United States Naval Academy
STEM Center for Education and Outreach

Spring 2018

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CULTIVATE THE FUTURE

STEM Educator Training at USNA

On Saturday, February 24, 2018, the USNA STEM Center hosted the spring session of STEM Educator Training. This day-long professional development workshop was attended by 140 elementary, middle, and high school teachers from 90 public and private schools in Maryland, Virginia, Washington, D.C., and beyond. Principals and administrators were also invited to attend the workshop to learn how to better support their teachers in the STEM classroom.

The theme of the workshop was applied technology and engineering design, with sessions based on real-world applications, led by 17 faculty and staff, and supported by 28 midshipmen. Topics included Mapping with MATLAB, Health Technology, Space Technology, Arduino Coding, Solid Modeling, and Experimentation. Skills-based sessions included programming, soldering, and robotics. An engineering design session challenged teachers to improve the design of a simple catapult after collecting and analyzing performance data.

Participants received materials and content to enable them to immediately implement hands-on activities in their classrooms, using cost-effective methods. The training gave teachers the confidence and motivation to keep improving STEM education. One teacher shared, “[The workshop] gave me some great real-world tie-ins that my students can relate to. It has me excited to go back and try some of what I learned with my students.”

Impact of STEM Educator Training at USNA

Beginning in 2013, STEM Educator Training has been held at the U.S. Naval Academy each spring and fall, and has been attended by over 1000 educators. The workshop is an ideal setting for teachers to discover, explore, and test ideas for hands-on, project-based STEM education.

USNA STEM Educator Training is an effective tool in the mission to cultivate a future STEM workforce with the required skillsets to meet future national and DoD challenges. The training equips educators with the methodology, techniques, and activities to make STEM education more effective and engaging for students. Attendees take home curriculum and supplies so they can implement hands-on science and engineering in their classrooms right away.

Teachers can impact an entire classroom, grade or school full of students for years to come, making the educator training a multiplying, sustainable effort. A single educator training event is estimated to impact 25,000 students annually, based on estimations provided by the teachers.

At the end of each training, teachers complete an exit survey to evaluate the program. Attendees consistently report that they learned something new at the training. Over 95% agreed or strongly agreed that the activities are applicable to their curriculum and easy to use. Additional follow-up surveys are sent each year in May, and demonstrate that the training has a positive impact on teachers and their students.
DoDEA STEM Educator Training in Italy

The USNA STEM Center presented STEM Educator Training in Italy for Department of Defense Education Activity (DoDEA) teachers and DoD personnel. DoDEA supports schools for military children stationed in the U.S. and overseas.

Four full-day workshops were offered in May in Vicenza, Aviano, and Naples. Ninety-four attendees included teachers from DoDEA schools in Italy, Germany, and England. DoD military and civilians attended as community partners in support of STEM education for military youth, and included representatives from Navy Medical, Navy Facilities Engineering Command (NAVFAC), and Child and Youth Programs.

The workshop provided teachers with strategies, curriculum, and supplies to integrate hands-on STEM activities in the classroom, across subjects and grade level. Topics included chemical and physical properties of water, fundamentals of cyber and robotics, applications of sound and light waves, use of sensors and circuits, and an engineering design challenge based on simple machines.

Exit surveys completed by participants indicate that the training helped by providing ready-to-use activities and ideas along with real-world applications and resources, as well as methodology, motivation and confidence, and an opportunity for networking and collaboration. “The workshop will be so important in changing the climate of my science class—much more hands-on and student discovery,” shared Frank Lewandowski, teacher at Aviano Middle/High School, “I think that my training will impact all my teaching and classes—not just science. The use of design then discovery will bring so much more depth and meaning to the class.”

NOAA/SeaPerch Educator Training in Tulsa

USNA STEM faculty traveled to Tulsa, OK to provide an educator workshop in collaboration with NOAA, DoD STEM, and the Tulsa Regional STEM Alliance. Thirty-six educators from 26 schools in the Tulsa region attended the workshop on February 12-13. Attendees learned about NOAA’s ocean exploration strategy and how to build a SeaPerch underwater remotely operated vehicle (ROV).

Hands-on projects focused on real-world applications of ROVs, as well as supporting technology and underlying concepts, including sonar, sensors, properties of water, optics and light, and robotic manipulation. Catalina Vizueth of Dove Science Academy commented that the training “has empowered me with the skills, knowledge and hands-on experience that will make it easier for me to implement SeaPerch at school and continue to explore STEM professions.”

How did the training help you as a STEM educator? [Exit Survey, Italy]
**Workforce Development**

**Best Practices in DoD STEM Outreach**

The DoD STEM community includes commands around the nation that are committed to promoting a growing workforce in science and engineering. Members of this community take part in STEM outreach aimed at inspiring and engaging next generation scientists and engineers. In an effort to broaden and enhance this outreach, the USNA STEM Center developed a series of workshops to train members of commands across the nation.

On March 12-13, USNA presented a workshop sponsored by DoD STEM for 34 participants from 13 commands around the nation, including Army, Air Force, Navy, Missile Defense Agency, National Geospatial-Intelligence Agency, National Security Agency, and Uniformed Services University of the Health Sciences. Attendees explored hands-on activities in DoD-relevant topics such as autonomy, cybersecurity, corrosion, biomedical applications, fluids and flight, and engineering design.

At the workshop, participants were trained in activities that are hands-on, DoD-relevant, concept-oriented, scalable, and easy to implement. They put their skills into practice by implementing a STEM outreach event for middle and high school students. Discussion sessions allowed participants to share successes and challenges.

**Impact of DoD STEM Outreach Workshop**

Beginning in Sept 2014, USNA STEM developed a best practices in STEM outreach workshop series for the Naval STEM and DoD STEM community. Sponsored by the Office of Naval Research and DoD STEM, 14 workshops have been offered at the Naval Academy and at command locations around the nation, including 365 participants, from about 30 different commands at over 75 sites.

At the close of each workshop, participants completed an exit survey, indicating satisfaction with the workshop, applicability of content and activities, and expected use of training. Combined exit survey responses from the 14 workshops between Sept-2014 and Mar-2018 demonstrate a high degree of satisfaction with the workshop by attendees, as shown in the figure below. “I gained knowledge about resources I can use in my command’s STEM efforts,” commented Randall Lewis, NAVAIR, Mar 2018 DoD STEM workshop, “I will take back the lessons provided and use in my STEM programs.”

The next DoD STEM Workshop will be held at USNA on August 14-15, 2018.
Midshipmen Involvement in STEM Outreach

Midshipmen are a key component of STEM outreach efforts at the U.S. Naval Academy, sharing their passion for STEM and serving as role models for youth. STEM outreach is a challenging leadership opportunity for midshipmen, developing them as future leaders and officers. They communicate complex ideas to diverse audiences, gain experience in logistics, learn how to adapt to unexpected situations, develop problem-solving skills, and serve as mentors.

Midshipmen can volunteer their time to support STEM events through the MSTEM extracurricular activity. They can also enroll in a STEM Education and Outreach course which provides academic credit for serving 15 leadership hours per semester dedicated to developing and implementing academic year STEM activities.

Midshipmen in the spring semester course completed a survey designed to evaluate the impact of STEM outreach participation on their own development. Responses from 64 midshipmen show that participation strengthened their leadership and communication skills, as well as their STEM knowledge and technical skills, and problem-solving skills. It also helped them more fully explore their own interests in STEM fields. One midshipman said, “it is important to share the information about STEM with others because this not only teaches them, but also helps us to better understand our own field of study.”

Impact of STEM Outreach Participation for Midshipmen

Outstanding graduating 1/C midshipmen were recognized for their ongoing support of STEM outreach at the Engineering and Weapons Division Awards and the Math and Science Division Awards. These nineteen midshipmen exemplified the meaning of service.

Two graduating midshipmen earned the Military Outstanding Volunteer Service Medal for 500 hours of volunteer service. MIDN 1/C Michelle Tran and MIDN 1/C Svetla Walsh earned this medal for service in support of STEM education and outreach to underserved populations. MIDN 1/C Michelle Tran was also awarded the annual Service and Leadership Award in STEM Education and Outreach provided by USAA. In addition to volunteering countless hours since her plebe year, MIDN 1/C Tran served as president of the MSTEM extracurricular activity, demonstrating leadership ability and dedication to service.
# Inclusion & Diversity

## Girls Only STEM Day

The USNA STEM Center aims to promote more young people entering STEM technical career fields. Inclusion and diversity remain important in this effort. The USNA Girls Only STEM Day is offered twice a year to provide middle school girls an opportunity to learn about STEM academic and career paths, through engagement in hands-on activities and interactions with women role models in a range of fields. About 240 students attend each Girls Only STEM Day, participating in a variety of modules designed to explore real-world applications of technology, as well as science and engineering concepts. The event provides an opportunity to meet fellow students with similar interests. Small group challenges allow them to practice teamwork, and to develop problem-solving and engineering design skills.

On March 3, 2018, over 200 middle school girls attended the Spring Girls Only STEM Day, supported by 15 USNA faculty and staff, 64 midshipmen, and members of the Navy Reserve community, Engineering Duty Officer community, Naval Health Clinic Annapolis, and Fleet and Family Services Center. A program for parents addressed topics including nutrition and health, stress management, internet safety, STEM education, and college financing.

Highlighting the theme “Color Me STEM”, hands-on activities included web design, cryptography and coding, hull design, geometry and origami, biomedical applications, chemistry of color, paper making, biomimicry, and physics of sound and light. Midshipmen led a lunchtime panel addressing student questions about STEM majors and careers. In the afternoon, students worked in small teams, using the engineering design process to complete a parachute challenge.

## Impact of Girls Only STEM Day

Since 2013, over 2300 students have attended a USNA Girls Only STEM Day. At the conclusion of the program, each student completes an exit survey. Combined data from the last five years demonstrate the success of the program. At the end of the event, when asked to identify interest in a career or major, 77% of participants named a STEM field. The exit survey shows the greatest gains in student understanding and appreciation of STEM fields and how they apply to the real world, as well as confidence in their own abilities.

### Impact of Girls Only STEM Day, 2013-2018

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<th>Impact of Girls Only STEM Day</th>
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<td>Helped me better understand my own career goals</td>
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<td>Made me decide to take more STEM classes in school</td>
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<td>Made me decide to work harder in school</td>
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<td>Improved my problem-solving skills</td>
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<td>Helped me better understand what scientists/engineers do</td>
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<td>Taught me how STEM applies to real-world problems</td>
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<td>Made me more confident in my ability to succeed in STEM</td>
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<td>Increased my interest in studying STEM</td>
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<td>Challenged me in ways I had not experienced before</td>
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Scale of 1 to 4, 4 is A Great Deal
On Saturday, April 7, 2018, in collaboration with the Office of Admissions, the USNA STEM Center participated in a STEM Day at Wagner High School in San Antonio, TX. Leigh McNeil of the Office of Admissions noted that hundreds of attendees came from all over the region to see industry and university-led activities in STEM topics.

MIDN 2/C Maddie Reynolds and MIDN 4/C Kam Chumley-Soltani provided hands-on interactives including cyber and logic, chemistry, and physics. “It was a great experience for those attending and for me, as a midshipman, as well,” shared MIDN 4/C Chumley-Soltani, “I really appreciated that so many people from diverse backgrounds could share the same learning experience.”

Mini-STEM: Building STEPS

Each semester, USNA STEM hosts groups of high school students for Mini-STEM events as part of an effort to expose under-represented groups to STEM fields at the U.S. Naval Academy.

On February 1, a Mini-STEM event was held for the Building STEPS program, which works with Baltimore City high school students to help them achieve college and career success.

Led by STEM faculty and staff, including Sarah Durkin, Rachel Fees, Angela Moran, and Mark Murray, students participated in a planetarium session as well as interactive activities investigating the color and temperature of stars. They explored principles of flight by observing the Bernoulli effect using windbags, paper, and ping pong balls, followed by building and testing a simple straw rocket model to understand lift.

In collaboration with the Office of Admissions, thirty high school students from Chicago’s Phoenix Military Academy participated in a Mini-STEM event held at USNA on February 23.

Faculty members Prof Brad Barrett and CDR John Schedel, along with ten midshipmen, led students in hands-on activities emphasizing real-world applications of science and engineering concepts. One module investigated buoyancy and hull design. Another module taught students how to use the engineering design process to build a structure out of simple materials to withstand an extreme weather event.

Activities were held in the hydromechanics and aerodynamics laboratories, providing students a chance to see undergraduate laboratory and faculty research facilities.

Mini-STEM: Chicago

STEM Day: San Antonio, TX

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INSPIRE & ENGAGE

NESA Merit Badge Jamboree
On January 20, 800 scouts and leaders came from all over the country to USNA for the 21st annual STEM Merit Badge Jamboree. Led by 80 midshipmen volunteers, scouts earned a STEM merit badge, toured the academy including lab spaces, and heard about servant leadership from guest speaker Lieutenant General John Sattler (USMC, Ret). Executive Officer for the event, MIDN 2/C Nate Pfiefer, shared, “The reason I came to the Academy is because I learned about it through this event. Now I have the opportunity to give back to the program that gave so much to me.”

SeaPerch Challenge
On April 7, the USNA STEM Center hosted the annual Maryland Regional SeaPerch Challenge. Over 300 middle and high school students competed with SeaPerch underwater remotely operated vehicles (ROVs) that they designed, built and modified during the school year. SeaPerch is a national program sponsored by the Office of Naval Research and Association for Unmanned Vehicle Systems International (AUVSI). Volunteers included 35 faculty and staff, and 48 midshipmen who served as judges and support for the event. In the preliminary round, teams competed in the Hydromechanics Lab tow tank, testing for speed, maneuverability, and completion of a retrieval mission. During an interview session, teams were judged on creativity of their designs, engineering ability and teamwork. A math challenge was also offered. The top eight teams were selected for a final round in which they had to maneuver the ROV to transfer rings and cubes from an origin platform to a scoring platform. The top four teams earned spots at the International SeaPerch Challenge, held in June at the University of Massachusetts Dartmouth.

USA Science & Engineering Festival
The USNA STEM Center, in collaboration with the Office of Naval Research and DoD STEM, was a partner and exhibitor at the 5th USA Science & Engineering Festival, held April 7-8 at the D.C. Convention Center. Faculty and midshipmen hosted a booth for visitors to participate in hands-on STEM activities in DoD-relevant topics. Many dignitaries attended, including Secretary of the Navy Richard Spencer, shown here with midshipmen volunteers.
## Upcoming Events

### Summer 2018

<table>
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<tr>
<th>Month</th>
<th>Events</th>
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| **June** | - Summer STEM Program, USNA, June 4-22  
- Summer Heroes Youth Program, USNA, June 11-15  
- Girls Tech Camp, USNA, June 18-22 |
| **July** | - SET Sail DoDEA STEM Educator Training, USNA, July 9-13  
- SET Sail STEM Educator Training, USNA, July 16-19  
- Maryland Space Grant Consortium Intern Symposium, Baltimore, MD, July 28 |
| **August** | - Best Practices in DoD STEM Outreach Workshop, USNA, Aug 14-15  
- Mini-STEM Event, USNA, Aug 24 |

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