

Teaching STEM Subjects Using a Mission to Mars

By: Stephen DeAngelis

In a recent two-part series entitled "Getting Kids Hooked on STEM Subjects" [[Part 1](#) and [Part 2](#)], I discussed how important it is to get children involved in science, technology, engineering, and math (STEM) subjects as early as possible and examined some recommendations about how STEM education can be improved. In the latter of those posts, Alan I. Leshner, Chief executive officer of the American Association for the Advancement of Science, stated that STEM education must start early. He also believes you can't teach what you don't know. For that reason, he recommends that "the educational community needs to exploit the scientific community's desire to help. There are many, many retired scientists and engineers who'd love to go into the schools and use their knowledge and experience to assist the regular teachers." Personally, I wouldn't limit the search for help to retired individuals. I know from personal experience that actively employed scientists and engineers are just as eager to help as retired scientists and engineers.

In that same post, Paulo Blikstein, an education Professor at Stanford University, stated:

"We want kids in school to have that experience of seeing how science and math lead to making things. In a controlled study conducted in our lab we found a statistically significant increase of 25 percent in performance when open-ended exploration came before text or video study rather than after it. We'd like kids to learn how to solve hard problems and what it takes to pull off a complex endeavor, how to plan, collaborate, fail and not give up. In other words, we want them to see what science and math can do when they are used by a creative mind."



That's really the philosophy behind an approach that I've been supporting at my daughter's middle school — the Newtown Friends School (NFS). The NFS STEM initiative combines real-world challenges with a space exploration in a "Lift Off to Mars" program. The program will involve classroom study, lectures by subject matter experts, use of world-class lab facilities, and field trips. The initiative is being organized by a new non-profit organization called The Project for STEM Competitiveness and is being supported by local business leaders and scientists. In addition to my company, Enterra Solutions, other supporting organizations include Lockheed Martin and the U.S. Department of Energy's Princeton Plasma Physics Laboratory. The immediate goals of the initiative include:

- Learning and using science and engineering process skills.

- Understanding and using mathematical skills and concepts, such as proportions and ratios, graphing data, multi-digit computation, functions.
- Applying knowledge of science concepts, such as speed and power, motion and stability, forces and interactions, and environmental sustainability.
- Understanding concepts such as systems, patterns, structure and function, and logical thinking.
- Understanding the role of troubleshooting, invention and innovation, and experimentation in problem solving.
- Planning and managing activities to develop a solution or complete a project.
- Demonstrating creative thinking and constructing knowledge using technology.
- Using digital media and environments to communicate and work collaboratively.

The long-term goals of the project, which are in line with STEM education goals identified by the National Research Council of the National Academies, include:

- Growing community partnerships that provide middle school students with mentors, opportunities, and real-world experiences in STEM disciplines.
- Expanding the number of students who ultimately pursue advanced degrees and careers in STEM fields and broaden the participation of women and minorities in those fields.
- Expanding the STEM-capable workforce and broaden the participation of women and minorities in that workforce.
- Increasing STEM-literacy for all students, including those who do not pursue STEM-related careers or additional study in the STEM disciplines.

The NFS initiative hopes to change student perceptions of STEM subjects being boring. We hope to stir up their creative juices at the same time. In addition to traditional classroom learning, each supporting organization will bring something to the table.

Enterra Solutions, LLC, is going to provide students access to its Cognitive Computing environment which will perform artificial intelligence-based computational analytics on the Mars program - modeling real-world problems of the mission. Representatives from Lockheed Martin will provide students with an exciting look at its Orion Program. Engineers from the program are building the Orion Multi-Purpose Crew Vehicle, NASA's first spacecraft designed for long-duration, human-rated, deep space exploration. Orion will transport humans to interplanetary destinations beyond low Earth orbit, such as asteroids, the moon and eventually Mars, and return them safely back to Earth. Michael Bradshaw, CIO of the Mission Systems and Training Division of Lockheed Martin described Lockheed's interest in the Lift Off to Mars Program: "Advancing STEM education is a critical focus of Lockheed Martin. Anytime we have the

chance to inspire students with real-life, exciting examples of opportunities in the STEM field, we eagerly participate.”

The Princeton Plasma Physics Laboratory (PPPL) will mentor the program from its long experience in STEM education and will make its world-class research and scientists available to students throughout the project. PPPL is instrumental in supporting the creation of the curriculum, integrating other governmental agencies, such as NASA, and providing experimentation structure, guidance and support for the program.

Andrew Zwicker, Head of Science Education at PPPL, said “The best way for students to learn science is to do science. This new program is a unique opportunity through its project-based learning approach to begin to develop the skills needed to be a part of the 21st century scientific workforce.”

Phys.org, a leading European web-based science, research and technology news service, wrote in a recent article, "In a high-tech and rapidly globalising economy, science and mathematics education is more important than ever. ... At the same time, high levels of creativity and innovation, often and mistakenly seen as the antitheses of science and mathematics, represent equally important assets." [["Science, mathematics, creativity and innovation, when it counts most,"](#) 6 September 2013] The article goes on to assert, "The place to start is in early childhood education." The more creative we can become in teaching STEM subjects (and the earlier that teaching begins) the greater the likelihood that we will get more of our children excited about careers in science, technology, engineering, and mathematics. It's not just their future that is at stake, it is the future of our country, and our planet. The challenges that society now faces are going to require new solutions and approaches and those solutions must be founded in good science.

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<http://www.enterrasolutions.com/2013/09/teaching-stem-subjects-using-a-mission-to-mars.html>