Inventing the Next Magnificent Toy

This lesson has been adapted from: More Picture-Perfect Science Lessons, NSTA Press, 2007 and “Design Dilemmas”, Science and Children, September 2015

Question: How do different inventions help us solve different problems?

Lesson focus:
This lesson is intended to focus on the process and skills of engineering, especially defining the problem to be solved. It could be modified to address a particular science content area by modifying the design challenge given to students. The engineering design process is structured in this lesson.

Standard(s):
3.3-5-ETS1-1. Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.

3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.

3.3-5-ETS1-4(MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.

Practice(s):
Defining Problems
Designing Solutions
Obtaining, Evaluating, and Communicating Information

Objectives: Students will be able to:
- Make connections between the structure of an invention and its function or purpose for human use.

Literacy Connections:
The Most Magnificent Thing, by Ashley Spires (Publisher: Kids Can Press, 2014)

Galimoto by Karen Lynn Williams (Publisher: HarperCollins, 1990)

Materials:
For demonstration:
- 1 snow shovel
- 1 garden shovel/spade

For each pair of students:
- 2 example toys

For the class:
A variety of building materials. Suggestions:
- Toys or toy parts
- Bouncy balls
- Hotwheels cars
- Fabric
- Magnets
- Pencils
- Weights
- Rubber bands
- Brass fasteners
- Spools
- String
- Masking tape
- Cardboard
- Plastic straws
- Pipe cleaners
- Popsicle sticks
- Recyclable containers
- Paper
- Glue
- Scissors

www.mits.org
Instructions:

**Engaging Activity**: Display two shovels to the class - a snow shovel and a garden shovel/spade (these can be photos if you do not have shovels available). Ask students to brainstorm why these two shovels look different. Have students turn and share their ideas with a partner, then ask a few to share with the whole group.

**Introductory Discussion**: Facilitate a group discussion about the following questions - What is an invention? What is the difference between an invention and a discovery? (Teacher note: An invention is something that is created to meet a need or solve a problem; a discovery is something that is found for the first time. For example, Ben Franklin discovered that lightning is electrical current, but he invented the lightning rod.) What do inventors do? (Teacher note: Guide students to consider that inventors think about people’s needs or problems and come up with solutions. If students have prior experience with engineering, you may want to label inventors as a type of engineer. If not, this might be a good time to introduce the term “engineer”.) Ask students to think back on their ideas about the shovels as they consider this question: How do different inventions help us solve different problems?

**Engaging Activity**

Present one or both of the books to the class will and ask them to make an inference based on the cover - What do you think this book is about? Use a think-pair-share to collect a few ideas from the group.

Read the picture book *The Most Magnificent Thing* to the students, stopping along the way to ask questions. (This book introduces the design process.)

Example questions:

- What are some of the steps the girl goes through in designing her magnificent thing? (knowing what she wants, sketching it, making it, changing it, using it)
- Why do you think she almost gave up on making the most magnificent thing? What did she do to calm down? (She was mad that it wasn’t working out, she stepped away, and she took a walk)
- What problem do you think the girl is trying to solve? (She’s trying to design a sidecar for her dog to attach to her scooter. This is shown on the last page of the book.)

Read the picture book *Galimoto* with the students.

**Toy Testing**: Tell the students that, to learn more about inventions, they are going to act as toy testers for Waddatoy Toys. Provide examples of two toy inventions for students to look at (each student or pair of students should have both toys). On the board, label the examples “Toy A” and “Toy B”. Allow students several minutes of guided discovery with the toys, then have them fill out the “Toy Testing” handout. Choose one toy to explore further. Use a think-pair-share to collect student responses to the question “What need or want does this invention fill?” Use thumbs up/thumbs down to gather data about the group’s fun and safety ratings for the toy. (If time allows, create a bar graph of each set of ratings and guide the students through interpreting the patterns they see in the data. See attached “Fun Ratings” and “Safety Ratings” for a graph template.)

Make a T-chart with the words “benefit” and “risk” on the board. Discuss that all inventions can have both benefits (good results) and risks (bad results) for people and the environment. Ask the following questions, and write the students’ responses on the T-chart:

- What are the possible benefits of this toy? (Answers might include: You can have fun with it and you can enjoy it with friends)
- What are the possible risks of this toy? (Answers might include: You could get hurt by it, you could lose it outside, and creating it could cause pollution.)

Explain that some inventors try to improve existing products by increasing their benefits and reducing their risks.

**Invention**: Tell students that they are going to have the opportunity to be toy inventors. They will be inventing a new toy or improving a toy that they already have or know about. Pass out the “My Toy Invention Journal” to each student. The journal will help them brainstorm ideas and keep track of their invention process. Have them work in groups of 2-4 students. Explain...
that inventors always have constraints, such as time and materials. Introduce the materials that will be available for building a prototype of the invention (you may choose to do this before or after the students draw their invention).

Give students time to build prototypes of their inventions. If students become frustrated with their invention, ask them to consider what the girl in *The Most Magnificent Thing* did when she had trouble, and suggest that they could use some of the same strategies.

**Wrap-up:** Have students create an advertising poster for their invention, including a labeled drawing and creative name for the toy, two reasons for people to buy the toy, and directions for using the toy safely. Share these posters in a gallery walk.

**Resources:**

The Most Magnificent Thing Teaching Guide
[http://www.kidscanpress.com/sites/default/files/products/assets/MostMagnificentThingThe_2177_teaching_2.pdf](http://www.kidscanpress.com/sites/default/files/products/assets/MostMagnificentThingThe_2177_teaching_2.pdf)

The Ned Show’s “The Most Magnificent Thing” Lesson Plan

Museum of Science, Boston’s page for Da Vinci - The Genius (No longer on exhibit at the museum, but still includes background info and lesson plans about Leonardo Da Vinci the artist and inventor.)
[https://www.mos.org/leonardo/](https://www.mos.org/leonardo/)

Other children’s books on this topic:


Summary: The who, what, where, when, and why of roller skates, potato chips, marbles, and pie told in rhyming verse.


Summary: Leo Cockroach, who secretly tests toys for the bug-hating president of a toy company, seeks a job with the competitor across the street and finds himself worse off than before.


Summary: A fictional story based on true events and highlights of the life of inventor Lodner Phillips. Papa (the story is told from the perspective of his daughter) tinkers and tries to develop a variety of things but is rarely successful. Finally, he designs a mechanical fish - a submarine that takes friends and family beneath Lake Michigan.


Summary: From the time Henry is a baby he loves to put things together - wheels with rods, switches with levers, cranks with gears. By the age of 6, he’s built an Amazing Machine that fills his entire room. By the time he’s 10, the machine has taken over the entire house - and the yard. His parents are proud of Henry, but they’re getting a little worried. They can’t help wondering: What does it do?


Summary: A young girl used to have fantastic ideas about how things work, but Dudley, a pencil-wielding, bespectacled dog, tells her how it really is. This lively picture book explains the inner workings of mechanical objects such as vacuum cleaners, refrigerators, dishwashers, toasters, and garbage trucks.


Summary: “What did people use before they had refrigerators?” and “Where do inventors get their ideas?” are some of the questions answered in this intriguing question-and-answer book about common household inventions.
Name: 

Toy Testing

You are a toy tester for Waddatoys! Follow this procedure for each toy, and record your data below.

1. Play with the toys! Then draw and label each toy below.

Toy A Drawing   Toy B Drawing

2. Give each toy a fun rating:

<table>
<thead>
<tr>
<th>Toy A</th>
<th>Toy B</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Sad]</td>
<td>![Sad]</td>
</tr>
<tr>
<td>not fun</td>
<td>not fun</td>
</tr>
<tr>
<td>![Neutral]</td>
<td>![Neutral]</td>
</tr>
<tr>
<td>sort of fun</td>
<td>sort of fun</td>
</tr>
<tr>
<td>![Happy]</td>
<td>![Happy]</td>
</tr>
<tr>
<td>very fun</td>
<td>very fun</td>
</tr>
</tbody>
</table>

3. Give each toy a safety rating:

<table>
<thead>
<tr>
<th>Toy A</th>
<th>Toy B</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Sad]</td>
<td>![Sad]</td>
</tr>
<tr>
<td>not safe</td>
<td>not safe</td>
</tr>
<tr>
<td>![Neutral]</td>
<td>![Neutral]</td>
</tr>
<tr>
<td>sort of safe</td>
<td>sort of safe</td>
</tr>
<tr>
<td>![Happy]</td>
<td>![Happy]</td>
</tr>
<tr>
<td>very safe</td>
<td>very safe</td>
</tr>
</tbody>
</table>

4. Which toy would you prefer to buy? Why? ____________________________
Fun Ratings

Toy A □ Class Rating: ____
Toy B □ Class Rating: ____

Number of Ratings

0

5

10

15

20

25

not fun

sort of fun

very fun

Ratings
Safety Ratings

Toy A: [ ] Class Rating:
Toy B: [ ] Class Rating:

Number of Ratings

1. Very safe
2. Sort of safe
3. Not safe
My Toy Invention Journal

Inventors: ________________________________
Brainstorming Page

1 List some toys you like to play with:

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

2 Inventor
List some toys you think could be more fun or more safe if they were improved:

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
Inventing Page

1. Invent a new toy, or choose one toy you are going to improve. Draw the new or improved toy in the box.

   Name of Toy: __________________________

2. Fill out the T-chart to tell the benefits and risks of your new or improved toy.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Risks</th>
</tr>
</thead>
</table>
Advertising Poster Page

Make a 3-2-1 poster to advertise your new or improved toy. Your poster should include:

3 Points: A labeled drawing of the new or improved toy, including a creative name for the toy.

2 1 0

2 Points: Two reasons why people should buy the toy.

2 1 0

1 Point: Directions for using the toy safely or a warning label.

1 0

Extra Credit: A catchy slogan, a jingle, or a drawing of the toy’s packaging.

1 0

Total Points_____/6

Comments: ____________________________________________