

Construction Kits

By: Roxanne Grebey
Vernon Ho
Kanit Nangkala
Kenn Oldham

For: Prof. Susan Finger

April 7, 1998

Introduction

Teaching students about potential careers is important so that they can decide what profession they would like to pursue when they graduate. Talking to them early in their schooling will help them determine what they might and might not want to focus on in their studies and raise the awareness of what an engineering career entails. To this end, we have designed a construction activity that will teach elementary school children about some engineering topics, such as structures, design, and materials.

Problem

Activities designed to teach children about careers are often taken into elementary schools by outside sources, but they must be compact and easy to set up, run, and clean up. Messy projects are liable to cause the teachers to not ask the presenters to come back again, and education of this sort is important, so we have tried to design a project that is self-contained. The children should have fun participating in them and learn something by the end. Presentations are a good way of conveying information, but if that is all there is to the activity, the children will not learn very well. Children remember information better if left to discover on their own, so we believe that a hands-on project is the best way to teach children.

Objectives

Our primary objective in this effort is to provide an introduction for elementary school students to the work of engineers. We want the students to actually participate in a short activity that will teach them something about what engineers do and how they approach problems. This goal requires an activity that will hold the interest of an elementary school class and appeal to all types of children within the classroom. It is very important that the activity be fun and interesting in order to hold the attention of the students while they are working. Meanwhile, the activity must be convenient for any adults running the project to set up and clean up, as well as direct the students in the process.

Our activity must accommodate a class of about thirty students. Time constraints limit the activity to about thirty minutes, devoting ten minutes to preparation and clean-up. All children should be able to use and relate to the project, not favoring any particular temperament. Furthermore, any objects used in the activity should be durable and safe. The project should be suitable to an indoor classroom and transportable in a compact car.

Solution

We propose to teach children about engineering by asking them to build a bridge using set of supplied parts, then adapting and improving the bridge to meet specified requirements. In the classroom, the moderator breaks the class into groups of three or four students. We will then supply each group with a “Construction Kit.” These kits will

be boxes containing a set of parts made out of a variety of materials. The budget contains an exact list of the contents, which will include such parts as wood and plastic blocks, pipe cleaners, connectors, string, and cardboard. With the activity box, the moderator will also distribute a small narrative booklet on the story of the bridge which will describe the tasks the students are to fulfill. The moderator will tell the children that they will be building bridges, and ask them to start at the beginning of the book, and solve the problems within it as they work.

The book will begin by stating the need to cross a river. It will ask the students to design, in any way they desire, a bridge capable of crossing this river. When completed, the book will then inform them that over the years boats have become very important on the river. The bridge needs to provide enough space for the boats to pass through it. The students must now adapt or rebuild their bridge without any intermediate supports between the ends. If they accomplish this, the book will move forward in time again, and state that more and more people are using the bridge. The students final task, then, is to support as much weight with the bridge as they can, although this does not require that they load the bridge to its breaking point.

We believe that the process of adapting and improving the bridge is a good introduction to how engineers approach problems. The construction of the bridge will involve the students in design, while the subsequent adaptations form a rudimentary example of analysis. The activity forces students to look at what approaches work and do not work, and use this knowledge to improve a design. As a process of trial and error, students will be able to try ideas themselves and observe the results.

Meanwhile, bridge-building itself incorporates several important engineering topics. The variety of materials available requires choices as to which materials and parts are most appropriate. Bridges also teach a great deal about structural soundness and stability. Another topic the project involves is connections. Connections can be some of the most important decisions in engineering, and here student will have an opportunity to work with a number of different types, such as pinned, stacked, cantilevered and tension (string). The open-ended nature of possible solutions emphasizes creativity and flexibility. Finally, the project rewards teamwork, an important aspect of engineering endeavors.

We have targeted this project towards fifth grade students, and believe it will work well in classroom setting. Construction kits are highly suitable to the rest of the requirements as well. We will make the parts with durable and non-toxic materials, without sharp edges or other unsafe features. The constructions will be easily transportable, requiring only a small box to transport each kit. Finally, we designed the activity to be goal oriented, rather than competitive, in order to appeal to a larger number of children. In total, our construction kits are an excellent method of introducing students to engineering.

Plan

April 10 - Have AutoCAD drawings for plastic parts completed and submitted for construction. Start to obtain wooden pieces.

April 13 - Have a write-up of what presenter will say completed.

April 23 - Purchase dowels, binder clips, popsicle sticks, string, matteboard or cardboard, pipe cleaners, and rubber bands. Hopefully have all kits completed, depending on whether plastic parts have been completed yet.

Budget

Parts	Size	Estimated Quantity per Kit	Total Quantity	Total Cost
Dowels	1.5" long, 0.25" diameter	20+	120+	\$5.00
Wood Blocks	5.75"x0.5"x1.75" 0.25" hole 7/8" from edge on wide side	10(?)	60	scavenged
Plastic Blocks	same as above	10(?)	60	prototype system
Binder Clips	N/A	6	36	\$6.00
Popsicle Sticks	N/A	8	48	\$3.00
String	2 ft lengths	4	24	\$5.00
Matteboard/ Cardboard	3"x6" 0.25" hole 0.5" from edge	6	36	\$10.00
H-pieces	H-shaped connectors with 0.25" holes	10(?)	60	prototype system
Corner Pieces	Corner Connectors with 0.25" holes	10(?)	60	prototype system
Pipe Cleaners	6" pieces	12	72	\$5.00
Rubber Bands	N/A	depends on amount in pack	undecided	\$2.00