**Holding Weight**

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**References:**

* <http://42explore.com/bridge.htm>
* <http://jimsgraphix.com/recycle/table_1.htm>

**Benchmarks:**

**3rd grade**

Science and Technology - Benchmark B: Describe and illustrate the design process

4. Use a simple design process to solve a problem (e.g.,identify a problem, identify possible solutions and design a solution).

5. Describe possible solutions to a design problem (e.g., how to hold down paper in the wind).

Scientific Ways of Knowing - Benchmark D: Explain that men and women of diverse countries and cultures participate in careers in all fields of science.

1. Explore through stories how men and women have contributed to the development of science.
2. Identify various careers in science.

5. Discuss how both men and women find science rewarding as a career and in their everyday lives.

**4th grade**

* Gr. 4 ST-A2: Investigate how technology and inventions change to meet peoples’ needs and wants
* Gr. 4 ST-B3: Describe, illustrate and evaluate the design process used to solve a problem

**5th grade**

Science and Technology - Benchmark B: Describe and illustrate the design process

1. Revise an existing design used to solve a problem based on peer review.
2. Explain how the solution to one problem may create other problems.

Scientific Ways of Knowing - Benchmark D: Explain that men and women of diverse countries and cultures participate in careers in all fields of science.

1. Identify a variety of scientific and technological work that people of all ages, backgrounds and groups perform.

**Materials:**

* Cardstock
* Paper clips
* Rubber bands
* Straws
* Whatever else you think to add to the pile…
* (Optional glue stick)
* Weights or heavy objects

**Target Concept:**

Explicitly using the engineering design process to build a support structure with specific requirements

**Initial Discussion:**

Write on the board and discuss the steps in the Engineering Design Process:

1. Define the problem
2. Do background research
3. Specify requirements
4. Create alternative solutions, choose the best one, and develop it
5. Build a prototype
6. Test and redesign as necessary
7. Communicate results

Make sure that the students know what each of these terms means.

Tell the students that today they are going to be engineers. Ask if they know what an engineer is. You can probably get a good discussion going with them. Some things to add in to help them out: engineers use their knowledge of math and science to intelligently design and construct things. They might have to solve problems to make a structure they build serve a purpose.

A simple example: creating a building. Ask the students what kinds of questions an engineer would need to ask. (If you need to help them out - Where are they building it? Does it have to hold up to certain types of weather such as extreme winters or earthquakes? How big does it need to be? What material(s) will it be made out of? What will the building be used for? Does it need a lot of floors/windows/etc? )

Now think about the Scientific Method. Do engineers have to follow these steps when they make a new structure?

Today, the students will be engineers. Their job will be to create a structure that holds weights (show them the weights). Their limitations are that they can only build the structure out of very specific materials that you will give them. Additionally, the structure must be at least 2 inches off the table. They will only be given a certain amount of time to build it, and it must support as much weight as possible.

**Procedure:**

1. Have the teacher break the class into groups (3-5 students/group)
2. They will need to build a structure at least 1 inch off the table to support as much weight as possible in a limited amount of time.
3. The first 5 minutes – The students will be given time to observe all of the items in the middle of the table. They are now allowed to touch them, see what they’re like, and discuss with their group.
4. Call for the class’s attention and ask them what they observed. They can share some observations with the class.
5. Have them discuss for 5 minutes with their groupmates what they *think* wouldbe the best way to design their structures. Walk around and help them out with this step. They should be using their observations.
6. Now call their attention again and tell them that for the next 10 minutes, they should construct their structures as planned.
7. If after this time, no one has a good structure, show them how to make a column out of paper (by rolling it and securing with a rubber band) or short pieces of straw, explain that this is sturdy, but don’t show them how to implement it into their designs. Give them another 10 minutes and allow them to talk and change their structures as desired. No one is allowed to test their structures until the this ten minutes are up.
8. Now, walk around with the weights and test the structures by placing weights atop them.
9. Have the groups each briefly share with the class what they did and whether or not it worked. If the “class” is very large, could alternatively combine sets of 2 groups each and have them share with each other.

End this lesson with a class discussion, referring yet again to the list of all the elements of the Engineering Design Process on the board. The students should be able to discuss how the Engineering Design Process was used and adapted in this lesson.

If you have extra time, talk to them about whether or not they think it would be a cool career to be an engineer! Have any of them ever considered it? What would it take to be a good engineer? Etc.