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“Elementary” Engineering Experiences

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Project Introduction

The number of U.S. students who will enter college engineering programs is projected to continue to drop, a trend that many believe will have a negative impact on the U.S. workforce (NAS et al., 2007; NAE and NRC, 2009). Even if a relatively small number of children go on to become engineers, citizens in our technology-based society need to understand engineering issues, perhaps even be prepared to work collaboratively with engineers (NAE and NRC, 2009). This requires an understanding of what engineering is. The objective of this project was to further develop a program to expose elementary school children to engineering and technology by bringing them to the College of Engineering and Applied Sciences (CEAS) at Western Michigan University. Through hands-on activities and informal interactions with college students and engineering faculty, this program helps to dispel the mysteries of who engineers are and what engineers and engineering technologists do. The focus on elementary school students takes advantage of the natural curiosity and creativity of children prior to the development of opinions of engineering and its associated careers. Hopefully, this can be done before these students and their parents have missed opportunities to make significant choices concerning elective courses and informal learning opportunities where they may choose to opt out of science and engineering-relevant activities. Therefore, through early exposure to engineering, this program attempts to open the minds of children to future exciting opportunities that are accessible to them if they are appropriately prepared in mathematics and science.

The Program

The program consists of a two to four hour session in which students, parents, and teachers are walked through a sequence of hands-on activities in various locations within the CEAS building. In addition to immersing the students in engaging activities, time is also invested in helping students understand who engineers are and what engineers do. This includes describing the various engineering disciplines and their workplaces.

According to Reynolds et al. (2009), engaging students in activities and design problems can change their career interests in engineering. This program incorporates both. The activities presented to the children are tied to either the current research in CEAS or to the tools of engineering. In all cases, the activities have been chosen so that a child can safely interact with, and in most cases touch and operate, an engineering object or device. The design problems are presented though competitive team “design challenges”, which pit the creative minds of children against one another. In the following sections, a more detailed description is given of the elements of the program.

Hands-on Demonstration of Engineering “Toys” and “Tools”

Engineers create and use interesting “toys” and “tools”. During this part of the program students are taken to 3 to 6 different locations within the CEAS building to see, touch, and sometimes play with the creations and tools that the WMU engineers and engineering technologists have to offer. The following is a partial list of the activities that students have encountered to date:

- Vibrating on a mechanical shaker table
- Operating and competing with the mobile robots
- Riding a hydraulic bike
- Drawing 3-D CAD models
- Interacting with Robo Bronco
- Taking a trip into an anechoic chamber
- Manufacturing a WMU license plate
- Sitting and moving on a pressure map
- Holding the solar panel cells and wheels of a solar car
- Adjusting a test chair



Engineering Design Challenges

Engineering design challenges tap into the natural curiosity and creativity of elementary children. The design challenge is limited by constraints such as materials available, time, and resources. When elementary students are required to compete in design challenges for prizes, it encourages their critical thinking and their competitive spirit. In addition, the presentation of their final products requires that students defend their ideas and integrate their conceptual understanding of mathematics, science, and technology.

Students find design engaging, and thus it can be a motivator for learning the precursors or foundational skills and concepts that must be in place before higher level engineering skills can be learned. Design problems can create a powerful motivation for the learning of relevant science and mathematics. (Reynolds et al., 2009)



Findings to Date

Anecdotally, through hand polls at the beginning and end of each program session, there is an astounding increase in the students’ openness to a possible future engineering career following their experience at CEAS. Early reports back from schools have been extremely positive with requests for future visits and with reports of students singing the infamous Sponge Bob Square Pants song, “It’s the best day ever” all the way back to school. Furthermore, we have found that the accompanying parents and teachers are just as enlightened as the children following the program. From a logistics point of view, it appears that by keeping the time of the program from two to four hours, most schools have the ability to utilize this program as an educational “field trip”.

Current and Future Planned Experiences

School Visits in 2009-2010:

Paramount Charter Academy (multiple grades)
Gagie School (multiple grades)
Plainwell Elementary (fifth grade)
Kalamazoo Christian (multiple grades)

Upcoming 2009-2010 School Visits:

Washington Writer’s Academy
Woods Lake Elementary
Vicksburg

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