

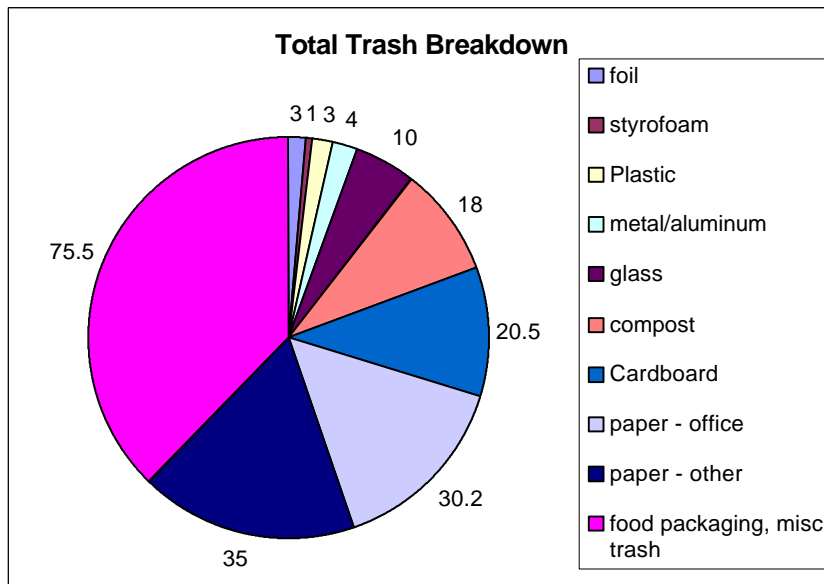
PIE Program: Building Blocks From Paper-mâché

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Engineering isn't a subject that most high school students know a lot about. They don't know what is involved with or what it takes to be an engineer. The objective of the Partners in Engineering Program is to give high school students and more specifically women, a chance to learn a little bit about engineering. The high school students have been presented with a problem that can be solved in the same way that any other engineering problem would be. The steps of solving an engineering problem have been explored with the students.

The students have investigated removing a component from the waste stream in the high school to make it into a usable product. This problem was chosen due to the fact that it was a subject that the students could relate to and see everyday in their school. In the first semester, the students went through the beginning processes of problem solving. They first used many methods to define and understand the problem. Surveys of lunch ladies and janitors, people who handle the trash everyday, were conducted. They did a trash inventory to find out how much of all the different types of trash could be found in the garbage. Pie charts were created to show the distribution of trash.



Based on this, it was decided that paper would be the component of the waste stream that they would try to reduce.

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Once paper was chosen, the students brainstormed ideas on what could be done with the paper. The importance of writing down every idea and that no idea was a bad idea was stressed. After the students had a list with about fifteen to twenty ideas on it, they did a feasibility assessment of their ideas.

During the feasibility assessment, the large list of ideas was narrowed down to just a few. This was accomplished by asking such questions as: Are the ideas possible? How much will it cost? Is the product something people will want? By using a checklist with these questions on it the students managed to narrow down the long list of ideas to a shorter one of two or three. The final ideas were paperboard, fuel pellets, and children's building blocks.

After determining what appeared to be the best ideas, it was time to put these ideas to the test. The class split up into groups and each group was assigned one of the final ideas. They were given the materials necessary to go to work to try to construct the paperboard, building blocks, and fuel pellets. At the end of the semester, the groups all gave a presentation of their findings. The paperboard and block groups recommended pursuing the ideas further. The fuel pellet group found that the pellets were more difficult to make than originally thought.

This semester, the structure of program has changed. Since the original purpose of the program was to help high school students learn about engineering, more discussion of what an engineer actually does has been integrated into the classroom time. The students have been given the opportunity to ask questions of the Clarkson students in the program. It was found that the students had little or no idea of what an engineer actually was. They seemed to enjoy the chance they had to get to know the Clarkson students.

Also, the high school class that is being worked with is different this semester than last semester. This has proved to be a good choice, being that the class size is smaller and the students more motivated. Since last semester it was difficult to hold the students attention, this semester a lot more hands-on work has been introduced. All of the projects being done with the students now have been done in the laboratory first to make more practical use of the limited time allotted.

All of the work done with the students from the previous semester was explained to the students this semester so they could pick up where the others had left off. The next step in the process was perfecting the methods in making the blocks and the paperboard. Almost immediately, the paperboard was eliminated due to the tediousness of it.

A method for making the blocks was needed. Certain variables such type of pulp and type of mold needed to be considered. There are many different recipes for making pulp papier-mâché. The recipes tested included flour, flour and salt, wallpaper paste, and just plain pulp. The papier-mâché was put into molds so it could dry. Many different kinds of molds were tried and it was quickly determined that the pulp needed exposure to air in order for it to dry in a reasonable amount of time. Screen material was determined to be very useful in this way. The one problem that remains however, is the fact that it is

difficult to create a perfect shape. Several molds have been made from milk cartons and others from picture frames. Since the design of the molds was very time consuming, it was decided that it would not be worthwhile for the students to actually do this part themselves. They have just been testing the different types of pulp.

The students began to explore what types of stresses and strains will be applied to the block on a day to day basis. They concluded that the blocks will have to stand up to such things such as drool and a weight bearing load equivalent to that of a small child. Now the students will begin to explore methods to test these variables. In the lab it has been determined that the blocks will need some sort of waterproof coating and will need to be tested using weights to see how much force they can withstand. The weight-bearing test will be useful in determining what type of recipe the students will use for the final product. Once the methods are perfected, the students will begin to mass-produce blocks.

The program has been an overall success. The students seem to enjoy the project and are very interested in learning a little more about what an engineer actually does. They have been given a valuable tool whether it is for engineering purposes or not. This kind of problem solving technique could be useful in many day-to-day situations.