We Are All In This Together!
President’s Message
Dr. Laguna O. Foster

We are all in this together!

We all have a personal stake in the advancement of children’s engineering and informing others of its value!

“We cannot hope to build a better society without improving individuals.” - Marie Curie (1867-1934)

In this simple statement, Madame Curie summarized a specific responsibility for us as educators to ensure that those who follow us have the opportunities afforded us. This would require us to actively encourage our discipline and to leverage the power of engineering to improve lives.

I am deeply honored to serve as president of the Virginia Children's Engineering Council. I hope you will join me in creating opportunities for future generations of children and teachers who are interested in engineering.

My personal goals are:

• To increase opportunities for students and teachers to enter engineering and technical fields also known as STEM related careers.

• To establish and sustain partnerships among businesses and corporations, higher education institutions, school systems, civic/professional organizations, government agencies and other entities committed to our cause.

• To support educational improvements in engineering, science, technology and mathematics.

It is most important that we continue to expose students, at an early age, to a wide variety of experiences. These experiences must be aimed at improving their academic skills, especially in these related areas, which will broaden their awareness and interests in these fields.

Please contact me if you have any questions regarding Children's Engineering at lfoster@nps.k12.va.us.

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A Kinder “Garden” Adventure
By Karen Lucka-Beristain, Kindergarten Teacher, Campostella Elementary School of Science, Technology, Engineering, and Mathematics, Norfolk, VA

Summer comes to an end, and the teachers slowly begin to arrive back to school at Campostella Elementary, the exciting news is released that we would be implementing the first phase of our new S.T.E.M. (Science, Technology, Engineering, and Mathematics) Program. Although we would be integrating the four areas of STEM, our primary focus would be the engineering aspect. Each grade level would be assigned a different engineering field. Pre-Kindergarten, Kindergarten, and First Grade teams were assigned the Agricultural Engineering Field. Since we had made a small garden the year before, we planned to build a “real” garden. I had been introduced to square foot gardening at an early age by my mother in the early 1970's. My mother was “green” before it was in fashion and she taught me about agricultural engineering with raised garden beds, composting, and recycling. The seed had been planted and the garden was planned.

As the snow starts to melt after a long, hard Hampton Roads winter, the Campostella Kindergarten team is preparing to build a square foot garden box to house our vegetable garden. The seasoned planks are brought in and unloaded from the truck, the electric screwdriver and the wood screws are prepared. The teacher, Mrs. B, vaguely discusses what she wants but allows them the opportunity to visualize and “play” with the planks to see what they are able to design. The construction begins and the planks are assembled with the help of parent volunteer, Mrs. Burke, who happens to be in the construction business. With help and guidance, each child screws in the screws to construct a sturdy garden box. One by one the planks are put together and the box is built. We level the ground and stabilize the box so the children begin to dig holes to plant the support legs into the earth. Finally, we line the box with landscaping material to prevent weed growth. Lastly, Mrs. B delivers in her big green truck a load of top soil and compost. The children all participate in the unloading of the soil mixture in preparation for the planting.

Our science curriculum, K.6a-c, investigates the basic needs and life processes of plants and animals. We began planting seedlings in the class as well as several potato plants in a garbage can. We discussed and observed the growth and learned what the plants need to survive. My early arrivals come running into class, “Mrs. B. , Mrs. B, we need to take the plants outside to get some sun,” or “Plants need water and they are looking pretty thirsty, do you think I should water the plants?” We plan the garden together and discuss the growth patterns of each plant and how much space they will need to grow. We finally planted our seedlings and our seeds after the soil warmed up. We were all so excited. The next few days, we are observing the growth or lack of and the broken leaves. We brainstormed the possibilities of why the leaves of the plants were slowly and surely disappearing: flying balls, curious hands, or maybe even insects. The answer revealed itself one afternoon. It was none other than WILD GEESE. The geese were enjoying our garden also. We again brainstormed possibilities to prevent the geese from getting into the garden. The children suggested a plastic cover some what like a greenhouse cover, a gate, and a scarecrow. We ended up encircling the garden with florescent orange tape that blew in the wind...
assumed scared the geese away. The plants began to flourish. We planted radishes, potatoes, snap peas, green beans, tomatoes, green peppers, zucchini, yellow squash, beets, broccoli, tomatillos (green tomatoes originating from Mexico), cucumbers, watermelon, and strawberries. We learned about the animals that help the garden with pollination such as the bees and the butterflies.

Our broccoli was covered in caterpillars. Since we had just freed our newly transformed butterflies, they wanted to again observe the transformation process so we cut the broccoli and placed it in a netted cage. The caterpillars devoured the broccoli and 10 days later we again freed 18 white butterflies. Each time the children see a white butterfly in the garden they think it is one of ours. Our garden is an on going science experience for the children. Each day is new and exciting.

Everyday we haul out buckets of water to water the garden because we do not have an outside water hook up although we had a hose. The children take turns carrying the buckets, hoping that more gets outside than in the hallway. We are hoping to design a different watering system for next year!

Everyday students go outside to observe growth in the plants, weeds, and stake up plants for optimum use of the space. The more experienced agricultural engineers in my class explain the difference between a weed and a plant to the newer engineers. The children learned to water the soil and the roots instead of the leaves especially on hot days. They learned to make sure the plants received enough sunlight to grow. They learned that where there was a flower, a fruit or a vegetable would eventually grow. They observed the different leaf forms and textures.

Our most exciting time has been the harvest period. We have eaten raw snap peas, radishes with salt and butter, cooked beets with French vinaigrette, and grilled yellow squash and zucchini. We are hoping for the green beans to be ready before the end of the school year, only time will tell.
“Foundations of Engineering & Technology” presents an engaging introduction to basic principles of technology and engineering using simple, captivating, hands-on projects.

Each grade-specific unit can be easily incorporated into existing curriculum, with components related to Science, Math, Reading, Language Arts, Health, and Social Studies.

Each unit contains teacher prep material, project set-up, student worksheets, grading rubrics, and more. Materials are correlated to national STEM standards.

Great Lakes Press, publisher of “Engineering Your Future” introduction to engineering resources for high school and middle school students, now offers Foundations of Engineering & Technology curriculum for Elementary School students.

Nationally, there is an increasing push for greater technological literacy among students. These new resources are ideal for providing younger students with an elemental, foundational knowledge of principles related to technology, laying a strong foundation for further education in engineering and technology in later years.

For more information, call 1-800-837-0201 or email service@glpbooks.com or visit our website at www.glpbooks.com.
Using STEM to Answer the “Why” and “How” Question
By Nila Nash-Jackson, Second Grade Teacher, Campostella Elementary School of Science, Technology, Engineering, and Mathematics, Norfolk, VA

Children grow with a natural curiosity about the world around them. Toddlers will ask questions about living and non-living things beginning with the word, “Why?” For example, a three year old asks, “Why is the grass green?” Of course going into depth about the process of chlorophyll may cause the child to have a puzzled look or lose interest in what they initially inquired about. However, making a connection of the grass to some things they are familiar with such as the sun can begin to help develop the understanding of why the grass is green.

As children begin to mature to school age, they begin to ask the question, “How?” For example, a student asked me, “How does water come out clear from the faucet?” With this burning question the child gave me the opportunity to introduce water filtration. I had to find a way to make a connection with what was happening to the water outside in comparison to the water they observed coming out of their faucets at home.

Through the connection of literacy research, the students were surprised to find out that we used the same water over and over. The children were reminded to look at the percentage of water that covered our earth. Most of the students knew that it was seventy percent. But the real question was how much of that seventy percent could we drink.

The scientific research began about water through the internet. The “Why” questions needed to be addressed for the children to begin to understand the importance of water function and use such as, the water cycle, water conservation and water pollution. After the research, the children took a virtual tour of a water filtration plant and began to come up with ideas of creating their own water filter. Students began testing various materials to observe which water filter did the most effective job making the water clear. The students were provided with a cost assessment of materials and had to determine how much material was needed and affordable based on a given budget. After several trials, students determined which water filtration material was most effective.

As demonstrated in the above example, STEM can provide students with a systematic way of discovering the answers to the “why” and “how” question through problem based inquiry, critical thinking skills and making connections through technological literacy.
We often hear policy-makers cry out for innovation as the basis of economic salvation in this nation. That is followed by a call for more emphasis on “STEM” education, which is often followed by a move to have children take another math or science course. This is wrong! Innovation is the child of engineering – the “E” of STEM. Technological innovation certainly draws on science and math, but the process itself is that of engineering. The following two examples emphasize this subtle but important difference between science and engineering.

I often hear people speak of NASA rocket scientists – when I told people that I worked for NASA, they would then say: “Oh, you are a rocket scientist!” The fact is that NASA has only a few scientists. What NASA does have in order to carry out its mission is lots of engineers. For example, suppose NASA is asked to send a planetary rover or lander to Mars (as was the case with Viking, Spirit, and Opportunity). The science mission may be to discover what the planet’s atmosphere is made of or what the soil is made of or whether or not water or life is present. The main role of the scientist is to define the measurements that need to be made to satisfy these mission requirements. The role of the engineer is then, working with the scientists, to develop measuring instruments that can achieve the requirements. If the engineer cannot develop a perfect instrument, then she and the scientist work back and forth to try to get something less but adequate. Meanwhile, other engineers develop a “bus” – the lander or rover that will carry the instruments safely to the planet’s surface and deploy them. Then guidance and control engineers develop an entry trajectory to land the package where the scientists want it and other engineers develop an entry vehicle that can resist any atmospheric turbulence and heating, and follow the trajectory to a soft enough landing that the instruments can survive. Of course, the package must be launched from Earth and cross millions of miles of space which requires still more engineers to calculate that trajectory, design a package with steering rockets to get it to the planet’s area, and of course a powerful launch vehicle that can carry the package out of Earth’s gravitational pull.

As I write this article, engineers are hard at work trying to stop the millions of gallons of oil that are being released into the Gulf of Mexico by the failed BP deep water drilling operation. Scientists are also in the Gulf trying to discover and understand where the oil is, how underwater plumes form and flow, the impact of the oil on the environment and the impact of surface burning and dispersants on people and the environment. The May 29, 2010 NY Times had two headlines (and articles) that correctly emphasized the difference in

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focus of engineers and scientists (though they rely heavily on one another's work in the end):
• Page A10: "Little Headway on Leak is Made by Engineers"
• Page A11: "Scientists Build a Case for Undersea Plumes"

Scientists are focused on discovery and understanding; engineers are focused on solving a societal problem.

So where does engineering fit into our K-12 curriculum? It does exist in K-12 education, often as a Technology Education course. The goal of such courses is to give students an understanding of what engineering is, and to develop knowledge that will help them in preparing to enter engineering school or other technical fields. But engineers must complete four years of college and often require, in addition, a professional engineer (PE) certification. Engineering really completes a continuum of (or fills a gap in) K-12 education ranging from the pure theory of math and science to the almost purely hands-on trades. While trades prepare the student to build and repair existing systems, engineering prepares the student to design and fabricate new systems – that is, to innovate systems to take humans to the moon and return them safely to earth, to take landers to far planets to discover new secrets of our solar system, and to carry out operations in the extreme environment of the deep ocean to close off the flow of oil that threatens the environment and livelihood of millions of people. The scientific method is to discover; the engineering design process is to bring new value to society by developing solutions to problems.

Engineering is truly cross- or trans- disciplinary; it fits neither directly in CTE nor directly in traditional instruction, but rather forms the critical bridge between these two sets of skills.
Edible Engineering
By Martella Buggs, M.Ed., Special Education Teacher & Jennifer Davis, M Ed., Second Grade Teacher, Campostella Elementary School of Science, Technology, Engineering, and Mathematics, Norfolk, VA

What is Engineering?

According to Children's Engineering Educators, LLC; engineering teaches creative learning and critical thinking. Engineering addresses diverse learners and all learning styles. Educators should implement engineering because it promotes hands on learning, differentiated instruction, and addresses state and local Standards of Learning (SOL). Using engineering, educators can witness results in ownership of essential knowledge, self-confident learners, and applied knowledge.

What is Edible Engineering?

Edible engineering is a creative and unique strategy that allows the use fun food to teach and reinforce curriculum based information. Students use the Technology Design Loop to decide what the problem is and brainstorm solutions based on the criteria and material available. In the design brief attached, the students must choose foods to represent landforms, bodies of water, the shape of the map, and the shape and location of Virgiina. When the group had designed their map, they must then request the materials they will use to build it. After the map is complete, they will compare it to maps and photos to test whether they have located the physical features listed, and then decide how to explain the map to their classmates and evaluate what they might change next time. Edible engineering also generates an instant incentive when information is retained.

Edible engineering is 100% engaging to students, memorable, retainable, fun and creative. The ultimate mission of Edible engineering is to make the curriculum stick the first time!

How it Works at Campostella Elementary STEM School?

At Campostella Elementary S.T.E.M. School, the school teaches local and state standards with emphasis of S.T.E.M. (Science, Technology, Engineering, and Math). Jennifer Davis (Second Grade Teacher) and Martella Buggs (Second & Third Grade Special Education Teacher) created edible engineering to enhance student’s knowledge of the curriculum in a fun and creative way. This strategy creates results such as immediate retainable information that will conclude at the end of the lesson with an edible incentive.

How to Make a Curriculum Edible?

As an educator you can use edible engineering in every content area. The educator will just need to be creative and totally think outside the box to meet the required curriculum and standards. Here's how Jennifer Davis and Martella Buggs use edible engineering in social studies. Their design brief is on page 9. Try it with your class.
Edible Map---- A Design Brief to Try
By Jennifer Davis and Martella Buggs

**Background:** History & Social Sciences SOL’s 2.5 and 2.6
We have been learning about the U.S. map and important land forms and bodies of water located throughout the U.S. Students will use the information they have learned and the pictures they have seen to design and build “Edible maps of the United States of America”.

**Design Challenge:** Design and build with your group a map of the U.S. that your group will explain to your classmates.

**Criteria---**Your map must be no wider on the board than 18 inches and no taller than 12 inches. It must include:

- A compass rose
- A title
- The Rocky Mountains
- The Appalachian Mountains
- The Rio Grande River
- The Mississippi River
- The James River
- The Great Lakes
- An outline of the state of Virginia
- A key that contains all of the above

**Suggested Materials:** (Please be aware of food allergies)

*There can be a limit of one sandwich bag per group of any one food*

<table>
<thead>
<tr>
<th>1/2 sheet Poster board</th>
<th>Frosting</th>
<th>grapes</th>
<th>pretzels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graham crackers</td>
<td>cherry tomatoes</td>
<td>celery</td>
<td>raisins</td>
</tr>
<tr>
<td>Candy corn</td>
<td>gumdrops</td>
<td>carrot sticks</td>
<td>red-hots</td>
</tr>
<tr>
<td>Twizzlers</td>
<td>Skittles</td>
<td>apple slices</td>
<td>Cheezits</td>
</tr>
<tr>
<td>Fruit by the Foot</td>
<td>Licorice</td>
<td>Cheese</td>
<td>Fruit loops</td>
</tr>
<tr>
<td>Tootsie Rolls</td>
<td>Wrapped gum</td>
<td>Vanilla wafers</td>
<td>Saltine crackers</td>
</tr>
</tbody>
</table>

**Tools:**
- Popsicle sticks as spreaders
- Paper towels
- Pencils for writing
- Colored Pencils/crayons

**Additional Edible Ideas**
Sol 2.1 Contributions of China & Egypt
- Build the Great Wall of China with graham crackers
- Build the pyramids with gum drops and icing

Sol 2.2 First Americans
- Powhatan longhouses with pretzels and peanut butter

Sol 2.12 Famous Americans (Helen Keller)
- Braille with candy dots
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If you would like to submit to the upcoming Fall 2010 edition on Structures and Going Green, please send articles to JLHNEELY@aol.com and design briefs to cholter@rockingham.k12.va.us by September 25. Published articles earn up to 45 recertification points.