

What is STEM

STEM is an acronym for science, technology, engineering and mathematics. Together these fields create an interrelated whole where discipline boundaries have been blurred. Countries, states and cities are embracing these STEM fields to meet the economic demands of the 21st century. Simultaneously the integration of science, technology, engineering and mathematics is beginning to play a key role in education.

Implementation of STEM in K-12 education frequently emphasizes problem-based or project-based learning opportunities. Research indicates that students benefit academically and socially when grappling with real world problems in an authentic context. By infusing STEM disciplines with rigorous real-world work, STEM education prepares students for both college and career pathways.

Why STEM

Establishing educational excellence is not exclusively a US entitlement. Other nations have the same opportunity to develop transformational practices; therefore, if we aspire to compete in a world where discoveries and innovations are cutting edge, it is essential that the US expand its STEM horizons. Not since Sputnik has there been such a concerted effort to influence K-12 education in the United States. The STEM Coalition, in its Testimony to the House Committee on Appropriations, stated that the areas of science, technology, engineering and mathematics play an important role in the ability of a country to address its security needs, energy needs and compete in the global market place (2011). Innovations of the future will only take place in the United States if the workforce is educated in the theory as well as the practical application of STEM principles. Our country needs a diverse, technologically literate pool of individuals to meet the known and unknown challenges of tomorrow.

Additionally, careers in STEM continue to grow as well as spawn new emerging STEM fields. According to a survey conducted on behalf of Microsoft, there will be in excess of 1.2 million jobs in STEM fields by 2018. In the same news release, Microsoft's general counsel and senior vice president Brad Smith stated, "If our students are to compete successfully for the jobs of the future, we must better prepare them to be lifelong learners and give them a strong foundation in science, technology, engineering and math" ("Microsoft Releases National," 2011). Furthermore, STEM fields are predicted to outpace non-STEM occupations by over 7.0 percent by 2018—9.6 percent to 17 percent respectively. The impact for Hampton Roads is also clear. With over 91, 000 current

STEM jobs, statistically the area can anticipate gaining an additional 15, 000 STEM positions in the coming years (OpportunityInc Email Correspondence, September 2011).

Clearly, the impetus for providing a robust K-12 STEM education had been laid. As clarified in Virginia Beach City Public School's "Compass to 2015", 21st century learners demand opportunities to actively engage in critical and creative thinking and problem solving, and they must learn to communicate and collaborate with others while designing solutions to real world problems in a global environment ("Compass to 2015").

Current Practices

Successful VBCPS STEM education takes place in comprehensive K-12 schools, STEM-related academies and technical centers. The STEM education goals for both schools and centers help to prepare the next generation of scientists, technologists, engineers, mathematicians and innovators, expand the number of capable students for the STEM workforce, increase STEM literacy for all and generally prepare students for postsecondary success.

Current STEM practices include both problem based and project based learning initiatives. The following is a compilation of those practices:

Elementary Schools: Linkhorn Park Elementary School's Mathematics and Science Academy offers enriched coursework in science and mathematics. Students in grades 3, 4 and 5 learn through hands-on laboratory experiences and real world application. Additionally, 17 elementary schools conduct school-wide science fairs which provide the foundation for fairs at both middle school and high school.

Middle Schools: The Middle School STEM initiative, guided by Compass to 2015, prepares students for success in the 21st century. Leading the STEM charge, Corporate Landing Middle School began a three year implementation of STEM pedagogy and instruction with assistance from National Institute of Aeronautics staff (NIA). STEM units are designed to encompass integrative, problem-based learning with an engineering focus that asks the question, "How does need drive change?" This middle school STEM initiative is currently expanding into other schools.

To provide students with more STEM problem solving experiences, the 8th grade technology education programs align with the STEM National Engineering Standards. Extracurricular activities to include First Lego League Competition and Future City Competition supplement STEM initiatives. In partnership with the College of William and Mary and the major military commands throughout Hampton Roads, VBCPS middle

school students have the opportunity to work with scientists and engineers in an annual one-week summer Hampton Roads STEM Academy.

High Schools: Several high schools and centers have a deep STEM focus: Ocean Lakes High School Math Science Academy is a rigorous and unique STEM program of study emphasizing the core areas of mathematics and science with an infusion of technology; Bayside High School Health Sciences Academy, in cooperation with local medical professionals and educational institutions prepares students for health care careers through advanced curricula, community partnerships and committed faculty; Landstown High School Technology Academy features a cutting-edge STEM curriculum specifically designed for students with a deep interest in and talent for engineering and technology.

Additionally, the Advanced Technology Center provides students with a high quality, focused education in advanced technologies and careers that supports the full integration of STEM in High Performance Manufacturing and Engineering, Information Technology and Marketing programs. Moreover, the Virginia Beach Technical and Career Education Center also offers students unique STEM related experiences.

Many STEM opportunities are open to students across the division. For example Computer Aided Design students participate in the Hampton Roads Chapter of the Society of Naval Architects & Engineers (SNAME) Annual Boat Design Competition; Architectural Design students compete with students from across Southeast Virginia in the Tidewater Builder's Association (TBA) Young Designers Competition to create homes designed to exacting criteria

Multi-level STEM: Middle and high school students participate annually in the Tidewater Science and Engineering Fair which offers opportunities for students to compete in STEM fields. STEM Robotics Competition (SRC) is open to all high school and technical center students as well as select middle and elementary school students.

Last, a STEM 101 college 3 credit course, robotics competition and STEM Seminar opportunities are available for eligible junior and senior students through a yearly Opportunity Inc. grant.

STEM Plan of Action

The world is drastically changing; the rate at which we acquire information and collaborate with others is remarkable. In this age of information explosion and with the narrowing of the digital divide, we must act expediently to equip young people with the skills necessary to thrive in the 21st century.

To fully integrate STEM practices across the district, the following actions need to transpire.

- Develop a VBCPS STEM strategic plan.
- Cultivate teacher capacity in best practices through focused STEM professional development.
- Articulate and map a K-12 STEM sequence of skills and processes with Ascending Intellectual Demand (AID).
- Establish a K-12 STEM implementation by age group.
- Further develop existing STEM enrichment opportunities and investigate additional possibilities.
- Expand partnerships with community members to support STEM endeavors.

Bibliography

Microsoft Releases National Survey Findings on How to Inspire the Next Generation of Doctors, Scientists, Software Developers and Engineers. (2011, September 07). Retrieved from <http://www.microsoft.com/Presspass/press2011/sep11/09-07MSSTEMSurveyPR.msp>

Thomas, Peterson, PhD. (2009). *Testimony before U.S. House of Representatives Committee on Science and Technology Subcommittee on Research and Science Education.*

Resources

A3 Creative Group. *A Guide To Goals After Graduation: Science, Technology, Engineering, and Mathematics Edition.* 2010.

Hoachlander, Gary and Dave Yanofsky. “*Making STEM Real.*” Educational Leadership. Vol. 68 No. 6 The California Center for College and Career, March 2011.

Interactive Educational Systems and Design and Daylene Long. “*2011 National Survey on STEM Education: Educator Edition.*” 2011.

Jones, Rachel B. and SETDA. *Science, Technology, Engineering, and Math.* September 2008.

Laboy-Rush, Diana. “*Integrated STEM through Project-Based Learning.*” 2007 www.learning.com/imaginemars

Lantz, Hays Blaine Jr., Ed.D. “*Science, Technology, Engineering, and Mathematics (STEM) Education What Form? What Function?*” 2009.

National Governors Association. “*Innovation America: Building a Science, Technology, Engineering, and Math Agenda.*” 2007

Pitt, James. “*Blurring the Boundaries—STEM Education and Education for Sustainable Development.*”

Design and Technology: An International Journal 14.1. University of York, 2009.

President’s Council of Advisors on Science and Technology. “*Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America’s Future.*” Executive Office of the President, September 2010.

Ramaley, Judith. “*Sustainability and STEM in a 21st Century Education.*” Winona State University, 2009.

Scott, Nathan, Roger Hadgraft, and Dr. Vojislav Ilic, eds. “*Engineering Education—Is Problem-Based or Project-Based Learning the Answer?*” Australasian Journal of Engineering Education, 2003-04 Retrieved from:
http://www.aee.com.au/journal/2003/mills_treagust03.pdf

The Bayer Corporation. “*Planting the Seeds for a Diverse U.S. STEM Pipeline: A Compendium of Best Practice K-12 STEM Education Programs.*” 2010