

Workshop 1

Behind the Design

DESCRIPTION

Young children are natural designers and builders, but if their interest is not fostered, it may wane as they move through the grades. This workshop will focus on the use of simple design prototypes that children are asked to improve upon in order to meet a particular challenge. You will see these design challenges in action in middle school classrooms, as well as hear teachers discuss their experiences using designs with their students.

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Workshop 1 Timeline

Getting Ready

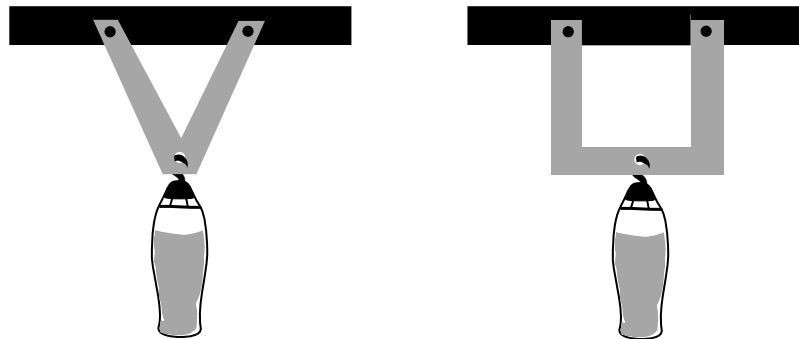
30 minutes

Bridge Challenge

Suspend a weight from a simple bridge for 10 seconds using as little paper as possible.

Materials Needed

- several single sheets of notebook paper with holes for a standard 3-ring binder
- *if possible*, self-adhesive hole reinforcements for both sides of the paper
- hole punch
- 2 pushpins
- scissors
- large paper clip (bent into an S shape)
- any object weighing about 750g (2 lbs.) that can be attached to the paper clip



Project DESIGNS, NSF grant ESI-9452767. © 1996 The President and Fellows of Harvard College.

Directions

1. Set up your simple bridge as shown in the diagram above.
2. Place hole reinforcements on both sides of the punched holes at the top left and right and on both sides of the punched hole at the bottom center.
3. Suspend the weight from the bottom center hole using the paper clip.

You should find that the bridge will hold your object without breaking. This is your prototype bridge.

Workshop 1 Timeline

Data Sheet

CHALLENGE

Your task is to modify your prototype paper bridge by cutting away paper so that you can still support the same weight for 10 seconds with as little paper as possible.

Record what happens when you test your modified bridge. Use the data sheet below to record your findings.

TEST 1

Sketch your bridge design here:

- Did the design support the weight for 10 seconds? YES / NO
- How will you improve your design for a subsequent test with a new piece of paper?

TEST 2

Sketch your bridge design here:

- Did the design support the weight for 10 seconds? YES / NO
- How will you improve your design for a subsequent test with a new piece of paper?

TEST 3

Sketch your bridge design here:

- Did the design support the weight for 10 seconds? YES / NO
- How will you improve your design for a subsequent test with a new piece of paper?

Workshop 1 Timeline

Watch the Workshop Video

60 minutes

Going Further

30 minutes

Approaches to Engineering Design

Approach 1

Many engineering projects that are undertaken in schools call for students to:

- build from scratch over long time periods; or
- test their design against the designs of competitors, for example, building a bridge made of toothpicks that will support a specified weight, creating a rubber-band-powered car that will travel the farthest, etc.

Approach 2

Sadler and his colleagues emphasize design projects that:

- provide students with manageable starting points (a prototype for their design),
- provide opportunities to test designs frequently to see if they meet a specific goal (tests against nature, not against other designs), and
- require record keeping to show the changes in the designs and the reasons for the changes.

Discuss with your colleagues your reaction to these two approaches to conducting engineering projects in schools. In particular, think about how well each approach may help all students to be able to:

- design a solution or product;
- implement a proposed design;
- evaluate completed designs or products;
- communicate the process of design; and
- see the connections between science, engineering, and technology.

Share with your colleagues any engineering design projects that you conduct with your students. Are there any changes that you may make as a result of today's workshop?

For Next Time

Ongoing Activity

Reflective Journal

Look through the national and/or state frameworks, as well as your school system's curriculum guide or text series for goals relating to design and construction (engineering and technology) projects.

As you reflect on your learning from Workshop 1, please consider the following:

- As a result of your participation in Workshop 1—Behind the Design, how has your understanding of national/state or school-system goals for design projects been impacted?
- What information from this workshop and from the Going Further discussions with colleagues will you use as you prepare future design projects for use in your classroom?
- What challenges do you face as you implement design projects and how might you go about addressing these?

Homework

Keep a list of your major activities (based in your house or in other places you go) on one weekend day and evening. Keep this list for your reference in the group discussion during Workshop 2.

Reminder: Sign up for a Web Buddy (see Workshop Components, p. 11).

Reading Assignment

To prepare for Workshop 2, please read the article by Marta Civil, “Bridging In-School Mathematics and Out-of-School Mathematics: A Reflection,” which can be found in the Appendix. Pay attention to her major topics: household visits, classroom implementation, parents as resources, and study groups.

