

# Stonington Public Schools

## Newsletter

October 2015



Science, Technology, Engineering and Math, or STEM, is a current focus in education and is an integral part of the experiences we offer our students. STEM education is an approach to learning that connects the four disciplines and combines them into real-world, rigorous, relevant learning experiences for students. STEM is not a course, but a range of strategies that help students apply concepts and skills from different disciplines to solve meaningful problems. It gives students opportunities to apply the skills and knowledge they have learned and gives them a strong base for post graduation classes and even for future careers. Our schools offer many opportunities for students to experience STEM in classrooms and in extracurricular settings in all grade levels. This newsletter highlights some of the STEM programs available to our students.

**Science - Technology - Engineering - Math**

## Elementary After School Enrichment at WVSS & WBSS



These programs were offered to students last year. Attendance and enthusiasm were very high for each challenge and the hope is that they will be offered again this year.

**STEAM Challenges :** Use science, technology, engineering, art, and math to undertake these exciting STEAM challenges. Learn about the field of Biomimicry as you develop a product based on nature to design and market to the NESS judges, take the marble maze craze challenge, build a model catapult, and investigate wind power using iPads and experiment with wind turbine shapes. (Open to students in 1-4)



**STEAM Challenges 2:** Use science, technology, engineering, art, and math to undertake these new exciting STEAM challenges. Measure success through angles by creating a contraption to withstand the simulated pitch and roll of a boat, unlock the buoyancy mystery of Davy Jones' Locker, test the strength of bridge designs, and experiment with boat keel shapes and sizes. Open to students in grades 1-4

**LEGO Fun:** Build things, over-and-over! Children learn about volume, support, and aesthetics. For aspiring young architects, crafts-persons, engineers, Lego sets are the building blocks (literally) to scientific success. Students will collaborate on one large standing project, while working on their own individual creations. Program brought to you by KidsConnect. Best for students in K-2, but open to students in all grades.

## Grade One and Two

Submitted by Teams 1&2 at WVSS and Teams 1&2 at DMS

Students in grade 1 begin the year by exploring how shapes can go together or be taken apart to make other shapes (engineering). This lays the foundation for work students will do in geometry. While exploring shapes, students are learning about patterns and connections, two important concepts in the science and math practices.



Second graders learn about the phases of matter. One example of how the students encompass the four aspects of STEM can be seen when learning about the gas phase. The students enjoy rotations throughout the various second grade classrooms and participate in different experiments to understand the gas phase more in depth. During one experiment the students help to assemble a balloon rocket and make predictions of



what will happen when the air is released from the balloon. The students observe the same type of experiment through watching a YouTube video of how to create a balloon car. The students observe how it is important to have precise measurements to create these balloon powered cars.

## Grade Three

Submitted by Team 3 at WBSS Teachers and Team 3 DMS Teachers

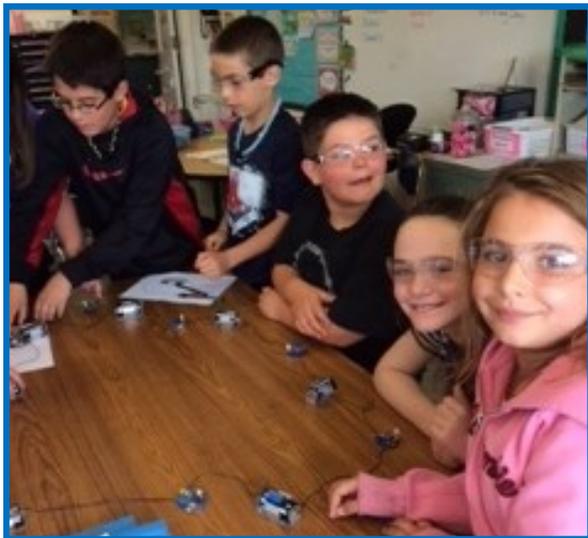
In third grade students make and record meaningful scientific observations. Students are responsible for maintaining a science notebook. Students investigate plants and adaptations in the beginning of the year. So far students have rotated through four plant centers and recorded easily observable data in their science notebooks.

During the first week of school, students participated in some fun STEM activities. Students were challenged to create the tallest index card tower that was free standing and could remain self supporting for ten seconds. This particular STEM Challenge required our students to use their engineering, problem solving and communication skills to accomplish the task.



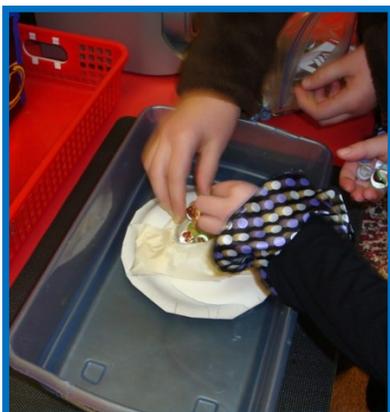
Last year, students engaged in an interesting STEM activity that involved the properties of matter. Students were given a wide assortment of materials (sponges, paper, popsicles, straws, tin foil, masking tape, etc.). They were then asked to design a "boat" or holder that will float and hold weight (marbles). Students had to think about the properties of the materials (absorbency, strength) when designing the holder. Students test their designs along the way and make revisions. Students connected their designs to real-world examples.





# WBSS & DMS Grade Four Students

*Submitted by Team 4 WBSS Teachers and Team 4 DMS Teachers*

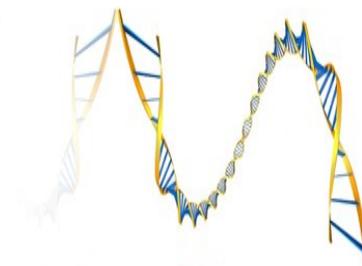


Fourth grade students have the opportunity each spring to learn about magnetism and electricity. The Millstone Power Station sends a teacher to guide our students through hands-on experiments with building simple circuits and the concept of magnetism.

Students recently learned about the concepts of force & motion by building catapults. Once catapults were built, students were then given the opportunity to experiment how well they worked by launching marshmallows. This hands-on



learning activity allowed our students to build and manipulate an object and better understand how force and motion work.



# Pawcatuck Middle School

## Students Experiment

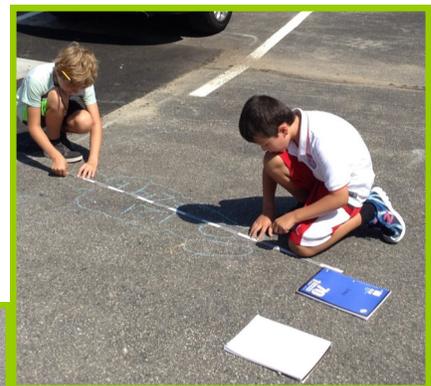
Students in fifth grade study the Alaskan sled dog race in several ways. Each student gets a musher (or 2) to track. They discuss times, pace, and placements of racers as the Iditarod race is tracked. Students learn about Alaskan temperatures in various cities and compare this information as the racers travel on the trail. Snow-fall amounts are discussed. Students in cooperative working groups to study the following Iditarod topics: tracking the dog team, rules, equipment, history, care of the dogs and role of the mushers. Students incorporate math skills in measurement, computations, predictions and distance calculations.



New England Science and Sailing, offers STEM experiences for our students. Students have studied salinity of the water and compare the water of the various bodies of water. Students also learn about the various wildlife, including birds and marine animals. Through experiential learning and observation, seine fishing and collection, students see a variety of sea creatures live and up close. In the classroom students discuss and reflect on their experience.

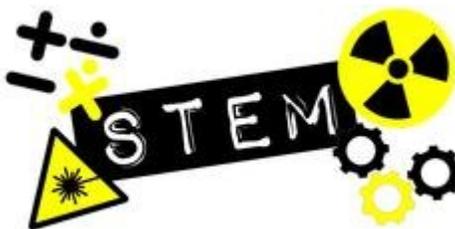
Each year the fifth graders travel to the Connecticut Science Museum. Concepts learned in third, fourth and fifth grade are reinforced in engaging activities. As our budget allows, students may also have the opportunity to participate in a hands-on experience of an advanced science concept using more sophisticated equipment and techniques in the museum classroom.

Students also integrate math and science as they experiment to learn about solar patterns. Using golf tee, solar trackers and compasses, they marked and measured shadow lengths and directions throughout the course of the day. Students then charted and graphed the information. (This required converting centimeters to millimeters- a current



math focus.) They followed up by drawing inferences about the sun's location in relation to the shadows, as well as reasons for the patterns of lengths. This was then related to careers in agriculture and solar engineering. We will conduct the same experiment later in the year for comparison, so that students can better understand how Earth's orbit and tilt affect sunlight on Earth.

*Submitted by PMS Team 5—Heather Pescatello, Sheila Adams, Elaine Temel, Emilie Cravinho and Kristina Torres and MMS Teachers—Devri Gill and Heidi McGowan*



# After School at MMS

Submitted by MMS Teacher Nancy Sullivan and PMS Team Six—Linda Whelan, Tina Eisenbeis, Tina Serluca, Marika Heughins and Devon Newman

Science Olympiad at MMS: As their website states: “A science fair is intense, individual, and quiet. A Science Olympiad tournament is full of yells, cheers, enthusiasm, and the kind of team spirit athletic teams have always enjoyed.” Culminating in a statewide competition in March, this club challenges its members to design and create solutions to real world problems through innovation and cooperation. Some of this year’s events include constructing an aquifer, designing and building a mousetrap vehicle, designing, building, and flying a water rocker – and twenty others to choose from!

## 6th Grade Science

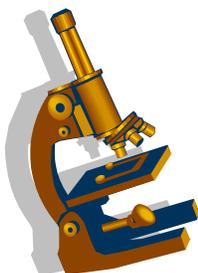
The Little Green Soldiers were having trouble saving the universe from evil because they were sinking in water like rocks. The students need to design life jackets for little plastic soldiers. They need to make sure the soldier's head was out of the water and used as little material as possible, because they won't wear them if they're not comfy! Change density by adding volume with as little mass increase as possible. They don't know this, they have to figure it out by testing and calculations.

In our discussion of global climate change, the students learn about scientists building shelters for penguins in South Africa where the temperature has recently reached 100F. If the parents leave their eggs to cool off in the water, the eggs are eaten by predators. The students are asked to design and build shelters for penguin shaped ice cubes. They need to "buy" supplies (everyone has a budget) and need to finish and test their first design in one class. Each purchase needs to be justified, temperature is monitored, and the penguin's mass is determined before and after time under the dome. Day two is for presentations and retries based on those presentations.



The students design a Mars/Moon colony that would meet the six needs of living things (water, food, energy, living space, suitable temperature, and oxygen.) Included in the challenge is designing and conducting experiments to compare the germination and growth of basil seeds planted in soil (geoponic) and hydroponically (more specifically, aeroponic, because the roots are sprayed.) The students build and maintain their own hydroponic growth stations and we assess the pros and cons of geoponic farming and hydroponic farming on Earth and the implications for space.

The students design, build, test, pollute, and retest wells. They create a desalinization system. They design, build, and test water purification systems and they test and evaluate a variety of methods for cleaning an oil spill. Each engineering challenge has time constraints and “budgetary” considerations, just like real life. Ideas and designs are tested and retested using the 5E model.



Students use the experience of sailing as an avenue to actualize STEM in an exciting real life application. Students learn the physics behind sailing, simple machines and basic navigation principles. In addition students participate in a kayak expedition which focuses on our watershed. Students use science equipment in the lab to test water quality and use microscopes to identify plankton in the water samples they collect.

Sixth Grade students go to Alton Jones for a two day trip. This is a 2,300 acre wilderness area that is used to provide environmental education to learners of all ages. This overnight trip gives students a hands-on, outdoor experience with a focus on increasing student appreciation and understanding for their environment and each other. Specific topics of study include; Forest Ecology, Predator/Prey, Team Building, Group Building.

Students use the Mystic Aquarium to make connections to our ecology unit. They identify and familiarize themselves with the different habitats and food chains of the animals at the aquarium. There is an emphasis on environmental education and the health of our oceans. *Through inquiry based instruction students participate in hands-on activities and labs that focus on the scientific process. Students use a variety of methods and tools to pose questions, make observations, investigate and analyze data.*

Environment!

Ecology!

Physics!

# Hour of Code

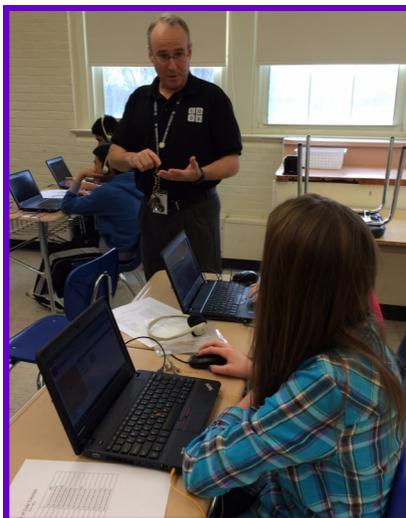
*Submitted by: Tim Smith*



For the last two years, Pawcatuck Middle School has participated in the world-wide “Hour of Code” event as part of national computer science week. The first Hour of Code was held after school with a handful of interested students. Last year we expanded the event to a school-wide hour, where every student in the school had an hour to learn how to write computer code.

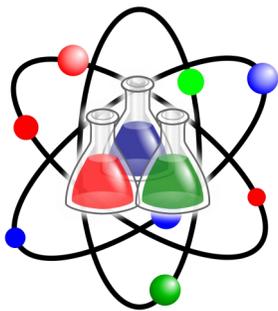


With our school-wide participation,



Pawcatuck Middle School was also invited to join the Hour of Code kick off event. A group of our students participated in a live broadcast of a Google+ video chat with Clara Shih. Clara Shih is CEO and founder of Hearsay Social. A pioneer in the social media industry, Clara developed the first social business application in 2007 and subsequently authored the New York Times-featured best-seller, *The Facebook Era*. She has also been named one of Fortune’s “Most Powerful Women Entrepreneurs,” among other recognitions. This

was a great opportunity for our students to meet and talk with this inspirational leader in technology.



During our 7<sup>th</sup> grade physics unit we will have plenty of opportunity for building and mastering engineering skills (simple machines for example). There will also be discussion of current technology and the use of online models to help conceptualize difficult scenarios such as orbit, conservation of energy, and work.

However, incorporating engineering and technology in life science is sometimes more difficult. This year we will build replicas of muscles to help visualize motion of the body. This hands-on activity is perfect for life science because it relates to our unit of simple machines and it is building and design. Using three-dimensional programs on the computer or iPad helps students understand size proportion and anatomical concept.

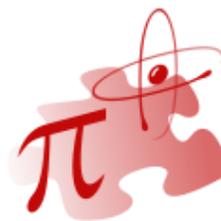
Students learned the mechanics of buoyancy, wind and air pressure, currents, and sea floor features as they took on the role of a writer for a surf magazine. In the article they wrote for the surf magazine, they had to explain why the site they chose is the best surfing site in the world. Supporting data had to include a surf break analysis, budget, absolute and relative location, and nearby points of interest. Student groups made presentation to the class in addition to their written article.

Working in small teams, students did research on the environmental and human impact of the 1980 eruption of Mt. St. Helens. They were then given the task of creating a museum exhibit to share their learning. Exhibits had to include information on types of volcanoes, history of eruptions, scale models of Mt. St. Helens both before and after the eruption, and an interactive component.

In teams, students took on various roles (archivist, market researcher, ergonomic engineer, designer, and ad executive). They then worked to research the history of backpacks, comparing to how Civil War soldiers carried their goods, and what they carried, designed experiments to test different loads in different backpacks, learned advertising techniques, went through the design process, and designed and carried out surveys to find out what students wanted in a backpack. After gathering all this information, teams met and decided on three improvements they would make to backpacks, and prepared a skit to present their findings to their classmates. Skits included models of their new designs.



*Submitted by:*  
*Kristina Torres*  
*PMS Team 7*  
*Natalee Denard*  
*MMS Team 7*



# 7<sup>th</sup> Grade Physics Unit

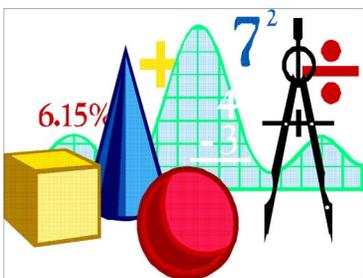
Each June, seventh grader girls from PMS and MMS attend the Girls STEM Expo at Mitchell College. Working together, they learn about the Science practices in a fun, challenging manner. They also meet with female scientists, engineers, technicians and mathematicians to learn about different careers.

# 8th Grade

STEM is embedded intrinsically into the math curriculum. For example, in Algebra, we examine hydrocarbon molecules and make predictions about how the structure changes with an increase of Carbon atoms. In Pre-Algebra we evaluate the amount of fresh water and salt water on earth and use Scientific Notation and ratios to represent these amounts relative to the surface area of the Earth.

Chromebooks are used everyday in 8th grade social studies, and as such there has been a fundamental shift in both the delivery of content and the products students create in class. Due to the use of Chromebooks, this class has zero lectures. Students rotate through a series of themes (often incorporating scientific issues) throughout the year, so at any one time there are three different topics being covered in class. This means that all teacher directed instruction occurs in small groups for no more than ten minutes at a time. The students work through various independent assignments and collaborate with group members to attempt to solve real world problems. I've included a few testimonials from last year:

As part of the 8<sup>th</sup> grade legacy project started in 2103, Team 8 PMS students along with their boundless energy, applied their math skills of estimation, measurement and equations to real life scenarios. The math teacher led one team of students in rejuvenating the stucco wall surrounding the front of the PMS campus. After researching the proper type of medium to use, students estimated the dimensions of the wall and the cost to paint it. They called on the expertise of Mr. McQuade, of Ace Hardware in Westerly, RI, to explain how to prepare the wall's surface and the proper application of the paint. After weeks of scrubbing and prepping, the eighth graders gave the wall a marvelous makeover.



A second team, under the guidance of the science teacher, put their knowledge of local plants and their gardening skills to good use. Students learned about the negative impact of non-native plants on the surrounding habitat and choose drought resistant native species to incorporate in the front flower beds. Both the students and teachers enjoyed the legacy project and its lasting results.

The biggest engineering unit is the bridge unit where the students focus on how forces act on a structure, and then create their own model bridge to test. Students test their creations to the point of failure with weights. Students will calculating the engineering efficiency of their models after they are tested. The school record remains 58 pounds for a 'legal' bridge built to code although those designers have just started college. Maybe this year students will break the record!

In addition to the Bridge unit, math is integrated into the Forces & Motion unit where students are asked to calculate speed, momentum, acceleration etc. and in the Astronomy unit where we discuss light years and the exponents in relation to objects in the universe. We also focus on the smaller scale objects, as in Genetics, where we discuss probability and calculate the chance of inheriting genetic traits. Students conduct labs (practicing data gathering & graphing skills among others) on friction (the two embedded tasks), flight of paper airplanes, and factors that affect the size of craters. Students will be calculating and drawing the eccentricities of orbits.



*Submitted by: MMS - Barbara Wells and Kim Brandt*

*PMS Team 8—Emilia Cassata, Dan Agins, George Hardison, Amber Manfrede and Whitney Stamm*

# HIGH SCHOOL

## Honors CEP

Submitted by: Kaitlin Johnson

Students in Honors CEP worked collaboratively to design an experiment testing the effectiveness of two different types of solar cookers. Together, the students researched types of solar cookers, planned and wrote-up an experiment, and built solar cookers to conduct their tests. Once they conduct their experiments, they'll have to analyze the data and use it to support/refute their original claim about which cooker will be most effective.

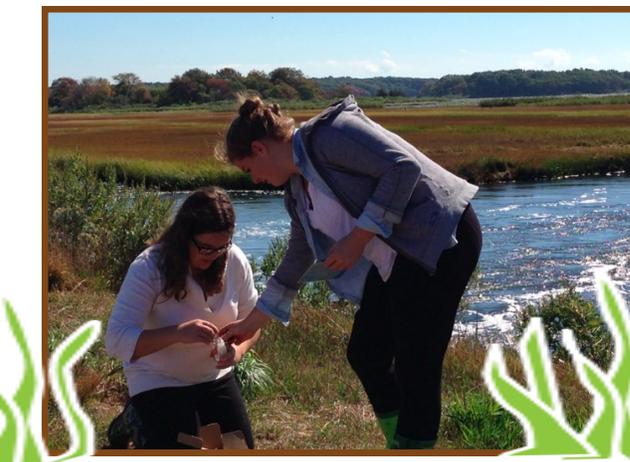
## Oceanology

Submitted by: Catherine Ellis

Science classes are naturally intertwined with math skills, as they are integral to interpreting the data that is collected in both field and laboratory experiments. We use basic math skills (calculating averages) all the way to advanced algebraic skills (dimensional analysis in physical sciences) to help us interpret data. We also use geometry to help us determine area, volume and density that are sometimes part of the data set. This data is then used to form cogent conclusions about the experiments that we conduct in class, and is communicated by means of lab reports. Lab reports include not only the raw data, but then the students must analyze the data and interpret it for the reader, ultimately returning back to the hypothesis to determine if it was supported or rejected by the data. Students use the data to construct graphs and tables to illustrate the trends in the data.

Data is critical to what we do in science as it helps us back up theories, generalizations and hypotheses with facts. Incorporating STEM-like practices such as data collection and interpretation gives students the opportunity make connections between the classroom and the real world, thus hopefully piquing their curiosity into their natural world.

Oceanography is a class that is offered at the high school twice a year on a semester basis. This is an introductory class where students learn about both the physical and biological components of the ocean. In this curriculum, we incorporate STEM-like practices where students go into the field once during the semester to collect data about the Barn Island Wildlife Refuge here in Stonington. Working with staff from Mystic Aquarium, we collect data about the salinity of the water and discuss what characterizes a brackish environment (15 ppt – 30 ppt) vs. an oceanic environment (30 - 35ppt). In addition, we collect soil samples and test the pH in the peat bogs and conduct dissolved oxygen tests on the water in the salt marsh. Using this data, we are able to make inferences about the wildlife in the environment, and about the health of the ecosystem as a whole. Culminating this field lab activity, we sample the waters surrounding Barn Island, as well as the marsh and conduct a population study of the animals residing in the area at that particular time of the year. We discuss the effect of temperature on native organisms, how it affects their metabolism and explain why there are seasonal changes in our local waters.

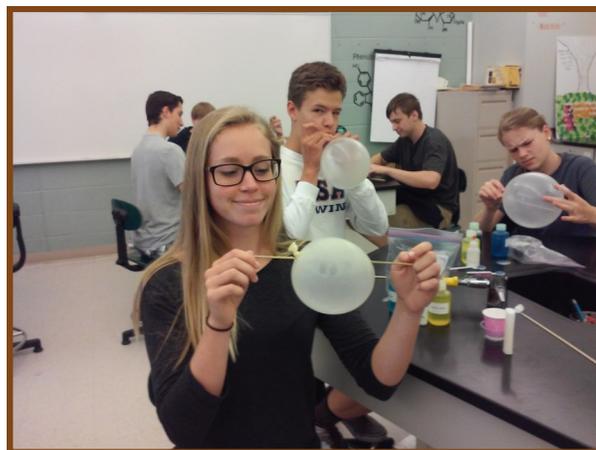


PBL project consists of learning both fall and spring gardening skills through seed germination, seedling planting, garden maintenance and harvest. Supplements to the PBL portion consist of reading non-fiction science text assignments, videos that include history of agriculture and exemplar techniques for a successful harvest and mathematical skills necessary for planting purposes. Students participate in a lottery and are assigned one garden plot that becomes their small group's sole responsibility. Students are encouraged to bring harvest home to share with their families. All food that is not consumed by the SHS community and families is donated to Human Services and is made available to Stonington community members in need or want of fresh vegetables. Students are introduced to the Human Services Community Garden Program by speaker Kristen King and tour the facility, making comparisons among various styles of gardening.

## Plastics

*Submitted by: Rosamaria Burger*

Davis Standard sponsored a visit from the Society of Chemical Engineers' Plastivan program in June 2015. It's wonderful to see corporations invest in their local communities. Many of our students knew Davis Standard was right next door to the high school but didn't know what the company did. Through the program, not only did they learn that Davis Standard produces extruders, they also learned how those extruders are used to make almost everything we come into contact with in their everyday lives. They learned how plastics are made and saw demonstrations of polymer production. Margie Wiener, the presenter, explained how disposable diapers work, dissolved a Styrofoam cup through a chemical reaction, and showed students how nylon is made.



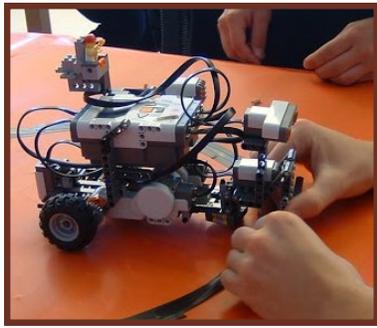
The students were able to manipulate polymer chains themselves by putting a stick through an inflated balloon without popping it. They also cross-linked polymers to produce a putty.



During the presentation, students also learned about careers in engineering and how in-demand these careers are. It would be wonderful to see some of our SHS students come back to our community after graduating college to work as engineers for Davis Standard.

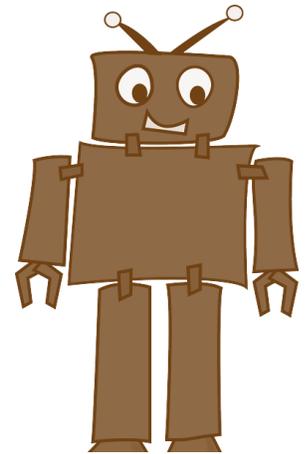


**Engineering & Robotics**  
 Submitted by: Yolanda Fernandez



**Robotics:** Design, programming motors and sensors, troubleshooting, problem solving.

**Engineering:** Design, construction, analysis of data, calculations, extensive use of technology to research

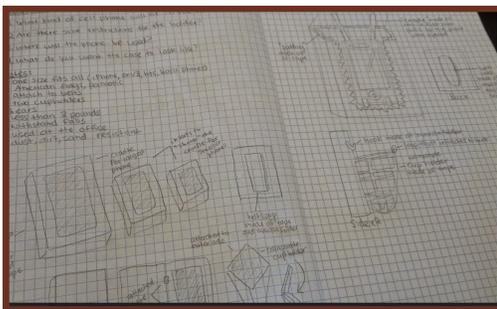


**Examples of Engineering & Robotics**



**Bridge Project:** Construct model, computer design a new model minimizing cost

**Cell Phone Holder:** Design and build prototype, calculate production cost and retail price based on customer specs.



(Pictures show two different designs)



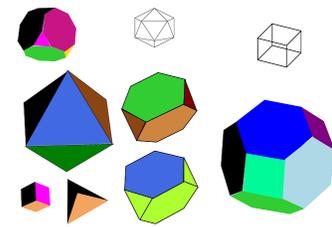
**Electric House:** Design and build a model house with required types of electrical circuits to light each room.

**Physics:** Creation of mathematical models to make predictions, use of graphing software, collection of data using probes and Vernier software, use of video analysis software.

## ***Real World Geometry At Zachary Nuclear Engineering***

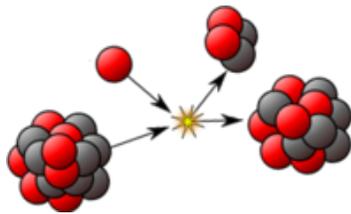
*Submitted by: Jayne Scott*

Zachry Engineering has worked with Geometry students for the past three years. The Geometry students were invited to a presentation by Derek Anderson and Jordon Powers in 2013 and 2014 in the cafeteria. They explained to the students what engineers do and presented a real life problem for the students to work through. The problem they presented involved a large building that was created to house a diesel oil storage tank. The building protects the tank from damage due to extreme weather such as tornadoes and hurricanes. Beyond that, if the tank leaks the oil must be contained in the building. The problem they posed was to determine what volume was needed to prevent leakage out of the building and the required height of the entrance door sill. Jordan asked the students, "The first thing an engineer does when faced with a problem, is to ask what do we already know? Then ask yourself what do I need to figure out?" Derek explained, "The shapes given for the tank are assumptions that are made during our work process. Given these assumptions is the volume of the building to the base of the door adequate to contain the oil in the tank in the event of a spill? If not, how much higher does the door height need to be?"



The students had to calculate the volume of the various shapes representing the tank and determine the necessary height of the door sill to prevent leakage out of the building. Over the next month the students worked through the problem in groups during a portion of class. Mr. Anderson and Mr. Powers returned to discuss the solution with the students.

In 2015, Katherine Goldberg and Patrick Sullivan visited my students. They discussed engineering and presented a new problem to determine the number of fuel assemblies that can fit into the spent fuel pool based on the dimensions provided. The students worked through the problem at that time.



The students were very enthusiastic and excited about the presenters and their introduction to engineering.

Currently, we plan for the Zachry engineers to continue providing a presentation and problem for the geometry students.

**In addition the high school offers a range of STEM infused courses and programs in the areas of:**

- 👉 **Science approximately 27 courses including:** AP Bio, AP Physics, AP Chemistry, Biotechnology, Forensic Science, Robotics, Neuropsychology, Astronomy, **Engineering Exploration**
- 👉 **Technology Education approximately 15 courses including:** Web Design and Development, Manufacturing Technology, Photo Journalism, Publications, CAD, Game Development and Simulation
- 👉 **Math approximately 18 courses including:** Probability and Statistics, AP Programming, AP Calculus, and Computer Trouble Shooting