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A Message from the President

I bring you greetings from the Board of Directors of the Virginia Children’s Engineering Council (VCEC)! For over 20 years, the VCEC, an organization sponsored by both the Virginia Department of Education (VDOE) and the Virginia Technology and Engineering Education Association (VTEEA), has worked assiduously to help educators provide students with authentic opportunities so they can begin to think freely, critically, and cooperatively. As Martin Luther King, Jr. said, “The function of education is to teach one to think intensively and to think critically. Intelligence plus character—that is the goal of true education.” I believe this embodies what the VCEC wishes to accomplish. As I begin my tenure as President of the VCEC, I will diligently work to uphold the bylaws of the Council:

- Provide instructional experiences for students to create, design, work cooperatively, think critically, and problem-solve within real-life contexts.
- Develop design- and technology- enhanced instructional material embedded with the Virginia Standards of Learning for elementary programs
- Offer professional development opportunities for teachers and administrators
- Foster leadership in the promotion of children’s engineering in elementary, secondary, and university programs.

We are already off to a phenomenal start for the 2017–18 school year with the completion of our 2017 Children’s Engineering Convention held at the Hotel Roanoke in Roanoke, VA from February 9th to 10th. Educators across the state, as well as the country, gathered in Roanoke to participate in engaging sessions promoting design technology, demonstrations of how Children’s Engineering is the T and E in STEM (Science, Technology, Engineering, and Mathematics) education, and providing resources on how to incorporate the technology design loop. Be on the lookout for additional professional development opportunities that will be provided throughout the year in the state's six regions. Visit http://childrensengineering.org/ for additional information.

As the VCEC embarks upon another exciting ride this year of promoting the T and E in STEM education across the state through children’s engineering, we invite you to climb aboard and consider becoming a member of this forward-thinking organization and volunteer for one of our numerous committees and subcommittees. Please contact me (ljwash@nps.k12.va.us) or our Membership Chair, Kelley Davis (jazmined35@yahoo.com), for additional information.

We look forward to continuing to serve the dedicated educators of the Commonwealth and beyond. If we can be of service to you or to your district, please don’t hesitate to contact us. Again, thank you for all you do to promote children’s engineering and to serve the children of Virginia!

LaKesia D. Jolley-Washington
VCEC President
Albert Einstein said, “To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.” This quote embodies what children’s engineering is all about. Each year, the Virginia Children’s Engineering Council (VCEC) sponsors a conference to reinforce and guide Science, Technology, Engineering, and Mathematics (STEM) instruction, with an emphasis on the T and E. This year, we were given the opportunity to attend this event and represent our school, Ocean View Elementary, located in Norfolk, Virginia. This was our first time to attend the convention and it was definitely one to remember! We’d like to thank our administrators, Dr. Peterson and Ms. Jolley-Washington, for their support in continuing our professional development.

Once we registered for the VCEC Convention, we had to select the sessions that we would attend. This was an arduous task given the numerous engaging and interesting topics provided, which included Teaching Logical Thinking, Problem Solving, and Perseverance Using Computer Coding; Making Engineering the Foundation of a Problem-Based Learning Unit; Makerspace Projects and Implementations; Roller Coaster Magic; Thinking Like an Engineer as a Kid; Getting Started with Robotics and Programming; Integrating Maker Stations in your Classroom; Connecting Literature to STEM; Fraction Action; Green STEAM: Using Upcycled Goods to Engineer in Elementary School; Linking Science and Literacy with Problem-Based Learning, just to name a few. Luckily, the convention’s Schedule-at-a-Glance provided a synopsis of the different sessions and the target audience. We decided to “divide and conquer” and report back to one another to get the most information from as many sessions as possible. Of course, we both did some serious notetaking, eager to share all of the awesome information we were gaining. If our notes weren’t enough, we had access to the entire VCEC session materials (handouts, slideshows, lessons, etc.) on a shared internet folder.

We both agreed that every session was created with classroom teachers and the curriculum in mind. Because many of the presenters were educators, the presentations were useful and the information could be immediately implemented. The presenters were realistic about the time and budget constraints of public education. It was refreshing to leave a session with new methods to incorporate children’s engineering/STEM activities in the classroom. We could have literally taken the information from the sessions and put it into action on Monday!

The Hotel Roanoke and Conference Center was an amazing venue for this event. There was plenty of room for the sessions to incorporate hands-on activities, make and takes, and vendors. The main ballroom, where lunch was served, gave us opportunities to network and discuss educational practices with educators from other parts of the state and country. While eating lunch, we were able to listen to nationally renowned keynote speakers. Louis Mangione, Senior Teaching Coach, shared highly effective strategies for engaging students with content. He also shared up-to-date developments in brain research. The second speaker was Dr. Frederic Bertley, COSI Chief Executive Officer. He discussed visionary initiatives supporting innovation in STEM learning. These speakers were inspirational, passionate, and engaging.

According to a White House press release in 2012, the United States will need approximately 1 million more STEM professionals than are projected to graduate over the next decade. Future careers are going to require critical thinking and knowledge in science, technology, engineering, and mathematics. This prediction should motivate you, as a teacher, to take advantage of attending conventions like the VCEC so your students are college and career ready.
Empowering Students through Project-Based Learning
by Tricia Furtek, Moorefield Station Elementary, Loudoun County Public Schools

As educators, we joke about the need for more time, more room, or more resources. That, together with overcrowded schools with an ever-growing population, makes it seem impossible to have success with our students. Before the start of the 2015–2016 school year, a colleague and I faced the prospect of teaching in one room because we were running out of classrooms. After much debate and discussion, we decided to dive in.

The idea of co-teaching in a room of approximately 36 to 40 third graders, including special education students and English language learners, while completely embracing Project-Based Learning, began to take flight. We sat down and looked at our Standards of Learning, our county’s pacing guides, and what we hoped to accomplish through the course of the year. Of course, we wanted student success to soar, but we needed to be specific with what that success looked like. Those pesky test scores at the end of the year were always first in our minds as a measurement of success, but we also looked at other ways that we could collect data to show student growth. We reached out to many local businesses to ask for support in our endeavor, knowing that we would probably exceed any monetary allotment.

The pacing guides were thrown out the window first. How can you intertwine curriculum if you are to follow a beautifully laid out curriculum? We began by brainstorming and researching ideas for project-based instruction. Science and social studies were the backbone of content the students would be working with, as well as mixing in math standards. For example, wouldn’t it be great if students were working on economic content and developing a truer understanding of how money is used in the world around us? We found that every project that we wanted to take on easily covered all reading, language arts, and oral communication SOLs. We also had to be realistic that some content just needed to be taught through direct instruction.

Through our newly laid-out pacing guide, we were able to finish all necessary SOL instruction before the middle of April. That left almost a month of enrichment, remediation, and review before those almighty SOL tests. Our concentration during that month was application of information. Students were able to focus on applying the information they had been taught. They created lessons, games, presentations, etc. to enhance their understanding of reading and math material. We created lessons and projects that made them think outside the box.

Throughout the year, students were able to get more individual attention, as the student-to-teacher ratio was lower than other classrooms. Students that required more remediation or benefited from small group instruction were able to receive it on a daily basis, while the other teachers were in a more whole-group environment. Special education teachers and their assistants were also able to provide assistance to more students, both in special and general education, in the classroom. The co-teaching model was a fluid one. All adults in the room knew they were part of the instruction delivery and students responded to that.

Was this environment successful? We think so. Our SOL test data supports this success, but there was more than that. Students learned to communicate, critique, and, most importantly, solve problems. They were able to see, by using the PBL approach, the connection to the world around them. Community members frequently visited, presented, and participated in our projects. Some examples of community outreach were business owners coming to listen to our students pitch their business ideas, geospatial professionals presenting about how they use programs like Google Earth to help them do their jobs, health care professionals assisting students in researching and creating flyers to bring awareness of childhood health concerns. Their growth with these businesses was exponential in that these real conversations exposed students to their future.

Would we embrace this co-taught classroom again? The answer is YES! The 2016–2017 classroom was rolled out and expanded to more classrooms in the building. As we approach preparations for the 2017–2018 school year, we continue to expand to more classrooms and teachers in the building. We couldn’t be prouder of the learning environment and partnerships we have created. We only hope that the movement to think about how to best empower our students to become lifelong problem solvers continues and grows.
STEM at Tidewater
by Amanda Norris, STEM teacher at Tidewater Academy

In spring of 2013, Tidewater Academy had the privilege of receiving a staff development class on children’s engineering directed by Mrs. Joyce Anderson. She provided our K-5 teachers a day full of hands-on projects for us to design and build. As a fourth grade teacher, I was inspired by this class.

After that class, I shared my vision with my Head of School and the Lower School Director. I wanted Tidewater Academy to become a children's engineering school. Soon I was hired to lead the engineering classes in our Lower School. I attended several of the Virginia Children’s Engineering Conventions and observed how to integrate engineering into our curriculum, learned how to create design briefs, and learned how to engage the students in this type of learning.

Many design briefs start with a challenge. The students get the materials and they work in teams to design, build, or create. The students are there to help each other as they solve the problem. Many of the materials are recyclable items. Parents and the community donate items throughout the year to keep this class going.

Our students have worked on many Science, Technology, Engineering, and Mathematics (STEM) projects throughout the years. They have created name cards and invitations for Back to School Night. The fifth graders have completed roller coasters, egg drop containers, birdhouses and animals out of toilet paper tubes. The fourth graders have designed marble mazes using Legos. They have created bridges using K’Nex. A favorite of the fourth graders was making parachutes. The third grade class used their knowledge of the geometric shapes to create a geometric creature. Students in kindergarten through second grade have completed many projects, such as building a bowling alley and a community, designing bears and penguins, and constructing many buildings using Legos and candy structure.

Our community librarian has helped Tidewater Academy in many of the STEM projects, such as robotics, rockets and building structures. The Ozobot astounded the students. They all wanted an Ozobot for Christmas that year.

The students are engaged every week with the ongoing STEM projects. I wanted to create a class where the students would be having fun and learning at the same time. One can walk into the classroom and almost hear them thinking out loud. They are always on task, working on their projects.
Tidewater Academy gets a lot of positive feedback from our parents. We post pictures of the students’ projects on our Facebook page, so the parents and the community can see what their children have accomplished in the STEM program.

As the STEM teacher at Tidewater Academy, I am glad the students here have the opportunity to participate in the children’s engineering classes.
What is NASA eClips™?

NASA eClips™ is a proven and effective multimedia educational program. Since 2008, the National Institute of Aerospace (NIA) has worked with NASA to develop the NASA eClips™ suite of educational resources, including videos, educator guides, and numerous supporting classroom materials. NIA’s Center for Integrative STEM Education continues to produce new resources based on current research and continued needs of the country’s K-12 educators. NASA eClips™ is a web-based video and educator resource repository that focuses on grades K-5, 6-8, 9-12, and the general public. These resources are available on demand to every school in the nation and address the demand for instant information that is engaging, interactive, and easily integrated into daily lesson planning.

How can NASA eClips™ enhance my students’ learning experience?

The video format arouses students’ curiosity and encourages them to ask their own questions. NASA eClips™ help students explore new topics on their own. Video segments can be used to determine students’ depth of understanding. Students can design their own video segments modeled after NASA eClips™ to demonstrate their understanding of concepts taught in the classroom.

How do I get these programs?

Teachers and others can access all NASA eClips™ products on the Internet. Video segments are available at http://www.youtube.com/NASAeClips. Video segments with additional teacher materials and program information are available at https://nasaeclips.arc.nasa.gov/.
Do I need to register to use these programs?

Registration is not needed to use NASA eClips™ materials. Materials are available on demand and free of charge to anyone with Internet access.

How do I use these resources with my students?

Educator guides utilizing NASA eClips™-related activities and educational best practices are available on the website under the “Teacher Toolbox” heading. NASA eClips™ Educator Guides provide examples of ways teachers may effectively use video segments as instructional tools. Each guide includes instructional objectives, background information, links to video clips, instructions for implementing inquiry-based lessons, additional resources related to the topic, and suggestions for extending or modifying lessons. All lessons are presented in the 5-E delivery model and are aligned to national standards for science, math, and technology. There are several engineering challenges to engage students and provide them with opportunities to apply content skills and knowledge in a real-world context.

The Engineering Design Packets are part of the Teacher Toolbox. The elementary and secondary design packets can be used to introduce students to a formal design process. Students answer questions about each step of their design process. A rubric is included to assist with evaluation. These open-ended packets can be applied to any design project and can be used to enhance existing curriculum.

Why does NASA support this program?

For the United States to remain technologically and economically competitive on a global scale, educators and parents must engage and prepare students for careers based on a solid foundation in the sciences, technology, engineering, and mathematics (STEM). This NASA project brings together exciting video segments with educational best practices to inspire and educate students to become 21st century explorers.

Launchpad: Engineering Design to Support Scientific Discovery
Engineering design and technology development support scientific discovery. Learn about the roles engineers and scientists play when working together on NASA missions like the James Webb Space Telescope and how science and engineering take turns pushing each other to move exploration forward.

Real World: Citizen Science
What are citizen scientists? Why is their work so important to NASA? Join Dr. Michelle Thaller as she explains how the general public, using scientific protocols, careful observations and accurate measurements, can help NASA make exciting new discoveries. Find out how you can be a citizen scientist today.

Our World: The Sun, A Real Star
Learn about the important relationship between Earth and the sun. Find out about the layers of the sun and how Earth’s magnetosphere acts like a giant handkerchief to protect us from all kinds of space weather.

Launchpad: Solar Eclipses
Join NASA to learn more about solar eclipses, especially the awe-inspiring phenomenon of total eclipses. Find out about the unique geometry and the distances and sizes of the sun and moon as seen from Earth that allow us to witness the sun's corona or actually be in the path of totality.

https://nasaeclips.arc.nasa.gov/
Join Us
- Explore teaching strategies for integrating Children’s Engineering into your existing curriculum.
- Reinforce the Virginia Standards of Learning through hands-on designing, building, and problem solving activities.
- Attend workshops conducted by experienced K-5 classroom teachers.
- Network with teachers who share your interest in the need for every child to study and use technology.
- Visit educational exhibits and examine available materials from technology vendors.

Learn How Children’s Engineering Promotes
- Virginia Standards of Learning best practices
- National Standards (Mathematics, Science, Technology, etc.)
- Critical and creative thinking
- Problem solving
- Hands-on learning
- Decision making
- Cooperative learning skills
- Differentiated instruction
- Motivated and self-confident learners
- Mastery of individual learning styles of children, including the needs of gifted and special needs populations

Full Convention Registration Includes
- Lunch, afternoon break, networking reception with light hors d’oeuvres on Thursday.
- Continental breakfast, morning break, and luncheon on Friday
- Recertification points for teachers and administrators

Registration Fee: $230 ($250 after January 15, 2018) (non-refundable after February 1, 2018)

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Keynote Speakers

Liza Stark
Tina Manglicmot

Keynote, Thursday, February 8: Liza Stark is a designer and educator based in New York. Her work combines techniques, tools, and approaches from craft, textiles, and technology to explore the role of materiality in learning and the impact of hybrid spaces on identity formation. She is obsessed with building toolkits and designing modular frameworks; exchanging knowledge in open, accessible ways; and creating inquiry-based learning spaces through play.

She has worked with numerous organizations and companies to design STEM- and STEAM-focused learning experiences. Her most recent quest was at littleBits as senior manager of Learning + Engagement. Prior to that, she was a game designer at the Institute of Play, where she had the privilege of embedding in a NYC public middle school to collaboratively design games with teachers and students.

Other past adventures include hosting a web series on DIY electronics for families; facilitating EDesign Labs, a teacher-designer residency incubator; and co-founding gadgITERATION, a series of student-centered, hands-on workshops focused on creative engagement with electronics. She currently teaches in the MFA Design and Technology program at Parsons The New School for Design.

Keynote, Friday, February 9: Dr. Tina Manglicmot is the new Director of Science, Technology, Engineering and Mathematics (STEM) for the Virginia Department of Education. The office provides leadership, coordination and support of elementary and secondary programs in the areas of science, technology, engineering, technology, gifted education, Governor’s schools, driver’s education, health and physical education. Her office staff provide technical assistance and professional development opportunities to school division personnel and responds to inquiries from educators, parents, and other citizens of the commonwealth. Dr. Manglicmot is dedicated to K-12 education and the integration of technology into the classroom.
**Mechanimals**

**Background:** We read the book *Mechanimals* by Chris Tougas. In the story, a tornado destroys all the farm buildings and blows the animals away. Now the farmer needs your help to rebuild his farm so he can have his animals back. He needs you to help make his dreams become a reality.

**Design Challenge:** Work with two team members to design and build a farm out of recycled materials and limited craft supplies to help the farmer restore his farm after the disaster. Your farm must consist of at least one animal pen or shelter and at least four animals. The pen or shelter must have a door or gate that opens and closes. The perimeter of the pen/shelter should be between 20 and 40 inches. After you have built your farm, you will present your creation to the class.

**Criteria:**
Your farm must:
- Be made from recycled materials and limited craft supplies
- Have at least one pen or shelter
- Have a pen or shelter with the perimeter between 20 and 40 inches
- Have a door or gate that opens or closes on the pen/shelter
- Have at least four animals

**Materials:**
- Construction paper
- Scrap paper
- 4 paper fasteners
- Toothpicks
- 24 inches of masking tape
- Card stock
- Popsicle sticks
- Pipe cleaners
- Paper tubes
- Recycled materials

**Tools:**
- Scissors
- Glue/hot glue gun
- Markers/crayons/colored pencils
- Ruler

**Virginia Standards of Learning:**
Science 3.1 models are designed and built, 3.3 physical properties of materials
English 3.1 communication skills, 3.2 oral report, 3.5 reading comprehension, 3.9 written communication
Mathematics 3.10 perimeter of a polygon
Fine Arts 3.1 identify innovative solutions, 3.2 use the art-making process
Standards for Technological Literacy: 8,11,15 application of design process and agriculture technologies

Danielle Early, James Madison University  
February 2017
Fleeing From Fox
Based on the book
“The Gingerbread Man” by Gerald Rose

Background:
We enjoyed reading the book “The Gingerbread Man” by Gerald Rose. At the end of our story, the poor little gingerbread man became a tasty treat for the sly fox.

Challenge:
You are to design and create a “something” that will help the gingerbread man cross the river safely without anyone’s help.

Criteria:
Your “something” must:
- Be no larger than 6 inches by 6 inches
- Keep the gingerbread man dry
- Hold the gingerbread man on the river for at least 5 minutes

Materials:
- Construction paper
- Scrap paper
- Craft sticks
- Glue
- Straws
- Recycled materials

Tools:
- Scissors
- Ruler
- Push-pin
- Hole punch
- Crayons, markers, colored pencils, writing utensils
- Plastic tub of water for testing

Targeted Standards of Learning:
Science 2.1 investigations
English 2.1, 2.2, 2.3 oral language and communication skills, 2.8 reading fiction comprehension, 2.11, 2.12 legible writing and simple explanations
Math 2.11 measurement
Target Standards for Technology Literacy 5 recycling, 6, 8, 9, 10, 11 using the engineering design process, 18 transportation technology

Anita Ritchie, Fulks Run Elementary, Rockingham County Public Schools, 2013
Making a Makerspace
Pitsco’s Top 10 Tips

1. ORGANIZE
2. CONDUCT MINI SKILLS WORKSHOPS
3. COMBINE HIGH-TECH ITEMS WITH LOW-TECH ITEMS
4. HAVE A VARIETY OF TOOLS
5. CHALLENGE STUDENTS
6. LET STUDENTS CREATE
7. PROVIDE OWNERSHIP OPPORTUNITIES
8. GET THE COMMUNITY INVOLVED
9. RECYCLE
10. HAVE FUN!

STEM IN THE GYM™ – ELECTRICITY & MAGNETISM PACKAGE
Physical education, electricity, and magnetism all come together in the STEM in the Gym™ Electricity & Magnetism Package. With this innovative program aimed toward elementary grades, students will experience generating electricity, the type of circuitry involved in transferring electricity, and how electricity is used. They will also experience the force of magnets with the push-pull car activity focused around the push and pull of magnets.

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STEM IN THE GYM™ – ELECTRICITY & MAGNETISM

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