Building Bridges Gr. 3-5
A STEM Read lesson based on
_Iggy Peck, Architect_ by Andrea Beaty

Overview

In the book _Iggy Peck, Architect_ by Andrea Beaty, Iggy must build a bridge to save his teacher and classmates from an abandoned island. In this engineering challenge, students use the Engineering Design Cycle to build their own bridges and then write a reflection paper.

Grade(s):  P  K  1  2  3  4  5  6  7  8  9  10  11  12

Suggested Time Frame: Two to three sessions

Standards

<table>
<thead>
<tr>
<th>3-5-EST1-1</th>
<th>Define a simple problem reflecting a need or want that includes specified criteria for success and constraint on materials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5-EST1-2</td>
<td>Plan and carry out fair tests in which variable are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</td>
</tr>
<tr>
<td>W.3-5.2</td>
<td>Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</td>
</tr>
<tr>
<td>W.4-5.2.d</td>
<td>Use precise language and domain-specific vocabulary to inform about or explain a topic.</td>
</tr>
<tr>
<td>SL.3-5.1</td>
<td>Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3-5 topics and texts, building on others’ ideas and expressing their own clearly.</td>
</tr>
<tr>
<td>MP.6</td>
<td>Attend to precision.</td>
</tr>
</tbody>
</table>
Objectives
At the conclusion of the lesson, students will know or be able to

- Describe how Iggy Peck would have used the Engineering Design Cycle to plan, design, and test his creations.
- Identify techniques in creating a sturdy bridge, both from the text and video.
- Precisely evaluate materials to be used in a bridge design.
- Design a paper bridge, using the Engineering Design Cycle, to hold an 8 ounce water bottle.
- Write a reflection paper describing the Engineering Design Cycle, how they utilized it, and how they overcame challenges faced.
- Discuss their designs with the class and explain how they crafted their bridge.

Key Terms
Architect – a person who designs buildings.

Engineer – a person who designs or builds engines, machines, or structures.

Engineering Design Cycle – steps engineers follow to design and build solutions to a wide variety of problems. The engineering design cycle helps engineers come up with the best solutions to problems.
Materials

- *Iggy Peck, Architect* by Andrea Beatty
- Newspaper or other large paper
- Masking tape
- Popsicle Sticks
- Colorful scraps of paper
- Glue
- Rulers
- Paper clips
- Other miscellaneous materials (i.e. sequins, pipe cleaners, pom poms)
- Computers/mobile devices for videos
- 8 ounce water bottle

Procedure

1. Prior to the lesson, place two desks, tables, or other flat surfaces 12 inches apart.

2. Read the book *Iggy Peck, Architect* by Andrea Beaty and then ask the following questions and have discussions.
   - What is an architect?
   - What are some jobs an architect might do?
   - What kinds of buildings did Iggy build?
   - What is something useful you would like to build?

3. Watch a video on bridges. Here are two suggestions:
   - [www.youtube.com/watch?v=qFZGmHbjLSM&t=268s](www.youtube.com/watch?v=qFZGmHbjLSM&t=268s)
   - [https://www.youtube.com/watch?v=GJpHS6-iUrs](https://www.youtube.com/watch?v=GJpHS6-iUrs)

4. Discuss techniques they used in the videos to design stronger bridges and how those techniques could be used to design their own bridge that will hold an 8 ounce bottle of water for 10 seconds. Pass the water bottle around so the students will know how heavy it is. Show them the 12 inch gap you have created and tell them that is the length their bridge will need to span. Show and discuss the items that are available for them to use in their design. Tell them they can use some or all of the materials. It is up to their groups to design. They are also allowed to go back after they test their bridges to get more or different materials if needed.

5. Discuss the Engineering Design Cycle and how an architect or engineer would use it when designing a bridge. Discuss how the students should use the cycle while designing their own bridges.

6. Have students work in groups to design and build their bridges utilizing the Engineering Design Cycle. Allow them to test their bridges on the 12-inch span using the water bottle. Encourage them to go back and evaluate their design and improve
upon it if need be. They should repeat the process until they are successful, or time is up.

7. Students should then individually write a reflection paper describing the Engineering Design Cycle and how they utilized it in their bridge design. They should write about the steps they took, challenges they faced, and how they solved those problems.

8. Groups will then present their bridges and demonstrate how well it holds up the water bottle. They should be prepared to answer questions about the process they followed using their reflection papers.

**Extensions**

1. Extend the width of the gap, then challenge students to build a wider bridge. Discuss use of supports and alternative structures.

2. Find photos of unique or famous bridges. Help students to find the location of the various bridges on a U. S. or world map.

3. Creative writing prompt – Imagine you are Iggy Peck. What type of structure would you build and what everyday materials would you use to build it? Draw a picture of your structure and write how you built it.

4. Students can research various types of bridges and create a poster or Power Point describing each type.

5. A competition can be held by slowly adding weight to the bridges to see which bridge will hold the most weight.

**Considerations**

The water bottle can be replaced by a lighter weight object.

**Assessments**

Use or adapt the attached rubric.
<table>
<thead>
<tr>
<th>Rubric</th>
<th>Exceeds (3)</th>
<th>Meets (2)</th>
<th>Partially Meets (1)</th>
<th>Does Not Meet (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>Worked well with others and discussed ideas in a fair, respectful, encouraging way and was considerate of the feelings of others.</td>
<td>Worked okay with others and discussed ideas in a fair, respectful way, but may not be encouraging. Considered the feelings of others.</td>
<td>Worked with others, but did not contribute a fair share of work OR was discouraging and did not consider the feelings of everyone.</td>
<td>Did not participate or discussed ideas in an unfair, disrespectful way.</td>
</tr>
<tr>
<td>Use of Materials</td>
<td>Inventively chose materials that were interesting and precisely supported the project's purpose.</td>
<td>Chose appropriate materials to support the project's purpose.</td>
<td>Chose some appropriate materials but others worked against the purpose of the project.</td>
<td>Did not choose appropriate materials.</td>
</tr>
<tr>
<td>Engineering Design Cycle</td>
<td>Student clearly understood and fully utilized all four steps of the Engineering Design Cycle.</td>
<td>Student basically understood and utilized all four steps of the Engineering Design Cycle.</td>
<td>Student vaguely understood and utilized some steps of the Engineering Design Cycle.</td>
<td>Student did not understand AND/OR only utilized one or none of the steps of the Engineering Design Cycle.</td>
</tr>
<tr>
<td>Reflection</td>
<td>Student was able to extensively explain all the parts of the design cycle, explain how they followed it in the bridge design, and thoroughly explain the challenges they faced and how their group overcame those problems.</td>
<td>Student was able to explain all the parts of the design cycle, explain how they followed it in the bridge design, and explain some of the challenges they faced and how their group overcame those problems.</td>
<td>Student was able to explain some but not all parts of the design cycle. May have explained some of the challenges faced, but did not explain how those problems were overcome.</td>
<td>Student was not able to explain any of the parts of the design cycle. Did not identify challenges faced.</td>
</tr>
</tbody>
</table>
## Rubric

<table>
<thead>
<tr>
<th></th>
<th>Exceeds (3)</th>
<th>Meets (2)</th>
<th>Partially Meets (1)</th>
<th>Does Not Meet (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Design</td>
<td>The bridge design was inventive, aesthetically pleasing, and was able to hold an 8 ounce water bottle for over 10 seconds over a 12 inch span.</td>
<td>The bridge design was able to hold an 8 ounce water bottle for 10 seconds over a 12 inch span.</td>
<td>The bridge design held an 8 ounce water bottle for less than 10 seconds over a 12 inch span.</td>
<td>The bridge design was not able to hold an 8 ounce water bottle or did not span the full 12 inches.</td>
</tr>
</tbody>
</table>

| Total N/15             |                                                                              |                                                                              |                                                                                  |                                                                                  |