What to Expect from the Program

Thank you for choosing to spend your day at the Flint Hills Discovery Center. We are excited for your upcoming visit!

Next Generation Science Standards:

- **ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.

Lesson Objectives:

- Students will explore the engineering process as they build their windmill
- Students will identify constraints that impact the construction of their windmill
- Students will revise their windmill design to better meet project requirements
- Students will demonstrate that their windmill can spin in the wind and stand upright on its own

Activity Descriptions:

In this classroom activity, students will learn about the engineering process as they design and construct a windmill using materials provided by the FHDC. Students will begin their classroom program by discussing the engineering process and what engineers do on a daily basis. Then, they will explore different types of windmills that use wind energy to complete a task including wind turbines, water pump windmills, and traditional Dutch windmills. Students will then have the opportunity to follow the engineering process to create a windmill using materials provided by the "Hardware Store" such as tongues depressors, card stock, and tape. To be considered a successful windmill, the students' creation must spin when wind is directed at it and stand upright on its own. Students will need to consider their budget and time constraints as each group will receive a limited amount of money and our "hardware store" is only "open" for limited hours. As students work together, they will further develop their teamwork skills, critical thinking skills, and complete simple math problems to maintain their design budget. This classroom program is approximately sixty minutes. It is designed for a minimum of twelve students and a maximum of thirty students per session, working in groups of four to six.

Pre-Visit Lesson Plan

English/Language Arts Lesson Plan for 3rd through 5th graders

Common Core ELA Standards:

- RI.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
- RI.7 Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
- L.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

Lesson Objectives:

- Students will utilize context clues to infer meaning of vocabulary in text and diagrams
- Students will cite textual evidence from text and diagrams to support their answers

Materials:

For Each Student:

- Printed copy of "Comparing Windmill Designs," "Water Pump Windmills in Kansas" text, and "Water Pump Windmills in Kansas Guided Reading Questions" for each student.

For the Teacher:

- Printed copy of "Comparing Windmill Designs," "Water Pump Windmills in Kansas" text, and "Water Pump Windmills in Kansas Guided Reading Questions Key."

Preparing to Teach:

- Read "What to Expect from the Program" before teaching this lesson.
- Make a copy of "Comparing Windmill Designs," "Water Pump Windmills in Kansas" text, and "Water Pump Windmills in Kansas Guided Reading Questions" for each student and yourself, as well as a "Water Pump Windmills in Kansas Guided Reading Questions Key" for yourself.

Exploring Relevant Knowledge:

- Have students analyze the "Comparing Windmill Designs" completing the bottom half of the sheet to record their observations. Then, have students share their ideas about the windmill designs as a large group. We suggest prompting students to clarify their reasoning behind their answers.

Developing New Knowledge:

- Divide your classroom into small groups and give each student a copy of "Water Pump Windmills in Kansas" text, and "Water Pump Windmills in Kansas Guided Reading Questions."
- Students should read the text and complete the guided reading questions together as a group.
- We recommend discussing the worksheet as a whole class once students have completed it to ensure student understanding. This knowledge will be beneficial when students visit the FHDC.

Measuring Student Knowledge:

- Tell students that they will complete a "3-2-1" exit ticket to show their new knowledge.
- Collect student exit tickets and consider bringing them with you to the FHDC to use during your visit!

Post-Visit Lesson Plan

English/Language Arts Lesson Plan for 3rd through 5th graders

Common Core ELA Standards:

- W.1Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
- W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Lesson Objectives:

- Students will utilize letter writing skills to explain their choices in the Engineer it! Windmills program
- Students will clearly identify positive and negative choices from their windmill design

Materials:

For Each Student:

- Copy of "Engineering Windmills" letter template (optional)

For the Teacher:

- Access to "The Engineering Process: Crash Course Kids #12.2" YouTube clip (optional): http://bit.ly/1Gdzdc7
- Copy of "Engineering Windmills Letter Example"

Preparing to Teach:

- Pre-teach or review proper letter writing format with students.
- Preview "The Engineering Process: Crash Course Kids #12.2 " YouTube clip and determine if your students would benefit from reviewing the engineering process with this clip.
- Make a copy of ""Engineering Windmills" letter template for each student (optional) or decide if students will complete this assignment on notebook paper.
- Make a copy of the "Engineering Windmills Letter Example" for yourself.

Exploring Prior Knowledge:

- Have students watch "The Engineering Process" (optional) and review the engineering process.
- Review with students the general outcomes of the Engineer it! Windmills program. Discuss what types of designs worked, what types of constraints students had to work with (budget, materials, and time), and what they might do differently.

Developing New Knowledge:

- Explain to students that they will complete a reflection about their windmill design by pretending they are writing a letter to their friend about their experience.
- Tell the students that the first paragraph should be a general greeting similar to the introduction included on the letter example. It should include a reason for why they are writing the letter to their friend.
- The second paragraph should include at least two of the choices they made during the program, explaining the outcome of these choices. Tell students they should try to include one good choice they made as well as a bad choice they made when constructing their windmill.
- The third paragraph should focus on what the student would do differently if they were to complete the program again. Students should explain what prompted their changes.
- The last paragraph should be a very general closing.

Measuring Student Knowledge:

- After students have completed their letter, we recommend collecting them and evaluating the letters for student understanding.