

Curriculum topics:

- Engineering Design
- Models
- Creativity
- Drawing

Subject:

**Physical Science,
Math, Art**

Grade range: 4-12

Who we are:

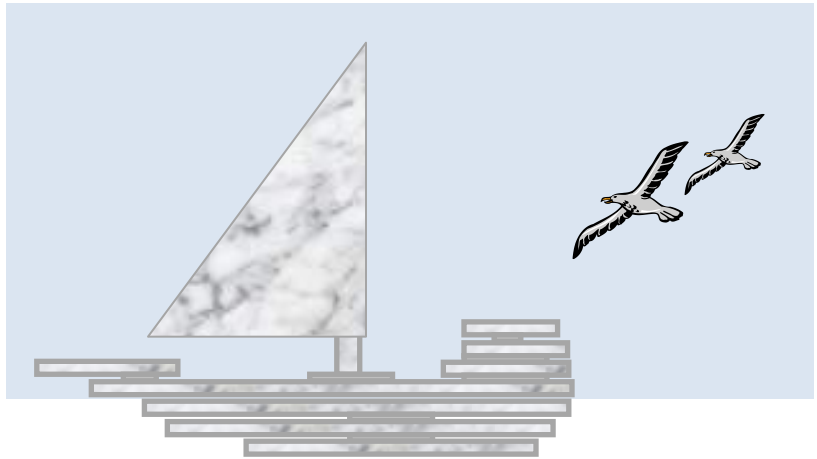
Resource Area for Teaching (RAFT) helps educators transform the learning experience through affordable “hands-on” activities that engage students and inspire the joy and discovery of learning.

For more ideas and to see RAFT Locations

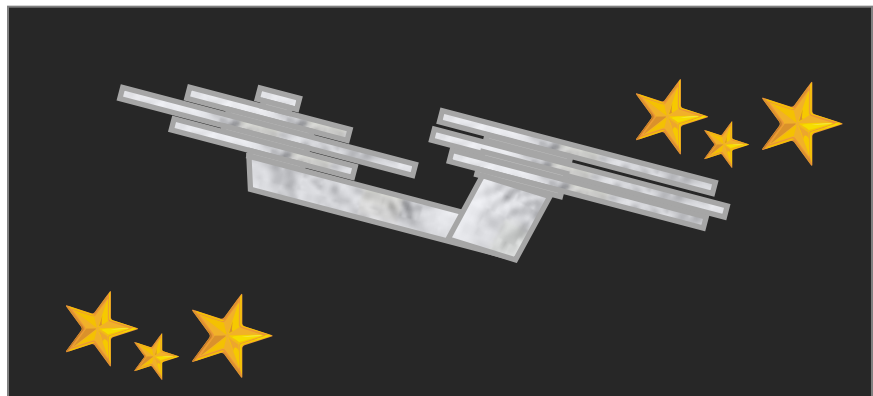
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RAPID PROTOTYPING

Use simple materials to build quick 3D models!



Quick models are the perfect tool to help young inventors explore new ideas and develop creativity. Use easy-to-cut corrugated board and double-stick tape to create conceptual models.



Explore the galaxy with a little cardboard and tape!

Materials required

Per student

- Corrugated cardboard or corrugated plastic, 30 cm x 30 cm (~12" x 12") piece or approximately the equivalent amount in random scraps
- Double-stick tape, foam preferred, ~1 cm (½") wide, 30 cm (12") long (note – thick tape makes it easier to create layered models.)
- Scissors

Preparing for the Activity

1 Before the session, think of a few “starter ideas” to help students imagine what they can model. Start with easy and small models of familiar objects. Here are a few examples:

- People
- Cars, boats, airplanes
- Houses and other buildings
- Trees, bugs, food items, or other natural objects

If needed, assign the students specific objects. (“Model a canoe”)

Visit the photo gallery (www.raft.net/raft-idea?isid=721) to see some other ideas.

2 Provide each team with plenty of building materials, tape, and room to spread out.

Introducing the Challenge

1 Ask the students to think about their experience with models. Have they built a model in the past? Have they seen models in museums? Connect their experiences to the working world. Point out some of the ways models are used in science, engineering, mathematics, and design:

- Scientists make models of existing or theoretical molecules
- Engineers make models of new cars
- Mathematicians model geometric solids
- Architects and designers model buildings

Why do these people build models? What do they learn from them?

2 Show the materials and give the students some pointers on their use.

Introduce the concept of creating “layers” by sandwiching pieces of tape between pieces of board. Emphasize this style of building. It will go much faster than other techniques!



Teacher tip: This would be a good time to do a “show and tell” by assembling a quick model of a car or other simple shape using some pre-cut, pre-taped pieces.

Completing the Challenge

1 Ask each student to select an object to model.

Teacher tip: Encourage students to start with a simple and small model to become familiar with the modeling technique.

2 Some students may need help getting started. It is often best to begin with the easiest or biggest part of the model (such as the hull of a ship or the base of a statue). Make sure that all students are focused on the task and off to a good start.

3 Give the students time to work! It is OK if they talk, compare progress, share materials, help each other, etc. This is all part of the engineering and design process.

4 Provide ample warning as time is winding down. This will be the time when the most progress is made!

Teacher tip: Some students will not “finish” their models in the time available. Invite them to take their materials home after school.

This can turn into a fun “family learning” opportunity.

5 Create an impromptu gallery by having the students line up finished (or in-progress) models in a prominent location.

Have each student share what they built.

What was easy/hard about the modeling process?

What did you learn about the object through the process of modeling it?

6 Invite the students to think about the concept of scale.

How big are their models compared to the objects they represent?

What scale would this represent?

Some students may have made big things small, while others made small things big!



Curriculum Standards:

Science and Engineering Practices (Next Generation Science Standards Grades 4 – 12)

Problem Solving and Reasoning (Common Core Math Standards: Mathematical Practices Grades 4 – 12)

Creative Expression strand of the CA Visual Arts Standards

Creativity and innovative thinking (National Visual Arts Standards: Creating – Generate and conceptualize artistic ideas and work, Grades 4-12)

Experiment with forms, structures & materials (National Visual Arts Standards: Creating, Grades 4-12)

Additional standards at: <http://www.raft.net/raft-idea?isid=721>

The content behind the activity

Engineers and designers routinely use “rapid prototyping” to visualize concepts that are still in their early stages. Building up objects out of layers of material is similar to what happens in 3-D printing, a fairly new process now being used in prototyping and manufacturing.

Learn more

- Have students create scale models of objects.
- Invite the students to go on a scavenger hunt to find models. A doll, a toy soldier, or a toy car is a model.
- Hold a “gallery show” in which students model different objects using a variety of common modeling materials (construction blocks, clay, etc.)
- Have students do research papers on the use of models in different fields. For example, how do architects use models to plan a new housing development, and how do dentists use models to plan orthodontia treatments?
- Connect this activity to social studies or art by inviting the students to model famous buildings, art objects, etc.
- Design Challenge: Have students create a design using rapid prototyping that will meet specified criteria.

Related activities: See RAFT Idea Sheets:

3D Topo Views –

http://www.raft.net/ideas/3D_Topo_Views.pdf

Making Mountain Models –

http://www.raft.net/ideas/Making_Mountain_Models.pdf

Resources

Visit www.raft.net/raft-idea?isid=721 for “how-to” video demos & more ideas!

See these websites for more information on the following topics:

- **3D printing: turning ideas into models –**
<http://mad-science.wonderhowto.com/inspiration/art-3d-printing-turning-cool-ideas-into-physical-three-dimensional-models-0135464/>
- **How to get started in 3D DIY (Do It Yourself) Modeling -**
<http://www.popularmechanics.com/technology/how-to/tips/how-to-get-started-3d-modeling-and-printing>