The Children's Engineering Journal
Fall 2020

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25th Anniversary Children's Engineering Convention
February 2-4, 2021
Virtual
Registration is OPEN!
Welcome friends to another amazing year of Children’s Engineering. I am so honored and excited to serve as the 2020-2021 Virginia Children’s Engineering Council president. I have learned and grown so much over the past six years from the teachings and guidance of my fellow council members. They are a dedicated group of volunteers who work relentlessly to provide quality STEM education for all. There are some big shoes to follow, but I will do my best to continue their ground-breaking work in the field of children’s engineering.

One of our goals as a council is to help fellow educators integrate children’s engineering into their daily lessons with understanding and ease. Over the past several years, STEM has become a prominent buzzword. Everywhere you turn, there are challenges, products, and activities labeled STEM. But are they truly STEM challenges? Are students solving real-world problems through engineering challenges? Are students becoming problem-solvers, critical thinkers, and team players? VCEC strives to make sure that educators know what makes a genuine STEM activity, how to follow the design process, and where to find authentic, ready-to-go challenges for elementary students.

A great opportunity for educators, regardless of your familiarity with STEM, is our 25th Annual Children’s Engineering Convention. It is a three-day convention filled with virtual hands-on classes for any level of expertise. We cover a wide range of topics, like writing design briefs, creating a STEM lab on a budget, robotics and coding, STEAM and literature, and escape rooms. You will leave with lots of activities and tricks, a new network of like-minded educators, and a stronger understanding of design, engineering, and technology for the elementary classroom.

I am eager to get to know each of you along with your interests and needs in the field of STEM. Your presence is an indication that you are committed to making a positive difference in not only your state and school system but in the lives of your students as well. Welcome again and please contact me anytime and let me know what I can do to help you navigate through the world of children’s engineering!

Kelley Davis
During the 2020 Virginia Children’s Engineering Convention, Hillsboro Charter Academy (HCA) received the ITEEA Program Excellence Award, recognizing Hillsboro for its outstanding contributions to the engineering education profession and to students at a schoolwide level.

HCA is a Loudoun County public charter school established in 2016 by a group of parents and teachers who did not want to see their small neighborhood school close. The teachers and parents worked together to write a charter proposal to the district with a mission and vision focused on Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. Students who attend this school of 144 students in kindergarten through fifth grade are chosen to attend by a lottery system. The current waiting list is over 240 students.

There is only one class of each grade level at HCA, and each class can have no more than 24 students. HCA students also benefit from a number of teacher assistants to help reach every student. Kindergarten has an all-day teacher assistant, first and second grade share a morning teacher assistant, and third, fourth, and fifth grades share a morning teacher assistant. HCA staff also includes interventionists for mathematics and reading as well as an enrichment teacher for all grade levels. The ratio of teachers to scholars is greatly reduced due to all of the specialized instruction. In the afternoon, the classroom teachers co-teach lessons with specialists during their E3 time (Explore! Engage! Engineer!), which also lowers the teaching ratio to be able to reach each student completely.

HCA’s mission is to incorporate an innovative curriculum focused on STEAM education and real world experience, including project based learning. Engineering design challenges are conducted on a regular basis where students have to follow the engineering design process to solve problems.

According to Megan Tucker who serves as a STEAM specialist and dean of curriculum for HCA, the school is focused on professional development and takes conferences such as the Virginia Children’s Engineering Convention into consideration when making their calendar. During VCEC 2019, the school sent a majority of the staff and presented five sessions! During VCEC 2020, the school sent their three newest staff members to learn and grow.
The HCA faculty has consistently been a supporter of VCEC, attending and presenting at our convention every year since they began. As the awardee of the Program Excellence Award HCA was awarded $1,000 to further contributions in STEM and children’s engineering.

On February 20, 2020 HCA was featured on the NBC Washington morning show. Students, parents, and teachers arrived at the school at 5:15 in the morning for a segment about “Introduce a Girl Engineering Day” as part of Engineers Week - EWeek! According to their Facebook post, “the kids powered through the day and worked hard at the Civil Engineering Design Challenges in E3. To cap off their day, Girls in GEAR hosted the Boys & BOTS Design Challenge this afternoon! The boys did a FABULOUS job of engineering a tool to clear the “snow” and the girls did a FANTASTIC job of facilitating!”

HCA has received a number accolades and awards for their STEM / STEAM contributions. Some include International STEM School of Excellence Award at the ITEEA Conference in March and a visit from Miss America. If you haven’t started following their Facebook page to see what they are up to at this amazing school, you certainly should start now. Be inspired by this amazing staff and see what ideas you can incorporate into your classrooms right now.

VCEC is looking for candidates for next year. If you think your school has what it takes to be the winner, please review the award application process at childrensengineering.org.
Practical Steps to Unleashing Creative Thinking in Every Classroom
by Jacie Mazlyk

It happened again! I ran into a former student who recalled a powerful memory from our time together in the makerspace. Sophie was a student who came to our school in the middle of the year and quickly found her place among other makers during our exploration time each day during lunch. “Remember when we had our sewing circles?” She recalled the weeks that a group of students and I would sit and practice our hand-stitching skills, just chatting about the day. As a third-grader, she marveled at the fact that we gave students real tools (including needles) in our school. “I can’t believe you let us use soldering irons and saws! It felt so good to be trusted to create anything.”

Now, as a young adult, Sophie remembered these opportunities that we shared with her—the chance to imagine and create in any way that she wanted to. This happened because we created an environment that could fuel her curiosities and support her to take responsible risks. Talking with her reminded me about the true power of creative thinking in schools. When we design opportunities in our schools for learners to engage in collaborative, hands-on learning, creative thinking can be unleashed.

Fuel Curiosity

Some educators may embrace STEM education, the integration of science, technology, engineering, and math, while others favor an approach that infuses the arts (adding the “A” for STEAM). In some schools it’s called STREAM, adding the “R” for reading or religion, or robots. It doesn’t matter what you call it—it is taking a meaningful, integrated approach to learning that students will connect with and remember far beyond the scope of their traditional K-12 education.

A huge part of designing meaningful learning means keeping students at the center of our planning. When students are curious about a topic, we need to develop opportunities for them to explore it. When students express interest in new materials or technologies, we can give students access to those new and different materials.

What can this look like in the classroom?

• Create a “curiosity corner” or other space where learners are free to tinker with different materials.

This can also be a part of your library or even a dedicated space in the hallway.

• Make student curiosities visible. Hang a whiteboard or a piece of poster paper in the classroom and post questions for students each week:
  ♦ What things are you wondering about?
  ♦ Where would you like to go on a field trip?
  ♦ What are the three careers that you are interested in learning more about?

For school leaders, don’t forget about stimulating the curiosity of your teachers, as well. If we don’t fuel new ideas for teachers, then how can we expect them to do the same in their classrooms?

• Plan professional learning that is collaborative, creative and fun.

• Carve out time for teachers to explore new ideas:
  ♦ Peer classroom visits or classroom visits to other schools
  ♦ Carve out time for creative conversations with colleagues (and keep regular planning time sacred so teachers also have the opportunity to connect with others.)

Take Risks

Great things do not evolve when we spend all of our time in our comfort zones. When we stretch our thinking and look beyond the proverbial box, classroom instruction can be transformed. Think about risks in terms of what you can do as the teacher, since these will lead to the kinds of risks your students can take.

Here are three risks every teacher should take:

1. Consider the learning environment and create flexibility to meet the needs of your students. Offer flexible seating, infuse color in the classroom, and create a classroom space that is comfortable and engaging.
These may be the features that your students need to get their creative juices flowing.

2. Switch up your assessments. Students cannot truly express their creative thinking if we continue to give them traditional assessment tasks. Consider options that are open-ended, offer hands-on choices, or allow students to choose the method in which they can demonstrate their learning in a particular unit of study.

3. Expose your own failures. Think aloud about your creative endeavors; include the successes and the epic fails. Students need to see us as role models for what it means to think, create, and persevere through academic and artistic challenges.

Bottom line: Get out of your comfort zone and take a risk!

Make Connections

As educators and school leaders, we have a responsibility to create connections for our students. Some connections are simple, like the connections that are created when we connect students with one another and value collaboration in the classroom. Connections also happen when we introduce learners to meaningful content. Connections can be more complex as we build a curriculum that connects to relevant topics and experiences for students. We can further strengthen connections when we take the learning that is happening inside our schools and connect it with those outside the school walls.

What can your school do?

Establish connections with local organizations that can support your mission to promote creativity and innovation in the classroom. Brainstorm a list of local or regional organizations that can support you. Choose one organization that you can reach out to this week.

Ask how they might want to partner with you to unleash some creative thinking in your classroom. Consider how your new connection might be able to serve as a mentor, a resource, or a strategic partner for learning in the future.

Moving Forward

We must give our students the time, space, and opportunity to think creatively about problems and encourage learners to use their imaginations to solve them. This won’t happen if the primary role in our schools is to consume information. Our students deserve opportunities to be creators, not merely consumers. When we give the creative opportunities in school, learning thrives.

Think about Sophie and the fond memories she had regarding opportunities to be creative in school. If we want to make learning last, we need to be intentional about creating pathways for students to fuel their curiosities, take risks, and make connections. When we do, we are showing students the power of creative thinking.

Editor’s note:

If you are interested in more from Jacie Mazlyk, check out her blog http://jaciemaslyk.blogspot.com

She also has a number of books available including:

- Remaking Literacy: Innovative Instructional Strategies for Maker Learning, Grades K-5; Classroom Maker Projects for Elementary Literacy Education
- Unlock Creativity: Opening a World of Imagination with Your Students
- STEAM Makers: Fostering Creativity and Innovation in the Elementary Classroom
“So completing a design brief and guided portfolio is a lot of fun, but how can I use this as a grade?” Many teachers ask this or similar questions when completing a STEM project or decide to skip the activity altogether because they don’t have time and need grades. Numerous grades can be taken from one design challenge! Let’s take a look at the Plant Power challenge and a few ways to use it as an assessment.

Rubrics: Rubrics are often used as a tool for assessment and help to define the criteria needed to show mastery and understanding. Rubrics can easily be made to align with design challenges’ criteria. Here is a basic rubric from the Plant Power challenge.

| Name __________________________________________________ |
| Plant Power Rubric |

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built a model of a plant</td>
<td>Yes</td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Has correct parts</td>
<td>At least 4 parts</td>
<td>3 parts</td>
<td>1 or 2 parts</td>
<td>No parts</td>
</tr>
<tr>
<td>Parts are made from different materials</td>
<td>At least 4 different materials</td>
<td>3 different materials</td>
<td>1 or 2 different materials</td>
<td>No differences</td>
</tr>
<tr>
<td>Parts are labeled</td>
<td>All parts are labeled</td>
<td>3 parts are labeled</td>
<td>1 or 2 parts are labeled</td>
<td>No labels</td>
</tr>
<tr>
<td>Freestanding</td>
<td>Yes</td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>No taller than 15 cubes</td>
<td>Yes</td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total points -

Comments -

This rubric focuses on the final product in the challenge and whether or not it meets the criteria. This can be counted as a Science grade and can provide support for a behavior/conduct grade.
Presentation: Another assessment type is the presentation that accompanies the project. This can be done orally for the class, in a video, on a Flipgrid, etc. The possibilities are endless! Part of the grade can be the oral communication skills in the English SOLs. Another part of the presentation can be the identification of the parts of the plant and an explanation of the function of each part. This can be counted as a Science and an English grade.

Writing: A natural assessment for this project is a written component. Students can write about their plant, its parts, and the function of each. This can then be counted as a science and a writing grade. A creative writing component is also a possibility, telling of an adventure the newly created plant goes on in its new habitat. If a guided portfolio is completed during this challenge, there are several components where writing is required. Students’ responses can also be graded.

So, from one design challenge, a teacher can easily get one to two science grades, one oral presentation grade, and one to two writing grades as well as a behavior/conduct grade. Using STEM challenges for assessments provides greater meaning to the students because they create the product that demonstrates their understanding while giving teachers multiple ways to get grades. That’s a win-win: deeper student learning experiences and numerous grades all in one STEM challenge.

Visit the design brief section of our website - [www.childrensengineering.org](http://www.childrensengineering.org) - to see samples of guided portfolios, including rubrics. A new set of design briefs with guided portfolios and rubrics is currently being worked on, so keep a lookout for them.

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Editor's Note:
Elizabeth Kirk is an advisor to the VCEC Executive Committee. She is the Innovative Learning Coordinator for Henrico County Public Schools.
Design Brief

The Bot That Scott Built

by Dawn Hillis

Background: We have just finished reading The Bot that Scott Built. In this book the young man builds a robot and ends up saving the science fair.

Design Challenge: Design and create a robot to help you do an everyday task at your house. It must serve a true purpose, have at least one moving part, be at least eight inches tall, and you may only use the supplies given by the teacher. Your group will need to work collaboratively. You will design and create your robot and then present it to the class.

Criteria:
- Your robot must serve a purpose.
- It must be at least eight inches tall.
- The robot will need at least one moving part.
- Use only the supplies given.
- Your group needs to work collaboratively.

Materials:
- Cup
- Googly eyes
- Construction paper
- Straws
- Glue
- Fuzzy sticks
- Cardboard tubes
- Buttons
- Craft sticks

Tools:
- Scissors
- Crop-a-dile

Standards:
SOLs Math 2.8, 3.7, 4.8, 5.9
STEL Standards 7 and 8
Guided Portfolio

Name: ___________________________    Date: ___________________________

Grade: ___________________________    Teacher: ___________________________

1. What is the challenge? State the problem in your own words!

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________


________________________________________________________________________    ______________________________________________________________________

________________________________________________________________________    ______________________________________________________________________

3. Create the solution you think is best.

________________________________________________________________________    ______________________________________________________________________

________________________________________________________________________    ______________________________________________________________________
4. Test your solution.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would your bot help you in your everyday life?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you only use the given supplies?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does your bot have at least one moving part?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is your bot 8 inches or taller?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did your group work collaboratively?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Keep notes on your progress.

What problems did you encounter? How did you solve them?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
6. Evaluate your solution.

<table>
<thead>
<tr>
<th>Was it the best solution?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would your other idea work better?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Tell me why.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

What is one thing you could do to improve your robot?

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

7. Share a picture of your final product. (sketch or photo)
Rubric for *The Bot That Scott Built*

<table>
<thead>
<tr>
<th>Criteria Assessed</th>
<th>Rookie</th>
<th>In Training</th>
<th>Mastered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portfolio</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restate problem in my own words</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brainstorm two ideas/sketches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keep notes about problems, solutions, and evaluation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record final design with picture and notes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Team Work</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share my ideas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listen to others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Help create final product</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Final Product</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did your bot serve a purpose?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you use only the supplies provided?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Does the bot have at least one moving part?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is your bot at least 8 inches tall?</td>
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<td></td>
</tr>
<tr>
<td>Did your group work collaboratively?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oral Presentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use oral language to inform, persuade, entertain, clarify, and respond</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share my final product</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share something that was hard and how I overcame it</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share one way I modified my product</td>
<td></td>
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</tbody>
</table>
A little over a year ago my school division added a STEM resource class at my elementary school. To say I was “excited” about the addition of the STEM Resource is a huge understatement! I jumped at the opportunity to be the teacher of the newly created resource class for the school. After accepting the position, I had the opportunity to visit Yvonne Richard and observe her STEM class, where I gathered valuable ideas and resources to incorporate into my STEM curriculum. During that visit I first learned about the VCEC Annual Children’s Engineering Convention. After checking out the VCEC website and speaking to Yvonne, I knew I should attend the next convention.

Let’s start with the venue. What a great location. As someone who spent 20 years working in the hotel and restaurant industry (before becoming a teacher), I can say the historic Hotel Roanoke offered a wonderful setting for the convention to take place. I was impressed with the clean, comfortable guest rooms, the delicious food, attentive service and the abundance of meeting space.

The breakout sessions were my favorite part of the convention. There were numerous and interesting options, and the hardest part was deciding which breakouts to attend. The descriptions provided for the breakout sessions were concise and informative. I found the WHOVA App easy to use when choosing my breakout sessions. Each session offered a unique opportunity to explore and participate in engaging classroom activities. From making chocolate for a Jamestown history lesson, using pneumatics to demonstrate the movement of the Earth’s plates, or trying to solve the Rubik’s Cube, each activity was hands-on and dynamic. I even managed to solve one side of the cube before the session ended. Most importantly, I took practical ideas away from each of the sessions that I can use in my STEM resource. My only disappointment, besides not winning one of the fabulous door prizes, were the breakout sessions I couldn’t attend due to scheduling conflicts or because the sessions were filled. I guess there is always next year?

Another great opportunity for learning and inspiration came from listening to each of the keynote speakers: Jacie Maslyk, Chuck English, and Rachael Mann. I purchased Jacie Maslyk’s book, Remaking Literacy because I wanted to learn more about connecting literacy with problem-based learning activities. Each speaker offered a unique message regarding the future and our role as educators to prepare future generations through STEM education. I haven’t even mentioned the numerous exhibitors who made themselves available to demonstrate products and answer questions. I did a lot of “window shopping” and thought, “If only I had an unlimited budget!”

I can honestly say this was the most relevant, informative and interesting educational conference or workshop I have attended. I strongly believe the Children’s Engineering Convention is a must for any teacher who wants to discover engaging and meaningful lessons, ideas, and tools to meet the needs of the 21st century learner. I have already marked my calendar for next year’s convention.
Virtual STEM?!?!

by Elizabeth Kirk

Virtual and STEM just seem like words that do not belong together. When I think of STEM, I picture collaboration, communication, creative thinking, critical thinking, and problem solving at its best. I see groups of students working together engaged in a hands-on activity. I hear that quiet lull of focused, controlled chaos that fills a classroom when the pure magic of a STEM challenge is happening. I see it within the walls of a school building or outside on the school grounds. That's not possible right now, but we've discovered that STEM is completely possible and more important than ever during this virtual learning time.

Students are facing an array of real life problems during COVID-19, so using a design process to solve a problem is a skill that needs continual practice. My school system decided to create family STEAM challenges for our elementary students and families to complete at home that follow the design process to help students develop problem solving skills that lead to life readiness.

The family STEAM challenges are set up in a video format on our Henrico County school's website so all can easily access them. Our first challenge is called The Fort and poses the problem of needing a quiet place to read and work during this virtual learning time. The STEAM teachers created a two-part video series to walk the families through the design process. They begin by showing the problem, then brainstorming and designing collaboratively, stopping when it is time to build. Families then view the design challenge criteria and create their solution. For at-home challenges, materials and tools are left more open-ended, allowing families to use found materials from around the home. After building, the students move onto the second video, where the teachers communicate their successes, challenges, and redesign in a virtual platform, encouraging students to share with their families and also post on social media. Many students and families work together to solve our family STEAM challenges in unique and creative ways!! Feel free to check out our Family STEAM Mini Series on the EdFlix site within Henricoschools.us and here are a couple of others: The Machine and The Game.

Students are excitedly awaiting eight new challenges that will be released this summer that have connections to science and social studies Standards of Learning and include a mini lesson to review the content before posing the challenge.

So, as you can see, virtual and STEM do belong together and continue to be a critical piece in education that is developing students to be life-ready problem solvers of tomorrow.
2021 Summer Graduate Course/Workshop

Children's Engineering: K-5 Strategies for Implementation

This hands-on interactive course is designed for teachers in grades K-5. Participants will learn to use design, engineering, and technology instructional resources to enhance children’s attainment of the Virginia Standards of Learning in science, mathematics, social studies/history and language arts. Emphasis will be placed on the 5 C’s in the Profile of a Virginia Graduate, including strategies for deeper learning.

The course/workshop will engage participants in critical thinking and problem solving experiences that contribute to a child’s ability to retain instructional content and apply knowledge and skills learned.

Participants will discover how easy it is to integrate Children’s Engineering into the existing curriculum as a strategy for increasing children’s academic success. Teachers will take home product samples, design briefs, and ideas for enhancing their daily instruction.

Save the date!!!

Graduate Course/Workshop
K-5 Children’s Engineering
July 19-23, 2021
(and one follow-up Saturday with date to be determined)

Hosted Virtually by
Goochland County Public Schools

For more information, contact:
♦ Yvonne Richard, yrrichard@kgcs.k12.va.us
♦ Dawn Hillis, dhillis@kgcs.k12.va.us

Goochland County Public Schools

Registration Form

James Madison University Course Information

Option 1: Graduate Course: Children’s Engineering (501)
- JMU - 3 graduate credits, 90 recertification points
- JMU Tuition – (cost pending, 2019 was $972)
- JMU Non-refundable Application Fee - $20
- VCEC Materials Fee $75

Option 2: Professional Development Points
- Non-college credit, 45 recertification points, $395

Registration deadline: June 15, 2021

Sponsored by: