



The U.S. Army Combat Capabilities Development Command (DEVCOM) leads in the discovery, development and delivery of technology-based capabilities to enable Soldiers to win our nation's wars and come home safely. DEVCOM is a major subordinate command of the U.S. Army Futures Command. The DEVCOM Chemical Biological Center is the Army's principal research and development center for chemical and biological defense technology, engineering and field operations. The DEVCOM Chemical Biological Center is headquartered at Aberdeen Proving Ground, Maryland.

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Army Scientists use Virtual Reality to Teach STEM Education

By Jerilyn Coleman



U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) research chemist Dr. Jared DeCoste shows a student how to perform an experiment in the virtual laboratory.

Aberdeen Proving Ground, MD – Harford County, Maryland students used a virtual laboratory to solve real-world problems as part of a learning experience developed by the U.S. Army's Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC).

The Center held a virtual laboratory exhibit and learning experience during the Magic of Science Fair and Family Festival

hosted by the Discovery Center at Water's Edge. The virtual reality outreach project was part of CBC's years-long commitment to science, technology, engineering and mathematics (STEM) outreach and education.

This effort was funded by the Army Educational Outreach Program (AEOP) and led by eCYBERMISSION, an AEOP STEM competition for students in grades six through nine, administered by the National Science Teaching Association (NSTA). In the virtual laboratory, the students were challenged to solve a real problem that DoD scientists and engineers have worked on that could ultimately assist Soldiers in the field. This particular challenge was to design a way to extract water from the atmosphere for drinking in extremely harsh, dry climates. A team of Center scientists and engineers, led by Center research chemist Dr. Jared Decoste, worked with eCYBERMISSION and commercial software company ROAM VR to storyboard a script and sequence of steps for the students to follow in the virtual laboratory environment.



Once immersed, the students created their own designer molecules, known as metal-organic frameworks (MOFs), to extract water from the atmosphere and store it inside the material's pores. The students selected combinations of organic struts such as oxygen, hydrogen and carbon; plus metal nodes such as copper, zinc or zirconium to create a MOF best suited to the job. Creating these three-dimensional crystalline structures is much like using tinker toys to construct a customized lattice, according to DeCoste.

Center research chemist Ann Kulsiewicz provided the virtual voice that guided the students through their experience, which included virtually mixing the appropriate chemicals in a beaker, heating their creations in a virtual oven, and ultimately testing their MOF's efficacy for adsorbing water in a virtual test chamber. During the process, the students were able to virtually hold the molecules they constructed and rotate them in three dimensions to decide how they might improve on their design. The students were also given a critique whether their material would give a Soldier enough water by the Center's technical noncommissioned officer, Sgt. First Class Robert Olsen.



Dozens of Harford County students lined up to experience the virtual laboratory.

DeCoste was pleased with the results. "Traditionally, we have not been able to have a K-12 audience work in our laboratories and experience what an Army scientist does. By building our immersive virtual reality experience, we were able to bring the laboratory to each of those students. In one afternoon, dozens of students had the opportunity to work in a virtual lab, get feedback from a warfighter, and be exposed to scientific concepts that they never would have if it wasn't for this project," he said.

The concept of extracting water from the atmosphere using customized materials started as a Defense Advanced Research Projects Agency project and is known as atmospheric water extraction. Together, the Center, eCYBERMISSION, AEOP, and ROAM turned it into an education module, including visualizations and animations. "It is our goal at eCYBERMISSION to inspire students to improve their communities with STEM while exposing them to the many STEM opportunities that the U.S. Army provides," said Winnie Boyle, NSTA assistant director of AEOP. "We are proud of how this project succeeded in achieving these goals in a way that is fun and engaging for students and look forward to developing more technologies like this in the future."

In the future, DEVCOM CBC and eCYBERMISSION are eager to develop more applications for further STEM outreach as well as other academic collaborations.



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