INNOVATION AND INVENTION IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

STEM VENTURES

Your STEMtastic Family Newsletter

Volume Five, 1st Edition

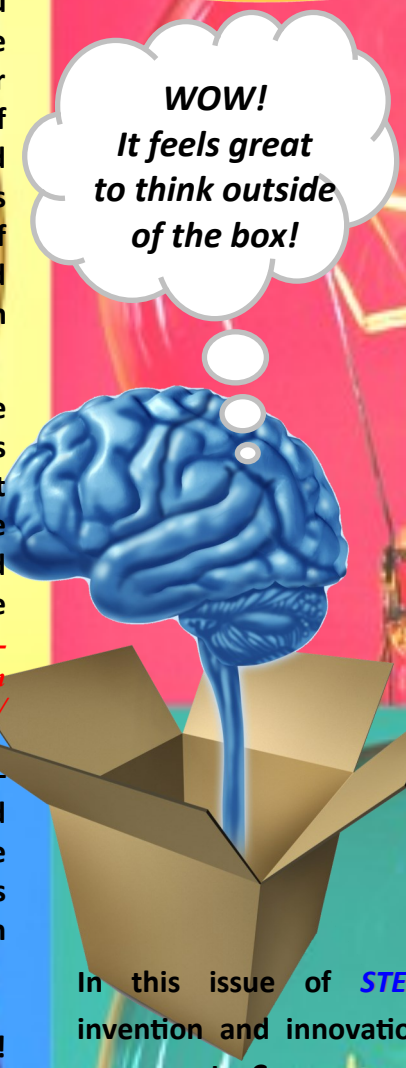
The Maker Movement (a.k.a. Engineering Design)

Have you ever heard of *Maker Faire?* If you haven't, chances are you will hear of it soon, as the maker movement is growing in popularity all over the world! Maker Faire is simply a big festival of "show and tell" for anything creative, crafty, and inventive. Mini-Maker Faires held in communities all over the U.S. provide a showcase for makers of all ages to demonstrate, discuss, share ideas, and try out new things. It's a family-friendly fun celebration of invention and innovation!

According to *MAKE* magazine, many "makers" have gone on to start their own companies from ideas shared at a maker faire. Maker Movement founder, Dale Dougherty states "I believe we are all makers . . . People who have the skills and knowledge to make things have the power to make the world a better place." *Abrams, M. Making Engineers: A Chat with Dale Dougherty. March 2014. American Society of Mechanical Engineers . https://www.asme.org/engineering-topics/articles/global-impact/making-engineers-chat-dale-dougherty* Many see makers as non-professional engineers, and by tinkering and trying things out, they are using the same creative and technical practices that engineers use. Makers have solved problems and engineered products in much the same way engineers do!

Making isn't only for adults! Kids are makers, too! Sylvia Todd is an eleven-year-old celebrity with her own online webspace and video series "Sylvia's Super Awesome Maker Show". (Check out her ideas at *http://sylviashow.com/episodes*). At a recent maker faire in Tyler, Texas, kids had the opportunity to explore robotics, 3D printing, bridge building, weaving, gemology, candle-making, rocketry, chemistry, and many other activities.

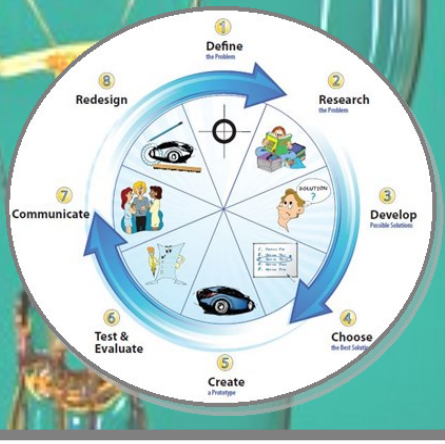
STARBASE Louisiana
A Department of Defense Youth Program



Inside this issue:

Our community has also caught on to this wave of inspiration! The first annual Mini Maker Faire will be held in Shreveport on September 19, 2015! Plan to take your family for a chance to "make and take".

In this issue of *STEM-Ventures,* we highlight invention and innovation, the basis of the maker movement. Can you see yourself as a "maker"? At STARBASE, you had the opportunity to work as an engineer to design solutions and solve problems. Why not tinker around with some creative projects this summer? Who knows? You could be a "maker", too!



EATING UP SCIENCE!!!

Recently, a group of nearly 40,000 chemical engineers voted on the most important chemically-engineered inventions of the last century. The Top Ten list included the development of a synthetic (man-made) fertilizer. At STARBASE, you learned that chemical reactions create a new substance. Inventor Fritz Haber developed the process in which the nitrogen in the atmosphere changes through a chemical reaction into ammonia. Ammonia is necessary for plant growth, and adding this ammonia-based fertilizer greatly increases the growth of crops. This helps provide the amount of food necessary to feed the millions of people on our planet! According to Hasan Baqar, from IChemE, "Almost half the people on the Earth are currently fed as a result of synthetic nitrogen fertilizer use." *http://breakingenergy.com/2014/02/06/chemical-engineers-vote-on-modern-eras-top-10-best-inventions-energy-dominates*

Having extra crops in recent years has allowed the United States military opportunities to provide help to disaster-struck regions throughout the world. Tsunami and earthquake victims, as well as those living in war-torn regions, are often supplied with food and water delivered by U.S. troops. *Listosaur.com. 5 Notable Humanitarian Mission by the U.S. Military. At: /politics/5-notable-humanitarian-missions-u-s-military/*

Do a cool experiment to see for yourself if nitrogen-based fertilizer helps plants grow. At STARBASE, you learned that scientists use repeated trials to verify findings. Ask a family member to conduct the trials along with you using the steps on the right.

What other innovations in food science would help the world?

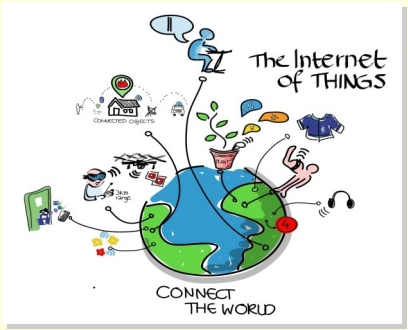
SCIENCE

U.S. troops provide aid to Indonesia after the tsunami in 2004. stltoday.com

Experiment Procedure (for each person):

1) Purchase seeds, nitrogen-based fertilizer, and a large bag of soil that *does not* contain added fertilizer.
2) Poke holes in the bottom of eight plastic containers. Label four of the containers "FERTILIZER" and four "NO FERTILIZER".
3) Add soil to each container. Moisten the soil in each container with a little plain water. Plant the seeds in each container. Place them in a sunny spot .
4) For a few weeks, water the "FERTILIZER" plants with water and fertilizer, according to package directions. Water the "NO FERTILIZER" plants with an equal amount of plain water.
5) Make a data table (like the ones you used at STARBASE) to record the day, the amount of water used, the growth height, and the number of leaves, flowers, or other observations. Use the same method to collect your data on all of the plants throughout the experiment. Compare the results!

Get Connected Through The Internet of Things!



Most of us use the internet every day, whether it is on a computer, smart phone, or tablet. However, with the increase in sensor-driven machinery, the internet is now used for more than just research or social media. Everyday objects are now networked with data collection and analysis devices that communicate with one another over the internet, creating an internet of *THINGS.*

The Internet of Things, also known as I o T, is a really *hot topic* in technology circles. Since the arrival of "smart" gadgets, this complicated cloud technology is rapidly expanding. There are around 13 billion devices, such as cars, watches, and household appliances, currently connected to the internet. This allows computers to communicate with and control these devices! *http://blogs.cisco.com/diversity/the-internet-of-things-infographic*

Try the activity on the right...you may be surprised at how 'connected' you already are!

Certainly, connected devices help make our lives easier. For example, you can check the temperature in your home from your phone or work computer and make adjustments. Sensors in your car can send you an email when your oil needs to be changed. However, as the number of "smart" gadgets increases, so do the number of cyber attacks! This concern has created a huge demand for cyber security experts to protect these huge amounts of information from cyber-hackers! The concerns have prompted the DoD to establish U.S. Cyber Command with the mission of ensuring information security for the United States Government.

http://www.schools.com/news/computer-security-specialist-salary-career-outlook.html

To help you visualize the interconnection between devices, make a list with your family of the internet-connected gadgets in your life. After making your list, draw an icon (little pictures) for each of the devices on a large sheet of paper, spreading the icons out all over the page. Next, draw lines from each of the icons to other devices to which they connect in some way. Your illustration will begin to look like a huge "web" – "WWW" = World Wide Web!

TECHNOLOGY

Ready...Aim...Fire!

"Dreamer. Innovator. Researcher. Problem Solver. Inventor. Creator. All are terms that . . . describe the characteristics of an engineer."(*TryEngineering: What is an Engineer? @ http: tryengineering.org/ask-expert/what-engineer).* Here is your chance to fill that role with a fun and easy engineering project.

Clothespin Catapult!

To complete the basic project, assemble:

1. spring-type clothespin
2. large popsicle stick
3. small scrap of thin wood or thick, hard cardboard
4. low-melt glue gun and glue stick (get an adult to help)
5. plastic spoon, paper pill cup, or bottle cap (used as the "sling" to hold and launch projectiles)
6. small, lightweight objects (cotton balls, ping-pong balls, marshmallows, buttons, etc.) for launching

Now watch YouTube video *"Supercharged Science Cast, Ep.21: Clothespin Catapult"* for step-by-step directions for building your catapult *https://www.youtube.com/watch?v=TqRiQuMazbI* or read *Clothespin Catapult @ http://www.sci-experiments.com/catapult/catapult.html* . Once it is assembled, practice launching your projectiles from the sling. With practice, you can make them land in a target, like a cup or a paper bulls-eye. At STARBASE, you learned Newton's Laws and that

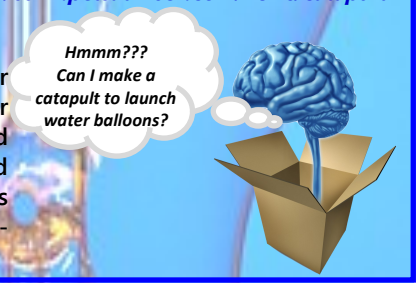
Force = mass x acceleration .

ENGINEERING

Although catapults have been around for centuries, the technology is still evolving. The military is designing an Electromagnetic Aircraft Launch System (EMALS) to assist in catapulting aircraft off of the short runway on U.S. Navy ships. *http://www.economist.com/news/technology-quarterly/21598325-electromagnetic-launchers-hurling-objects-electrical-energy-giving*

Your catapult is made to keep the force of the launches pretty much the same each time. Experiment with different objects that have different masses (the amount of material in them) and see if it changes your results. Make a record of your observations.

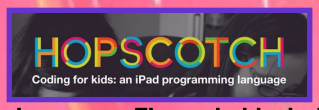
Now, it's time to dream, innovate, and invent. Brainstorm ways to improve your catapult's performance. Is there something else to use instead of a clothespin? Would a longer fulcrum (the popsicle stick) give you better results? Can you modify the catapult's design (size, materials, etc.) and make it a useful machine to make an everyday task easier? Go ahead and think outside of the box! (Watch this video of a unique catapult an engineer created to help his dog play catch at *http://buzz.petsadviser.com/news/catapult-teaches-dog-fetch/*)!



Remember, always consider safety first! Make sure your design changes are safe, and NEVER send a projectile toward a human or an animal! Always get permission from your care-givers before you start!

LOGIC + REASONING SUPER FUN APPS!

One of the fastest growing fields for mathematics inventors is developing computer applications or "Apps". There are almost 2 billion people using mobile devices like smart phones and tablets and 80% of their time is spent using apps. That is a LOT of users putting in a LOT of time using apps. We will need huge numbers of people to enter computer science fields to keep up with demand. To draw students into that career, App developers are creating apps that teach kids how to write code, the mathematical programs that make devices *do* what we *want* them to do. Some apps help kids learn logic and sequencing and to think like an inventor. Check out some of these apps with your parents!



Hopscotch is a drag-and-drop program where the user can write their own program using different characters. The code blocks have command words that are very easy to understand and users can easily edit and test their code to see if it does what they want it to do. There are dozens of tutorials for *Hopscotch* online allowing new users to sit at a computer, watch the tutorial, and follow along with their mobile device. (A great starting tutorial on YouTube is *"Hopscotch – an hour of code screencast."* Find it at https://www.youtube.com/watch?v=UH5CESyZ7So . By the end of the hour, you'll be programming like a pro! The app is *free* !

If you like to make fun, creative, and perhaps weird inventions, *Inventioneers* may be the app for you. It starts out with the character Windy who has to get a cat out of a tree. The user has to place objects in just the right place to make a series of events occur to blow the cat out of the tree and into the basket of his happy owner. The beginning levels are very simple but it gets much more complex as you progress. True-to-life physics concepts are developed in this game. The free version stops with the 40 levels of Windy's story. The full version, which is only $2.99, gives hundreds of scenario levels with none of the annoying in-app purchase pop-ups or restrictions.

Along the lines of *Inventioneers* is another free app, *Tinker Box*. This app does not use characters, but uses levers, buttons, funnels, springboards, and inclined planes to get objects to their final destination. You have to think logically and test and retest! The levels get very complex. This app also allows you to create your own puzzles from scratch and make them as complicated as you'd like! You will develop a firm grasp of geometry as you try to get balls to bounce at the right angle and go into an opening!

Available on the App Store

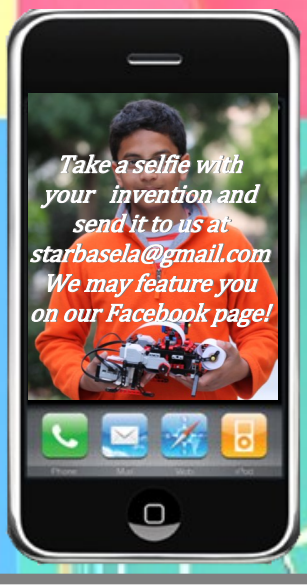
MATHEMATICS

STEM: What's the BIG IDEA

Have you ever said to someone, "Wow! Wouldn't it be cool if we had a ***(fill in the blank)*** that could ***(fill in the blank)***. Most of us have had a great idea another for something that doesn't yet exist. Yet few of us will ever have the opportunity to actually "make" what we can imagine. The folks at ***Quirky.com*** believe in your ideas, and want to help you make your ideas come to life. This fantastic website is full of inventions created by ordinary people like you and me! ***Quirky*** allows you to submit ideas for new products that make people's lives better. You can submit your ideas along with a sketch or drawing to be reviewed by their experts. If your idea is chosen, it may be produced and can even make you money! More importantly, you will have helped produce a useful product. You do have to register with ***Quirky*** to submit an idea, so get your parents to help.

The National Museum of Education is also interested in getting kids inventing. They sponsor an on-going competition open to students in Pre K-College, called the Student Ideas for a Better America. Prize money is awarded to three winning students each month! Visit: ***http://www.nmoe.org/students/siba.htm***

PBS Design Squad Nation runs contests for aspiring engineers on their website. After posting the challenge, contestants create their design, and post pictures and descriptions of their inventions. Web viewers vote for their favorite designs! This cool website also has project ideas, most of which can be made with simple everyday objects. Visit ***http://pbs.kids.org/designsquad/topbuilder/***



For a fun family contest, assemble several bags of identical items—Lego bricks, building blocks, bottles caps, paper clips, rubber bands, straws, etc. Divide your into teams. The object of the competition is to build the best original "thing" with the objects in your bag. Someone can serve as the judge and must leave the room while you build. The judge will determine which creation is the best. Set a time limit, and start building. You may amaze yourself!

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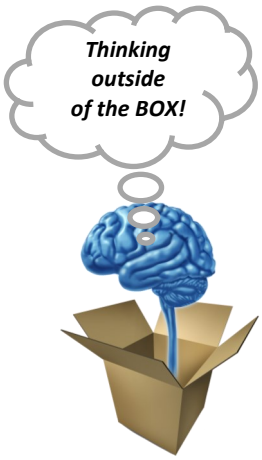

SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

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