze an increasing volume of data. During its first year working with the Mars Reconnaissance Orbiter (MRO), our beta-test involved scientists and engineers of the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) instrument. Students followed the same process used by the science team to evaluate global, 200 m/pixel mapping data and target follow-up high-resolution, 20 m/pixel observations: 1) teams received 5°x5° tiles of mapping data to import into REACT (software used to preview CRISM data and target CRISM observations); 2) teams then identified regions whose spectra indicated mineralogically significant deposits; 3) they selected and defined targets for future observation based on established criteria; 4) they uploaded 2-3 target suggestions that were included in uplink queue; 5) once a high-resolution image of the target was taken, the teams received the image and conferred with a science team mentor to analyze the data; and finally, 6) the teams wrote up and posted their findings and results on the MESDT website. The Mars Exploration Student Data Teams program allows the student teams to 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.

Because of the flexibility of being able to conduct training and meetings through distance learning methods, teams can implement the program within their school schedules as necessary. The distance learning component (using Adobe's Connect web conference system) has provided an opportunity for MESDT teams to enhance and supplement the connectivity of their classroom to Mars research scientists and the STEM content that the MESDT teams are researching.



MESDT Training on Adobe Live Connect

**Educational Impact:** MESDT is designed to be a student driven program and because of this, students develop a sense of ownership of the data they collect, thereby increasing their understanding of the science concepts being presented. The unique challenges that the program provides promote the students' scientific and technological literacy in the classroom.

MESDT is also designed to be a constructivist model that demonstrates the science process in a meaningful and concrete way. This approach helps to develop foundational abilities needed by all students, such as critical thinking, problem solving, cooperative group work, and analysis skills. The implications of having students involved in the actual data analysis 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.

Surveys taken by all team members show that the experience has been a very positive experience for the student teams.

Continued development of the program will help to refine and assess educational impact as MESDT is distributed on a wider basis across the country.



MESDT team, Livonia HS

**Modifications:** Lessons learned from the first beta test revealed technical issues with the installation of REACT on school computers. This was solved by implementing a web-based tool that accesses "browse" versions of the data, minimizing the need for specialized software, while still allowing teams to identify regions of interest. This tool, called CRISM-Map, has already been deployed for science team use, and its usage by MESDT will be evaluated during the second round of beta testing.

During the first round of MESDT, the forums were initially used for general communications and that activity diminished as the students worked on their data analysis. For this second round of testing, we will further utilize the forums to have students post some of their initial findings for other teams to view.

**Mars Exploration Student Data Teams first year results:** The beta test for the first year of MESDT was a positive one. Highlights include:

- MESDT teams successfully uploaded targets and analyzed data using REACT, then presented their findings to CRISM team members.
- All teams involved in year one have applied to be involved in year two.
- One team from North Carolina and one team from Livonia, NY presented their findings at a poster session at LPSC in 2008.
- Student teams from the following states have participated in MESDT: CA, MO, NC, and NY.
- One team has more than 85% minority participation.
- Team sizes range from a minimum of 8 to 30 members per team.
- Team comments: "It has inspired many of my students to go on to science related careers", "It was very unique and applied to the courses the students have taken", "I learned so much about Mars. No other students know as much as I do about the planet."

**Current Outcomes:** The primary benefit that has been observed (anecdotally) using the early data acquired during the MESDT distance learning events is that the MESDT students that participate in these opportunities are gaining a deeper understanding of the scientific method. This statement is based upon the observation that the participating students are able to formulate and test hypotheses, and present scientific findings with a high level of accuracy and detail.

**Future Outcomes:** Data on the MESDT distance learning events will continue to be collected and evaluated within the ASU MESDT Team. This is achieved using an on-line evaluation form that is completed by each of the teams after each distance learning event.

Because of the flexibility of the MESDT program to incorporate any planetary data set, other instruments onboard MRO, the THEMIS instrument on Mars Odyssey, and other planetary missions will be incorporating MESDT into their EPO plan. The initial success of the MESDT program is evidence that future implementation will be equally successful.