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Improving STEM Engagement

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New Program Uses SMART Products to Help Students Collaborate and Connect

By Alyson McAndrews

It's no secret that high school teachers throughout the United States are struggling to engage their students in science, technology, engineering and mathematics (STEM) education. As children get older, educators in many school districts across the United States witness a steady decline in student engagement and achievement in these subjects. In recent years, this trend has started to take its toll in the form of underemployment across a number of sectors. Despite the dramatic economic downturn, the U.S. Department of Labor lists advanced manufacturing, automotives, biotechnology, construction, geospatial technology, health care, hospitality and information technology as growth industries. All these industries require postsecondary education in STEM subjects.

Goals of the NGY Cyberjournalists program:

- To inspire students to achieve academic excellence
- To encourage students to enter careers in STEM
- To empower students to express themselves in new media

The situation, characterized as a crisis by the U.S. Congress, prompted Dr. Ronnie Lowenstein to seek innovative ways to increase student engagement. Dr. Lowenstein is an education advisor, advocate and policy developer for NASA's education partnership committee and International Space Station (ISS) task force for education. She also serves as an advisor to Congresswoman Diane Watson. When asked to design a demonstration project that would address the problem of dwindling interest in STEM subjects, she pioneered the SMART-sponsored NetGeneration of Youth (NGY) Cyberjournalists Investigating Careers of NASA ISS Leaders Shaping the Future.

Already familiar with the positive effects SMART products have on engagement (read this white paper to learn more), Dr. Lowenstein chose SMART Board™ interactive whiteboards, SMART Notebook™ collaborative learning software and SMART Bridgit™ conferencing software as the products students would use in their investigations. She then set up an NGY community of practice made up of astronauts and scientists with NASA and the ISS, giving students access to professionals who could provide real and inspiring examples of the careers open to students with knowledge of STEM subjects.

Three schools are currently serving as pilot sites for this program – Sir Winston Churchill High School in Calgary, Alberta, Canada; Susan Miller Dorsey High School in Los Angeles, California; and the Academy of Information Technology and Engineering (AITE) in Stamford, Connecticut. Students at these schools examine the issues facing space exploration today by conducting experiments, engaging in discussions with NASA and ISS professionals and documenting the entire process – all with the help of innovative educational technology and a program that uses it to great advantage.

Learning through real-world application

Inquiry-based learning that mirrors professional research inspires students. By discovering solutions to real-world problems, students learn where a career in the field could take them. This has been the experience of program participants at Sir Winston Churchill High School, a mixed demographic public school of about 2,000 students. Classes are large, so staff are constantly looking for ways to increase engagement and ensure no student slips through the cracks.

Churchill adopted the NGY Cyberjournalists program to encourage interest in STEM subjects. A team of four instructors from multiple disciplines has developed it as an after school club for 43 students from grades 10 to 12. The students are placed in project groups that investigate real-world scientific problems,

Astronaut Daniel Tani poses with two students at Dorsey High.

conducting experiments to develop independent research projects. Projects currently underway investigate topics such as alternative forms of propulsion, genetically engineered machines, satellites and telescopes, and the representation of spacial cues during space flight. A group is also exploring the sociocultural question of whether space is a unifying or a dividing frontier.

The approach of the students is scientific, mirroring the work of professional researchers. Groups work as research teams in a classroom, aptly dubbed the NGY Crater, that simulates a laboratory. They use the SMART Board interactive whiteboard to brainstorm ideas and view information sent to them from the NGY community of practice. They also simulate some experiments being conducted by NASA and ISS staff.

The classroom application of scientific research has proven extremely successful, not only in increasing student engagement, but also in improving learning outcomes. And since all the students' projects have a large component dedicated to studying large-scale, real-world research projects, they learn firsthand what a STEM career could entail.

Teachers at Churchill believe this approach is revolutionizing learning for these students. "This project serves as an example of the kinds of programs that are needed in schools and communities to ensure a robust future for our students," says Mike Frieter, professional development coordinator at Sir Winston Churchill. He goes on to say that exposing students to products like the SMART Board interactive whiteboard develops a variety of skills that could prove vital to their success in an ever-changing world.

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Mike Frieter
Professional Development Coordinator
Sir Winston Churchill High School
Calgary, Alberta, Canada

Collaborating to solve problems

At Susan Miller Dorsey High School, enabling students to collaborate as they answer complex scientific questions not only boosts confidence – it also helps them develop their writing skills. Dorsey is typical of many inner city schools in south Los Angeles, with a large student body and a graduation rate that hovers around 50 percent – almost 40 percent below the national average. Educators at the school found an overall lack of student interest in STEM subjects – until the introduction of the NGY Cyberjournalists program.

Trevor Oystrick, lead teacher on the project, began by using his homeroom class to stimulate interest in STEM subjects. Throughout the 2008–2009 school year, he spent 20 minutes a day involving his students in this area. Visits from Congresswoman Diane Watson, who was instrumental in bringing the program to Dorsey, and astronaut Daniel Tani showed students the sorts of careers that would be open to them if they worked hard in STEM classes. "Those visits really helped our students understand why these subjects are so important," Oystrick says.

Congresswoman Diane Watson and Daniel Tani (pictured with a student) address Trevor Oystrick's class.

Realizing he had a hit on his hands, Oystrick turned these homeroom periods into a pre-engineering option that fulfills a university science requirement. He saw the number of students considering a career in STEM go from 3 out of 31 to 26 out of 31. Now, students use the SMART Board interactive whiteboard to collaborate in small groups, designing solutions to engineering challenges like how to create a clay structure that floats. They complete their designs, build models and then write journalism-style articles about the challenge. The regular class structure is peppered with opportunities to interview NASA and ISS staff, take field trips to places like the Raytheon Laboratory and participate in the Raytheon Engineering Game Competition.

Oystrick has taken advantage of his students' interest in engineering to improve their writing skills. He approached the University of Southern California (USC) journalism department and proposed a mentorship program between university students and his class. "Our motto is, 'To build, you write,'" says Oystrick. "An interest in science is great, but you still need to put your thoughts down on paper in a coherent manner with proper spelling and grammar to get anywhere in life, and for some of our students, this is the biggest challenge."

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Trevor Oystrick
Science Teacher
Susan Miller Dorsey High School
Los Angeles, California

Oystrick expects students will learn a great deal from feedback provided by the USC students. "When it's not just coming from teachers and they see their work transform, I'm confident they will start enjoying the writing side more too."

As the NYG Cyberjournalists program continues, Oystrick hopes the participating schools can use the SMART Board interactive whiteboard and SMART Bridgit software to build even more collaboration into their work – among not just students in one classroom but all the program schools. "I'd love to see interschool challenges where one school designs a rocket or something, another school builds the design, and the third tests it. I'd also like to get something like a pen pal program running between the students." Teachers at the other schools have expressed interest in this kind of collaboration, and Oystrick is optimistic that, by the end of the year, it will be an integral part of the program.

Investigating STEM careers

Students can be inspired to pursue a STEM career when they are exposed to the careers of successful professionals – something teachers at the Academy of Information Technology and Engineering (AITE) are taking advantage of. Students participating in this school's NGY program are focusing directly on learning about the professionals they meet and then telling their stories.

AITE is an interdistrict, public high school with 650 students. It has a strong focus on project-based learning and collaboration – making it a perfect fit for the NGY program. Led by 5 teachers representing different subject areas, 50 students at AITE use their advisory period and some extracurricular time to participate in five projects.

A Dorsey High student works to construct a model for his project.

One of these projects focuses specifically on journalism. These students use SMART Bridgit software to interview NASA and ISS staff and write articles about what they learn. Through this work, they are finding out about the day-to-day lives of scientists who are currently working on experiments on the space station. They're also learning about a variety of projects under development at NASA.

Perhaps most importantly, students working on this project are discovering how the findings that emerge from ISS experiments and NASA projects affect the lives of normal citizens. Teachers at AITE say they have seen a marked improvement in student engagement from this unusual tactic. By learning about how people who chose STEM careers are making a difference in the world, students are inspired to apply themselves in these subjects and consider similar career paths.

These students have also documented the findings of the other four projects underway at their school so they can communicate them to the students at Sir Winston Churchill and Dorsey High. The sharing this group has initiated, made possible by SMART Bridgit and other products, has provided the foundation for an intersite virtual visit from a NASA astronaut in the coming weeks.

A video synopsis of Sir Winston Churchill's Spring Mission Update illustrates the development these students exhibited last year.

Transferring concepts to other schools

The NGY Cyberjournalists program demonstrates just some of the innovative ways educators can use technology and resources to increase their students' interest in STEM subjects. It was set up as a demonstration project, at the request of those involved in NASA and ISS education programs, to engage more students in these areas. As Congresswoman Diane Watson said in an address to Congress, without this engagement, scientific breakthroughs in university research and space exploration, or even advancements made by technology companies like SMART, could not happen.

Given the success these schools have had with the NGY Cyberjournalists program, all educators involved are hopeful for its expansion. Dr. Lowenstein is currently working on making the principles behind this program available to anyone who is interested. She is creating a guide that will help teachers throughout the United States and Canada set up similar private-public partnerships that enable them to collaborate over distance.

As those involved in the NGY program have discovered, members of professional scientific organizations are eager to work with students to encourage interest in STEM subjects. Often, all it takes is a phone call. "I have found most higher education institutes and professional organizations are happy to lend a hand, or an afternoon, or become part of a mentorship program when asked because they understand its importance," says Oystrick. By making connections like these and taking advantage of SMART products, teachers across North America can follow the example of the NGY Cyberjournalists program to engage their students in STEM and see great results. **EC**