2016

2nd Grade Exemplar Lesson - CCSD MSP

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### Material Properties and Assembly

**Essential Question:** How can structure and function determine what material I use?

**Unit Summary:** The purpose of this unit is to expose students to the notion that materials have different properties and that these materials can be used to create a variety of different objects depending on the purpose of construction. This will be done by designing train car containers specific to a certain community member’s resource needs using Legos and/or K-nex.

- **Lesson 1:** The unit begins with an exploration of different properties of materials.
- **Lesson 2:** Continued exploration focused on the different ways in which those materials can be used to construct objects.
- **Lesson 3:** The two explorations are connected to the idea of community partners by looking at what materials/design could be used to transport their needed resources.
- **Lesson 4-5:** Students will be given the role of a specific community partner and be tasked with designing a train car box that will effectively transport their resource. In small groups, they will draw a blueprint and then construct it with Legos and/or K-nex. The emphasis will be on students’ ability to support their design and material selection with evidence and reasoning.
- **Lesson 6:** The unit will end with a student discussion comparing model designs and reasoning behind design and material selection. The unit should end with a review of big takeaways.

#### Lesson 1 of 6: Introduction to properties of matter & engineering

**Standards**
- 2-PS1: Matter and Its Interactions
- K-2-ETS1: Engineering Design

**Performance Expectations**

**The lesson outlined in this table is just one step toward reaching the performance expectations listed below**

- **2-PS1-2.** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- **K-2-ETS1-1.** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Name and NGSS code/citation</th>
<th>Specific Connections to Classroom Activity</th>
</tr>
</thead>
</table>
| Science and Engineering Practices | **SEP 6: Constructing Explanations**  
  - Make observations from several sources to construct an evidence-based account for natural phenomena (2-PS1-3)  
  **SEP 1: Asking Questions**  
  - Ask questions based on observations to find more information about the natural and/or designed world(s) (K-2-ETS1-1) | Given different classroom scenarios, students will identify what the problem is, make observations about the materials available to solve the problem, and ask further questions based on their observations. |
| Disciplinary Core Ideas          | **Structure and Properties of Matter (2-PS1-2)**  
  - Different properties are suited to different purposes  
  **Defining and Delimiting Engineering Problems (K-2-ETS1-1)**  
  - Asking questions, making observations, and | Students will discuss why they thought one material would work better than another to solve each problem based on the properties of the chosen material (rigid, flexible, |
gathering information are helpful in thinking about problems (hard, soft, and breathable).

<table>
<thead>
<tr>
<th>Crosscutting Concepts</th>
<th>CCC 6: Structure and Function</th>
<th>Students will choose materials to address the problems they identify in each scenario based upon their structure and function.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The shape and stability of structures of natural and designed objects are related to their function (K-2-ETS1-2)</td>
<td></td>
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</tbody>
</table>

**Connections to Engineering, Technology, and Applications of Science:**
- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world (2-PS1-2)

**Connecting to the Common Core State Standards**

**CCSS.ELA-Literacy.W.2.8** Recall information from experiences or gather information from provided sources to answer a question.

Students will gather information from the three classroom scenarios to identify each problem, make observations, and ask questions that could help solve the problems.

**Suggested Procedure:**

**ACTIVITY 1 (targets SEP1/SEP6):**
- **Review from previous lessons:** What is a property? What are some different properties we have learned about?

- Explain that when faced with a problem (any situation that people want to change or create) engineers ask questions, make observations, and gather information. Can you think of a time you asked questions, made observations, or gathered information? Have students share their ideas and write these on the board/anchor chart. (SEP 1)
  - What did you do with that information? Did it help you solve a problem? (K-2-ETS1-1)
  - If student provides applicable example, extend by asking if another material would have worked/not worked and why. (2-PS1-2)

- Explain that students will be given different scenarios and for each they will need to **identify what the problem is,** make observations about the materials available to solve the problem, and **ask further questions.**
  
  Make explicit that it is essential to **clearly understand the problem before beginning to design a solution.** Why might that be?

**ACTIVITY 2 (targets SEP1, SEP6, K-2-ETS1-1):**
- Pass out the data table worksheets and use the PowerPoint to model what you expect students to do for each scenario (have the data table under a document camera so that you can model filling this in and have students fill it in as well). Present the scenario with a picture, identify the problem, make observations about the materials available, and ask further questions.

**Example:** Hole in jeans (flexible material)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Identify the Problem</th>
<th>Make Observations</th>
<th>What material would NOT work? Why?</th>
<th>Ask Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holy Jeans</td>
<td>Ex: There is a hole in Fabric and</td>
<td></td>
<td>How could you attach either</td>
<td></td>
</tr>
</tbody>
</table>
my jeans and cheesecloth are both soft and flexible. But why did you choose material for the jeans?

Difficult Door

New Classroom Pet

- Have students work in pairs on each of the two scenarios described below (you can project these or print them for student pairs). Have students spend around 8 minutes working on each scenario identifying the problems, making observations about the materials available, and asking further questions.

  - Difficult door (hard, heavy material)
  - Classroom pet lid (breathable material)

* You can come up with other scenarios and/or materials that would work for your classroom.

**ACTIVITY 3 (targets SEP 6, CCC 6, 2-PS1-2, K-2-ETS1-1):**

- After students have completed each scenario and filled out their data tables have them come back altogether as a class to discuss the information they gathered. Make sure you discuss these points:

  - For each scenario ask why students thought one material would work better than another to solve the problem. **What property did the chosen material have?** Introduce the vocabulary: rigid, flexible, hard, soft, and breathable as students discuss each scenario. (SEP 6, CCC 6, 2-PS1-2, K-2-ETS1-1)
  - When or why might you need a rigid material or soft material? (CCC6)
  - Have students define these new vocabulary terms in their own words with their partners.

**Exit Slip:** Have students describe one of the new properties discussed in their own words.

*The formatting of this table is based off the format used in The Science Teacher.*