## Huntington School Engineering is Elementary

## Grade: Kindergarten Unit: To Get to the Other Side: Designing Bridges

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| **Day 1,2**  **Lesson Topics**  **Guiding Question**  **Essential Vocabulary** | **Time: Materials, unit page #’s** | **Lesson Summary/Objective:**  **PS1.1 –**Matter and Its  Interactions  **PS1.2-** Motion and Stability:  Forces and Interactions | **Assessment** |
| **Introductory Lesson**  What is technology?  Who are engineers and what do they do?  Vocabulary:  technology  engineer | **Preparation**: 20 min.  **Lesson Span**: 1-2 days (50- 60 min)   * Read-aloud *The Handiest Things in the World* by Andrew Clements * 4 opaque bags * “Technology Around Us” Sheet (adapted for K) * Collect: ***plate, cup, straw, paper clip, pencil, ,glue stick, scissors, button, magnifying glass, thermometer, book*** for each bag * Chart with pictures of objects in bags | **Students will**   * Examine everyday examples of technology * Discuss why these objects were designed, what problems they solved * Draw and write about a technology from the bag * Learn that many of the objects we use every day are examples of technology * Learn that engineers design technology to solve problems * Be introduced to the Engineering Design Process (EDP)   Ask students if they know the word technology. Invite students to give definition.  Write the word on a sentence strip and put on vocabulary wall chart.  Read *The Handiest Things in the World*  Read the information for each technology . Instruct S to think about why the object was made. Then show the object and ask: what would we do if we didn’t have this technology.  Have groups of 6 S to go to a table where there is a bag of objects to examine. Tell S to think about why someone designed each object.  S return to the rug and think-pair-share about some of the objects on the chart. Teacher records answers on chart.  S use the chart to draw and write about one technology from the bag. S share their drawings and talk about the technology purpose.  Teacher shows the Engineering and Design Process visual on ELMO. Talk about how an engineer would have gone through the EDP to design one of the objects in the bag. | * Listen to students discussions and note their thinking      * Observe students’   drawings/ writings. |

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| **Day 3,4**  **Lesson Topics**  **Guiding Question**  **Essential Vocabulary** | **Time: Materials, unit page #’s** | **Lesson Summary/Objective:**  **PS1.1 –**Matter and Its  Interactions  **PS1.2-** Motion and Stability:  Forces and Interactions | **Assessment** |
| **Introductory Lesson**  What is technology?  Who are engineers and what do they do? | **Preparation**: 20 min.  **Lesson Span**: 1-2 days (50- 60 min)   * Read-aloud *Javier Builds* a Bridge (in binder) * 4 opaque bags * “Technology Around Us” Sheet (adapted for K) * Collect: ***plate, cup, straw, paper clip, pencil, ,glue stick, scissors, button, magnifying glass, thermometer, book*** for each bag * Chart with pictures of objects in bags | **Students will**   * Examine everyday examples of technology * Discuss why these objects were designed, what problems they solved * Draw and write about a technology from the bag * Learn that many of the objects we use every day are examples of technology * Learn that engineers design technology to solve problems * Be introduced to the Engineering Design Process (EDP)   Ask students if they know the word technology. Invite students to give definition.  Write the word on a sentence strip and put on vocabulary wall chart.  Read *The Handiest Things in the World*  Stop during reading to ask S to think about why some of the objects were made.  Have groups of 6 S to go to a table where there is a bag of objects to examine and think about why someone designed them.  S return to the rug and think-pair-share about some of the objects on the chart. Teacher records answers on chart.  S use the chart to draw and write about one technology from the bag. S share their drawings and talk about the technology purpose.  Teacher shows the Engineering and Design Process visual on ELMO. Talk about how an engineer would have gone through the EDP to design one of the objects in the bag. | * Listen to students discussions and note their thinking      * Observe students’   drawings/ writings. |

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| **Day 4**  **Lesson Topics**  **Guiding Question**  **Essential Vocabulary** | **Time: Materials, unit page #’s** | **Lesson Summary/Objective:**  **PS1.1 –**Matter and Its  Interactions  **PS1.2-** Motion and Stability:  Forces and Interactions | **Assessment** |
| **Lesson**  **2**  What are some of the forces that act on structures?  How do civil engineers design structures that can withstand these forces?  **Vocabulary:**  Structure  Stable  Push  Pull | **Preparation**: 30 min.  **Lesson Span**: 2 days  60 min   * 8, 5x8 index cards * 2, 3x5 index cards * Cellophane tape * 8 small paper clips * 4 drinking straws * Modeling clay   See p.58 and 59 for designing a one-story and a tower structure with the above materials   * 10 weights, about .6oz each * Table fan * String * Chart paper * Marker   See p.60 for how to make the chart | **Students will**   * Examine several structures and observe how each is affected by a force * Brainstorm and implement some engineering solutions to prevent forces from causing a structure to fail * Understand that a force is either a push or a pull   Activate prior knowledge by talking about *Javier Builds a Bridge*. Remind students that Javier’s stepfather was a civil engineer who designed structures.  Define structure and ask students to name structures in our community. Make a list to post.  Define a stable structure as a goal of all engineers.  Tell students that we are going to apply a force – push or pull – to some structures.  Invite students to try to make an index card stand up on its own without using hands to hold it up. Then say that they can use 1 finger. Explain that 1 finger is pushing against the index card to hold it up (p.64)  Show S the one-story structure.  Ask if there are any forces acting on the structure. Add 1 or 2 weights in the center of the roof so it begins to sag. Record  results on the chart.  Invite students to suggest a way to keep the roof from sagging. Add a 5th column to the middle and add weights again. Explain that this is an engineering solution to keep the roof from sagging. Record on chart.  Use the fan to create a force on the tower structure. Record results on the chart.  Attach string to one side (p.72) and turn fan on again. Discuss results. Add the second string to the tower (p.74), turn on the fan. Discuss results and record the engineering solution on the chart. | * Listen to students discussions and note their thinking |

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| **Day 5**  **Lesson Topics**  **Guiding Question**  **Essential Vocabulary** | **Time: Materials, unit page #’s** | **Lesson Summary/Objective:**  **PS1.1 –**Matter and Its  Interactions  **PS1.2-** Motion and Stability:  Forces and Interactions | **Assessment** |
| **Lesson**  **3**  How does the structure of a bridge affect its strength and how can we use different materials in our bridge design?  **Vocabulary:**  Structure  Stable  Push  Pull  beam bridge  arch bridge  deep beam bridge | **Preparation**: 30 min.  **Lesson Span**: 1 day  30 min  For each group:   * 4, medium-size building blocks * 4, 5”x8” index cards * 2 plastic cups * A marked up *Testing Bridges Set Up* sheet * 20 weights in cup | **Students will**   * Create a beam bridge structure and observe how it is affected by the downward force of weight * Test the bridge to see how much it can support and how adding weight affects the structure of the bridge * Materials can be used in different ways to accomplish different design tasks   Take a copy of the *Testing Bridges Set Up* sheet and make an arch bridge. Mark where the abutments should be placed on the sheet (p.86). Then make copies for each group.  Set up a table with the materials needed to build the bridge.  Explain that students will build and test a beam to learn about how they work.  Review Lesson 2 about forces on structures (p.88 for questions to ask).  Ask and post the following question: How does the structure of a bridge affect its strength?  Preview the experiment by showing students how to build the beam bridge.  Give each group a sticky note and ask that one member of the group be a recorder for how many weights were used before the beam bridge collapsed.  Have teams tell their results and explain what happened as more weights were added. | * Listen to students discussions and note their thinking |