Recommendations for Establishing Small Scale K, 1 Outreach

Angie Hill Price
Texas A&M University

Abstract

The need for general K-12 outreach has been the focus of many organizations on a broad scale approach. While that is certainly admirable and desirable, it is possible to initiate programs on a very small scale. Outreach is a viable plank in the platform for tenure as a service component. New and established faculty would profit from the opportunity to hone and refine teaching skills and submit their own conceptual understandings to the scrutiny of the very young. Particularly gratifying and beneficial is outreach aimed at kindergarten and first grade ages. These students are eagerly receptive to exposure to basic concepts in science and engineering technologies.

In this paper, some recommendations are discussed for establishing connections with local school districts on a small scale basis, specifically concentrating on the kindergarten and first grade levels. Examples are shared from the author's own experience in introducing materials science and engineering technologies and several science experiments, as well as participation in the development of a teacher training program. Engineering technology as a whole derives much benefit from this introduction to the students at an early age, so that the degree becomes a part of their concept of career goals.

Introduction

It is recognized that the public has a great interest in science and a growing level of understanding in the subject.[1] There are a number of large scale technical outreach programs that successfully address this desire to learn in areas across the U.S.[2,3,4,5,6] Why should anything else be done? Because there is still a problem – not everyone is benefiting from these as yet, and as the saying goes, every little bit helps. Small scale programs can be very rewarding to the students and to the faculty member. Service is one of the components of a successful tenure package, though a small one, and K, 1 outreach certainly qualifies as a necessary service.[7] It should not be about tenure, however, but about need. Most schools still need help, particularly at the lower levels. Everyone certainly can and should participate. If tenure has already been obtained or is not an issue, outreach can still be useful for promotion as well as for research; some research funding opportunities list outreach as a required component of a successful proposal. Some engineering technology programs are increasing participation in funded research; this type of experience can improve competitiveness for some programs. Engineering technology can benefit from small-scale programs, providing early exposure to K, 1 students to the field. When the decision comes whether or not to attend college and if so, what the major should be, wouldn't it be ideal if engineering technology was a first choice?

Suggestions for implementation

To the end that outreach is critical in the future of engineering technology programs, some suggestions follow as to means of starting such programs. Intensive monetary support is not required; time is the major resource required. Even one visit to a school can have a lasting influence on the students, again particularly the young. Where to start? Call a school or a school district and volunteer. Many already have volunteer programs, so that they can do a background check. Be up front about the time that you can spend, whether it is one time a year, a few hours a month or more often. The schools will be happy with whatever the faculty member can manage, though they always would be glad for more.

When establishing a relationship with a school district, consider going past the immediate local bonds. There are many schools in close proximity to universities, which often already benefit from a relationship with the university. Consider schools a step beyond, though not as convenient. Looking at the lower grades is very inportant – many outreach programs center on the upper grades, but these students have already decided on engineering or have been precluded by their choice of math and science courses. Another advantage to working with K, 1 classes is that the day is less structured, more open to interruption and special visits. The specific examples in this paper will focus on suggestions for interaction with kindergarten and first grade students.

Why don't kindergarten and first grade teachers teach science and engineering concepts? The curriculum may include a science component but it most likely could use augmentation. Texas schools have a science curriculum in first grade that is limited in nature. Lack of time and training prevents the teachers from doing more. All the teachers with whom this author has worked are enthusiastic and eager to participate if someone will help them. With the grading and course preparation that they do, it is difficult for them to have the time to develop experiments and demonstrations. The teachers have enjoyed these as much as the students and they almost always say they have learned something.

Techniques to consider

When working with the students, use simple language and simple explanations. Don't feel obligated to explain all of the concepts; the main thing is to introduce them to the idea of science and engineering. As one student put it in great surprise, "Science is cool!" Find analogies to everyday things that they can understand. Don't avoid technical terms – have the students say them and find easy explanations for them. Be prepared to explain concepts in two or three different ways. Not every definition works for everybody. The benefit to the faculty member is that explaining phenomena is a great test of their own fundamental understanding. Help them see the difference between science and engineering and engineering technology.

Emphasize the skills that the students will need and why, like math and reading and writing. Note how they don't have to love math, a popular misconception, but rather that math is a tool that is used to solve other problems. In the early years, the students are formulating their biases toward education. They will make decisions about the classes that they will take; these choices

will determine what they can do in the future. Give them a reason to try the more difficult and intimidating classes.

Serve as a resource for the teachers. Provide answers to science and engineering based questions that the students may ask. Email, if available, can facilitate this. Teachers can encourage their students to observe, and ask questions about the world around them. They can also tell the parents that questions asked at home can be referred to the teacher and the faculty member for assistance. When the teachers do have topics in a science curriculum, the faculty member can suggest ways of demonstration.

Examples of interaction with K, 1 students

These are not particularly revolutionary suggestions, but they are effective. There are many references which give ideas for science experiments, some of which are listed at the end of this paper. Try to use easily recognizable objects available to the students at home. Following are some demonstrations that the author has used with kindergarten and first grade children.

Materials Selection - Use everyday object for a central discussion about materials selection and how it is related to engineering technology. For example, use a school table in the classroom. With guidance, ask them to list properties that the table needs – hardness, strength, color, be easy to clean, inexpensive, last a long time. Most of them recognize plastic, metal, wood, rock and cloth. Discuss in basic terms the differences between these and have them guess why the material was selected. The goal is to change the way they look at things; make them understand that decisions had to be made as to which material is used for everything.

Metallography – Use micrographs to illustrate how metals look different and how that is related to their properties. Perhaps they have heard of or seen a cast iron skillet. Relate this to the micrograph of such a material. Show the students four pieces of cast iron: white, gray, ductile and malleable. Ask the students to tell the differences between the pieces, other than shape. They usually observe that the color is gray – not much else; to them metal is just metal. Show them the micrographs and how to identify each one. Show how engineering technologists use these types of pictures to tell the difference between different metals, just like photographs can be used to identify each of them.

Magnetism - Gather together a number of items that they recognize: paper airplane, wooden yoyo, plastic toys, toy cars, eating utensils in metal and plastic, aluminum cans. Discuss what magnetism is – give examples like refrigerator magnets. Test the magnetism of the materials and divide them according to whether they are magnetic or not. Before testing each material, ask them to vote on the magnetic properties. Start with the non-magnetic materials like paper, cloth, and plastic. Tell them, after the analysis, that these materials non-magnetic. Then test a number of magnetic metal objects, including a steel fork. They will see that these easily stick to the magnet; then test a fork made from aluminum or nickel silver. Show them that not all metals are magnetic; talk about the ones that are. Have them find metals around the classroom or on their clothing and test for magnetism.

Simple machines - Suggested materials include: small pulleys, rope, craft sticks, scissors, a fishing pole, water faucet, bolt and nut, short boards, blocks, and cans. Discuss the types of simple machines and what they do. Give examples of each and how the students use them everyday. Ask the students to identify simple machines in their classroom or school; flagpole, seesaw, stairs or ramps. Explain the concept of the compound machine. Demonstrate each simple machine, then distribute the materials to the students and allow them to build their own. Challenge them to find simple machines at home. Help them to learn about the mechanical advantage that can be gained with simple machines.

Conclusion

Outreach should be more than a popular term that assists in gaining tenure and research funding. For engineering technology to grow, outreach should be an integral part of every program. The quality of the students that are gained will only improve and more sections of society will be included in the educational process. How can engineering technology lose from that?

A few recommended sources for experiments:

365 Simple Science Experiments With Everyday Materials by E. Richard Churchill, ISBN:1884822673.

52 Amazing Science Experiments by Lynn Cordon, ISBN: 0811820580

Bite-Size Science: Activities for Children in 15 Minutes or Less by John H. Falk et al, ISBN: 1556523483

Usborne Book of Science Activities by K. Woodward and Helen Edom, ISBN:0746006985

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ANGIE HILL PRICE
Dr. Price is an Assistant Professor of Mechanical Engineering Technology at Texas A&M University. She has participated in engineering technology outreach for pre-K, K and first grade classes in a local primary school as well as in Veracruz, Mexico.