

The Design Challenge



Focus: Students apply their understanding of the properties of objects and materials to complete the design challenge: build a useful object of their choice using recycled materials.

Specific Curriculum Outcomes

Students will be expected to:

- 24.0 select and use materials to carry out their own explorations and investigations [GCO 2]
- 29.0 explore ways to join materials [GCO 1/3]
- 28.0 describe and demonstrate ways to use materials appropriately and efficiently [GCO 1/3]
- 31.0 identify problems to be solved [GCO 2]
- 22.0 use appropriate tools [GCO 2]
- 32.0 compare and evaluate personally constructed objects [GCO 2]
- 18.0 communicate procedures and results [GCO 2]
- 30.0 create a product by safely selecting, joining, and modifying materials [GCO 1/3]
- 7.0 make and record relevant observations and measurements [GCO 2]
- 8.0 communicate while exploring and investigating [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- make reasonable choices and predictions as to which materials best suit an object
- record a problem, pose questions, and design a solution
- use materials wisely, responsibly, and resourcefully
- test and evaluate their design and make suggestions to improve their design

NOTES:

Attitude Outcome Statements

Encourage students to:

- willingly observe, question, and explore [GCO 4]
- appreciate the importance of accuracy [GCO 4]
- be sensitive to the needs of other people, other living things, and the local environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- interact with sensitivity and respect, considering the situation, audience, and purpose [GCO 3]
- respond personally to a range of texts [GCO 6]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>What Is the Design Process?</i> poster • Science Card 6 • BLM <i>Student Self-Assessment of Design Process</i> • BLM <i>Design and Build a Useful Object</i> • BLM <i>My Useful Object</i> Literacy Place: • <i>Art for the Birds</i> (Shared Reading—I Can Make a Difference Inquiry Unit)	• recycled materials such as string, yarn, paper towel rolls, cans, cotton balls, buttons, broken toy parts, plastic containers, and so on • digital camera (optional)		• build • design • device • fastener • purpose • invention

Safety

- Ensure students follow safety procedures including wearing goggles when working with tools. Students should also wash their hands after handling materials and tools.

Possible Misconceptions

- Students may think that recycling objects is enough to reduce the negative impacts of garbage. Students need to learn that reducing our consumption of materials—by using resources and materials sparingly—is a better way to be stewards of our planet.

ACTIVATE



Literacy Place Connection:

Read or revisit *Art for the Birds* by Tara Harte in the *Literacy Place I Can Make a Difference* Inquiry Unit. Ask students to think about what problem the class had and what they did to solve the problem.

Connect the action in the story with the steps in the Design Process by asking questions such as:

- **How did you feel when you discovered what had hit the window?**
- **Why did Malik ask, “What if other birds do the same thing?”** (He was worried that other birds might get hurt in the same way.)
- **How is this a key question?** (This question made the class try to think of a way to solve the problem of keeping the birds safe.)
- **What solution did the students think of?** (The narrator said they could tape artwork on the windows.)
- **Why was this a good solution to the problem?** (By taping art to the classroom windows, the students made the windows easier to see and this stopped other birds from flying into the glass.)
- **How did the students in Mr. Sloane’s class share their idea?** (They wrote a letter to the principal urging her to ask the whole school to make window art.)
- **Were the birds safe?** (Yes, the window art kept the birds safe from flying into the glass.)



Point to the *What Is the Design Process?* poster and read aloud the steps. Then compare the steps in the poster to what the fictional characters did in the *Art for the Birds* story. Explain that the kids followed the same steps. Say that identifying a problem and solving it are key parts of the design process.

Review the steps of the design process as they relate to this text.

1. The kids in the story identified a problem. Then they thought of a solution and made a plan.
2. They made some artwork and taped it to the windows.
3. They saw that their plan worked.
4. They told others about their plan and how it solved the problem.



Design Challenge

Review the Design Challenge with the students: Design and build a useful object using recycled materials.

Show students Science Card 6. Read the title question aloud: *What can you make?* Then read the supplemental questions: *What is the problem? How will you solve it? What materials will you use?*

Explain to students that they can use the card for ideas on how to follow through with the Design Challenge.

Introduce the BLM *Student Self-Assessment of Design Process* by showing it on the IWB. Read through the points on the BLM with the students. Tell them that after they have built their useful object, they will use this form to assess how well they did.

CONNECT

Step 1: Identify a Problem, Think of a Solution, and Make a Plan

The first step is for students to identify a need. Remind students of building a pencil holder to solve the problem of never being able to find a pencil.

Discuss recycled materials and build a list for the students to refer to as they work through the process. Recycled materials could include string, yarn, paper towel rolls, cans, cotton balls, buttons, broken toy parts, plastic containers, bottles, and so on.

Encourage students to look at the objects and materials in the Curiosity Centre as well as Science Card 6 for ideas. Have students meet with a partner to discuss possible problems and solutions.

Provide students with copies of BLM *Design and Build a Useful Object* for them to draw their designs. You may want to encourage students to keep their designs fairly simple so that construction isn't too challenging. For example, if some students want to design a birdhouse, you might encourage them to create a design that requires minimal sawing and hammering. These are activities that will require adult assistance. Instead, students might consider using plastic containers, which are easier to work with.

Look at students' designs and offer constructive feedback to help them. Ask thought-provoking questions to help students identify trouble spots themselves. For example:

- **Will birds stay dry in this birdhouse?**
- **Could you use a recycled material in place of this material?**

Share some students' designs with others to demonstrate how recycled materials can be incorporated. This will allow you to make comments such as, "See how this design uses a yogurt container for the main form of the object?" Or, "Look at the way the string is used to join the container to the tin can in this design. The string makes a good fastener."

Remind students to think about which materials will work best for their design. Then ask them to think about which tools will help them build their object.

Step 2: Gather Materials and Build a Prototype

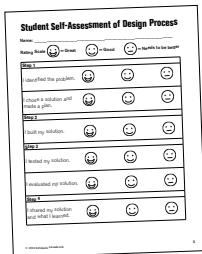
Remind students of safety rules when working with tools and encourage co-operation and sharing of materials. Circulate around the classroom, observing students as they work and provide prompts, such as:

- How big will your object have to be to work properly?
- Have you used too much glue?
- How much string do you think you'll need?
- Have you figured out how to attach A to B?
- Are scissors the best tool for making a hole?
- How could you make that stronger?

Step 3: Test and Evaluate Your Solution/Device

After students have tested their object to make sure it meets their need, encourage them to evaluate their own designed objects. Ask:

- Does your object solve the problem? How?
- Did you use some recycled materials?
- Is your object useful? What can it be used for?
- Are you happy with your object?
- What would you do differently?



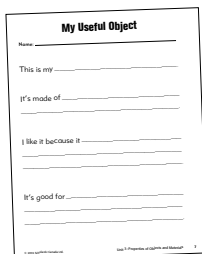
The form is titled "Student Self-Assessment of Design Process". It includes a header with "Name: _____" and "Date: _____". Below this is a legend: "Rating: 1 (Not at all) 2 (A little) 3 (A lot)". The form contains five sections, each with a question and three smiley face rating options (1, 2, 3). The questions are: 1. I understood the problem. 2. I thought about what I needed to make a plan. 3. I used my materials. 4. I tested my solution. 5. I improved my solution and what I learned. At the bottom, there is a line for "Teacher's Comments: _____".

You could also encourage students to compliment features they like in other students' objects. Encourage students to give positive feedback about the useful objects other students have made.

Have students complete BLM *Student Self-Assessment of Design Process*. You may need to read the questions to some students and have them answer orally.

CONSOLIDATE

Step 4: Sharing Your Solution/Device



The form is titled "My Useful Object". It includes a header with "Name: _____". Below this are several lines for writing: "This is my _____", "It's made of _____", "I like it because it _____", and "It's good for _____". At the bottom, there is a line for "Teacher's Comments: _____".

Provide time for students to present their objects to others in the class. You may choose to provide copies of BLM *My Useful Object* to help students plan what they will say. After, ask the students to talk about how other people found solutions to their problems, particularly if some students found solutions to similar problems.

Or, you could have a "Design Day" for students to share their work with parents or others outside the classroom.

Ask the students to think about how they are going to explain their object, including what it does, and what materials it is made from. Or you could have students take digital photos and write a sentence or two about the object they designed and created. Post these photos and explanations to the school Website or on a school bulletin board.

WRAPPING UP THE UNIT



Revisit the questions posted on the I Wonder Wall and have students discuss answers in small groups or with a partner. If there are questions which cannot be answered at the time, these can remain on the I Wonder Wall for students to research independently. Discuss what the students have learned about the properties of objects and materials and the design process.

Design and Build a Useful Object

Name: _____

Problem: _____

Design:

Materials and tools:

My Useful Object

Name: _____

This is my _____.

It's made of _____
_____.

I like it because it _____

_____.

It's good for _____

_____.