

AC 2008-1164: ENGINEERING MYTHBUSTERS BRINGS ENGINEERING PRINCIPLES TO KIDS

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Engineering MythBusters Brings Engineering Principles to Kids

Abstract

Penn State Erie, The Behrend College hosts a summer program called College for Kids. It is a series of week long courses for kids, ages 6 to 18, which are 15 hours in length. Over 80 courses are offered in a variety of topics ranging from art, music and writing, to sports, crafts and theater. There has been a demand for engineering offerings from both parents and the director of the program.

“Engineering MythBusters” is a class that draws inspiration from the popular Discovery Channel television show MythBusters. The MythBusters examine scientific principle through the examination of myths, to either confirm or disprove them. This class introduces a variety of engineering fields to children ages 8 to 12 in a fun and hands-on environment. Specific episodes of the television show are shown to generate interest in a topic. Experiments related to that episode are then created and implemented by the kids.

The class introduces students to aerospace, plastics, mechanical and civil engineering with some additional physics and chemistry. As an example, students design a car that can only be powered by puffs of air with a limited amount of materials.

Survey results indicate that the “Engineering MythBusters” class ended up being the most popular class offered in the College for Kids program. The original class was eventually expanded from 24 to 60 kids to accommodate the overwhelming demand. This paper presents a summary of the activities presented as well as a discussion of best practices.

Introduction

College for Kids is a summer enrichment program offered at Penn State Behrend. It has been in existence for 14 years. Each week has a morning and an afternoon session and each are 15 hours in length. The program now offers over 100 classes in a variety of topics from art, music, animals, and martial arts to computers, geography, games, crafts and dance. The number of participants is around 1,000 children ages 6 to 18. At the end of the summer, the director of the program sends out surveys to the families of the participants to get their feedback. One request that came back time and again was to see more classes in the area of science and engineering. These areas were not represented in the classes offered in the past.

Penn State Behrend has over 4,000 students that study in one of four schools: business, engineering, humanities and social science, and science.

The School of Engineering has over 1,100 students and offers bachelors’ degrees in computer engineering, electrical engineering, electrical and computer engineering technology, mechanical engineering, mechanical engineering technology, plastics engineering technology and software engineering. Within the last year, we moved into a brand new 162,000 square foot facility with

all new labs and classrooms. Part of the School's mission is to conduct technical and educational outreach to the community. The College for Kids program offers a unique venue of providing educational outreach to the younger members of the community.

In the summer of 2006 in response to the survey results, the course "Engineering MythBusters" was created as an enrichment program for children ages 8 to 12. The goal of the course is to introduce children to the different fields of engineering using hands-on activities. Inspiration was drawn from the popular Discovery Channel show MythBusters to get the kids excited about the engineering principles and to demonstrate that sometimes you have to "do" in order to find out how something works or does not work.

Program

The week long sessions are set up for 15 hours a week. Either from 9:00 am till 12:00 pm in the mornings or from 1:00 pm till 4:00 pm in the afternoon. Typically the kids are given a 15 – 20 minute break during the middle of the session.

Each 3 hour time period includes a discussion on a particular engineering field with follow-up hands-on activities, and experiments. An episode of MythBusters might be shown if it relates to the topic for that session. Most of the attendees are already huge fans of the show or become fans when they leave the class.

During the first session the topic of what engineers do and how many kinds of engineering there are is covered. The more popular and well known branches such as electrical, mechanical, civil, aeronautical and even plastics are discussed through out the week. The kids are given a copy of the *Engineering Go For It* magazine as a reference and also because there are articles about engineering. For the younger kids, it is not expected that they will read it but by looking at the pictures, they can see how far reaching engineering is and who it can affect. The magazine has included articles on roller coasters, space shuttles and even the music industry. These topics and subjects are engaging to the children. The magazine also includes several pages of the different fields of engineering and what those engineers typically do.

One session is spent discussing civil engineering but more specifically bridges. What are the different kinds of bridges? Where are the more famous ones located? A slide show is presented that displays pictures of the bridges and some of the architectural details that make them unique. One of the most intensive hand-on activities accomplished during the week is to build a bridge (see photo 1 below) out of Popsicle sticks and glue. The finished bridge is measures approximately 14"long, 5" wide and 5"high and can support 50 pounds.

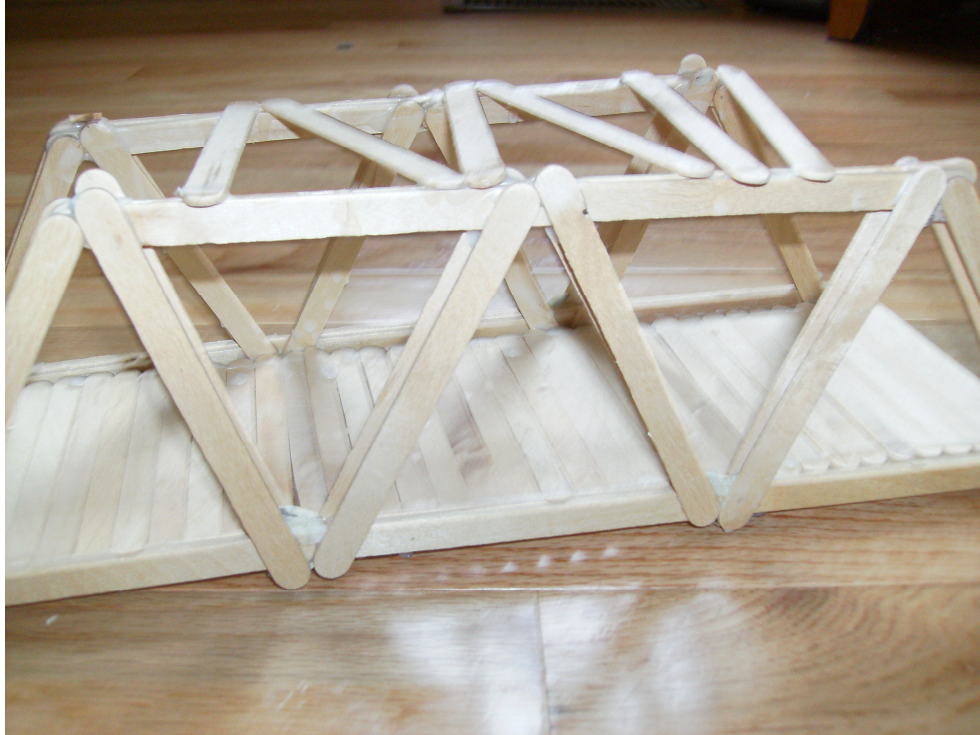


Photo 1: Popsicle Stick Bridge that supports 50 pounds.

The construction of the bridge is spread out over three sessions. There are six beams and they are built on the first day. The bottom and side supports are built next and then the final assembly is done. The activity is completed by day 4 in order for it to have time to dry so the students can take it home on the final day. It is recommended that the kids wait a week to test it out so that the glue is totally dry but ... students have tested it on day 5 and it holds.

During the week experiments are also performed on common items. This is to encourage the children to look at things from an engineering perspective. For example, gum. Chemical engineering had a part in coming up with different formulas of gum and what different types of features gum can have. Like bubble blowing, refreshing your breath, whitening your teeth and then just chewing. Each child is given 3 kinds of gum and each type is chewed for 2 minutes and then each kind is checked for elasticity. How long can each type be stretched? The method is not the most scientific but this leads to a discussion about how to keep the experiments more controlled. The children figure out that everyone chews differently, some of the kids just stretch their gum, and there is always the child that gets the gum tied up in the grass. Strongly recommend this as an outside experiment, it helps on the cleanup.

Since our university has a plastics technology major our program is able to offer a unique experience for the kids. One session is spent on car racing but more specifically Hot Wheels® car racing. The MythBusters have an episode where they lay ¼ mile of plastic track, create their own Hot Wheels® cars and then race them against an actual car. The myth is that the Hot Wheels® car can beat an actual car just rolling down a hill. The kids watch this episode and talk about the different designs of cars and what one would do the best racing down a hill.

Our plastics program has a mold and can actually make the plastic tracks that you can run Hot Wheels® cars on. The kids get to tour a 9,000 square foot plastics processing lab and see a video of how the plastic track is manufactured. Each student gets to select their own Hot Wheels® car based on the theories they came up with earlier. Outside approximately 60 foot of track is laid out down a hill and the students race their cars.

The first summer the program was offered, cars were timed to determine which was the fastest in the class. This led to some disappointed kids especially when the times were posted. The second year the format was changed and the students created challenges. Every child was able to issue a challenge to another, including the instructor. The challenge was based on the car designs and what feature of their car was going to make it faster or what feature of the other would make it slower than their own. The kids really enjoyed this format and this even resulted in challenges where the same 2 cars raced each other and the results were interesting.

Another hands-on activity related to a MythBusters episode was to build a hovercraft. There is an episode that Jamie and Adam create their own hovercrafts that holds a person. The kids do the same thing but on a much smaller scale, a hovercraft that can travel down a hallway. Their supplies are an old CD, one balloon, and the pop top from a water bottle. When this is assembled, the air from the balloon is forced through the center opening of the CD and they will travel several feet. The kids have a great time trying to see how far their hovercraft will go.

Aeronautical engineering is introduced using paper airplanes. The kids all design their own paper airplane using only one sheet of paper. A “runway” is setup in a hallway where 5 foot intervals are marked with tape. The students launch their airplanes and record how far they travel. The children try to answer the questions ... Does the paper airplane design have an effect on how far it goes? Can you run the experiment having a person launch all of the planes or does it work better having an automated system launch them?

The answer seems obvious; to control the experiment it would be better to have an automated way to launch the paper airplanes and to have everyone use the same design. The kids are given a Klutz® Guide called “The Best Paper Airplanes You’ll Ever Fly” (see photo 2 below), which they pick one of three designs and build that plane. Also introduced is the PAL2000, otherwise known as the Paper Airplane Launcher 2000. This piece of equipment was designed and built at Penn State Behrend and it is a portable paper airplane launcher. The kids now launch their own design and the Klutz® design on the automated paper airplane launcher and record their results. Once again, a discussion follows as to what happened and what differences did they see.



Photo 2: Klutz® Guide called “The Best Paper Airplanes You’ll Ever Fly”, see www.klutz.com.

Another popular aspect of the class are the design challenges. For example, with specific materials a participant must build a car that can only be powered by puffs of air. The students are given 1 sheet of paper, 2 paper clips, 3 straws, 4 life savers and 20 inches of masking tape. If any of the materials are damaged they are not replaced so the kids have to be very careful about building. A start and finish line are marked approximately 6 feet apart. The students are given 30 minutes to build a car and are allowed one test run during that time. All participants cheer for all of the cars and results show that some of the designs travel in a straight line and other do not. This leads to some great discussions about the different car designs and why each student built the one they did.

Conclusion

Once again the goal of the class is to interest the children ages 8 to 12 in the field of engineering using the popular Discovery Channel show MythBusters as well as fun hands-on activities. Each day engineering areas and principles are discussed. The side benefit was that topics like math, physics, chemistry, and design were also introduced to the kids.

The classes ran in the summer of 2006 and 2007 with anywhere from 18 to 22 children in each of the sessions. The ages were divided up from 8 to 10 and then 10 to 12 years old. The College for Kids program offered 3 sessions in 2006 and 4 sessions in 2007 and still had a waiting list for more sessions.

There are a few changes that are going to be made to this class. The first thing is to limit the class size to 10 or 12 participants. With these summer programs some children really want to be in the class because they love the MythBusters and they have a huge interest in engineering. There are others who attend because the session was for their age group and their parents use College For Kids as a day-care option. The second group of students do provide their own challenge for teaching a class such as this.

Another outreach program that came out of this class was the possibility of offering this class as an Act 48 class for teachers. In other words, teach the area elementary school teachers about the different types of engineering and some of the hands-on activities that they in turn could use in their classrooms. Unfortunately the enrollment needed to offer the class was not met but this may still be offered in the future.

The children really enjoyed the challenges and the experiments. There were a number of young female students who participated and hopefully that number will increase in the future. The class was designed to be generic and non-gender biased to appeal to all kids.

The students were also given a notebook and a mechanical pencil the first day of the class. They used these to record data, observations and draw designs as the week progressed. This is another aspect of the class that can be expanded upon.

There are so many activities and ideas available that this course could be adapted and used for almost any grade or age level.