From Trash to Treasure Activity

A common and familiar idiom handed down for generations is, “One person’s trash is another person’s treasure.” Even if your students have not heard it before, you can ask them to share what they think it means and they might recall a personal incident where they think it would apply.

Indeed, to make a functional device or tool out of something, or a collection of things, that might be considered junk can be challenging and even enjoyable. In some cases the ability to make something out of an assortment of unrelated items might serve to save lives. Those who recall the movie, Apollo 13, based on the ill-fated 3rd moon landing, might recall that at one point there was a life threatening depletion of oxygen in the space ship and NASA engineers on earth were asked to devise a system to generate oxygen from an assortment of items that were aboard the craft. Their time was limited and the scene is often referenced as an example of what it is like to create a functional devise out of unrelated parts.

In this activity, students will make a useful item (table) out of discarded items—trash—and test their product for strength. The trash will represent an assortment of items presented to them in a bag. They will be timed and then have their table tested to see how many 12 ounce cans of soda it can hold. This activity serves to model for structural engineering and the development of an engineered object because engineers use the same series of steps (Engineering Design Process) to design solutions to problems.

**Materials** (per student, or pair of students working as a team—preferred)
- Ruler
- Drawing paper and pencil
- Small rolls of duct tape
- Toilet paper tubes
- 20 oz soda bottles
- Cereal boxes
- Newspapers
- Cardboard tubes
- Paper towel tubes
- String
- Rubber bands

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1 Adopted from, *From Trash to Treasure*. Amy E. Landis, Ph.D., Arizona State University, School of Sustainable Engineering and the Built Environment, Ira A. Fulton Schools of Engineering

2 Consider taking a few moments to share short clips from the PBS Network, *Red Green Show*, which features comical efforts to make something useful from junk: [http://www.redgreen.com/](http://www.redgreen.com/), [http://www.youtube.com/watch?v=jv6MgODqMZc](http://www.youtube.com/watch?v=jv6MgODqMZc), [http://www.youtube.com/watch?v=zGM3-WiEZco](http://www.youtube.com/watch?v=zGM3-WiEZco)
• Cardboard pieces
• Other items that you consider applicable to this activity

Participants will design a table that is at least 8 ½ inches off the surface where they work and has a minimum of 3 legs. The tabletop must cover all legs and once completed they will be judges for strength with the placement of 12 oz cans of soda drink. Preferably, students will be allowed to redesign their tables at least once after the first tests are run. If so, then a second test will be performed to determine if improvements have been made as a result.

Provide each team of students with a, “Treasure Bag” that contains an assortment of trash. The bags should all have the same items in the same proportion so that everyone has an equal opportunity to design the strongest table from trash. If you want to announce an award for the final strongest table, doing so may provide more incentive for them to design as strong a table as they can.

Ask them to look at the items in the bag and then use the drawing paper and pencil to design a table that will hold unopened soft drink cans. Tell them that their table can only be made from the items in the bag and that once they have a design they will need to follow it as they proceed. Also, share that the table must be at least 8 ½ inches tall and have 3 or more legs with the top resting on top of all of the legs.

Allow them to draw their table designs to include indication to show where each item of trash is to be placed. Once all design drawings are complete, tell the students that they will have 15 minutes to build their table from the design they made on the paper. Set a timer for 15 minutes and signal that they can start.

At the end of the time period, signal that they must stop and you will now test their tables with the full soda cans. Ask for them to have their design drawings next to their table so you can see them together. Test each table with the soda cans and record the number each held on the board as well as their design paper.

In the Engineering Design Process, opportunity to improve design is as essential element in engineering education as it is in engineering, itself (See Figure 1). Thus it is important for the students to have at least one opportunity to improve their designs. Provide another piece of paper and ask them to redesign their tables based upon what they witnessed during the tests. It is okay if they learned something from one or more tests that were done with other tables. What is

![Engineering Design Process](image)
important is that they use the collective results as a source of information to help them design a stronger table.

After you complete the second (or final) tests, determine which table was the strongest and present the prize if it was included in your plan.

**What did your students learn about structural engineering, use of items initially intended for another function to design and build an unrelated device, and the Engineering Design Process from this activity?**

Questions to consider for your students when you return to class:

1) Structural engineers design buildings, bridges and other structures that support a variety of things. What did you think was the most difficult part of this activity? Easiest part?

2) (If you allowed them to improve their designs) Was your second design stronger than the first one? Why do you think so?

3) Can you think of a reason why it might be good to learn how to design and make things out of parts that are initially intended for some other function?

4) If you planned to design a table, what material(s) would you use? Why?

5) Can you think of another object that could be made from parts that were intended for something else? (See Figures 2-4 for an example of toy vehicles that are commonly seen in countries through much of Africa. Families often do not have money to purchase toys for children so make them out of other items, like wire taken from poachers’ traps).

**Figures 2-2.** Toy made from wire; a common sight in many countries in Africa where families often do not have enough money to purchase toys for children. A wire handle serves to allow the children to run while they push their toys.

**Figure 2-3.** Candleholder made from poachers’ wire and napkin holder made from a large seed.

**Figure 2-4.** Serving tray made from bottle caps weaved together by wire.