**Lesson Cycle (Gradual Release of Responsibility)**

**Lesson Title/Topic:** The Ups and Downs ofArchitecture

**Standards:** College and Career Readiness Standards, Cross-Disciplinary Standards I, C. (2)

Develop and apply multiple strategies to solve a problem.

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| **Lesson Objectives:** Using materials provided, the student will construct a miniature rollercoaster applying hills, turns, and loops with 75% accuracy. | **Assessment:** Students will construct their own rollercoaster and compare the speed of various vehicles. |
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**Materials:** 6 foam pipe insulation tubes, marbles, metal ball (3/4”, 1”), masking tape, cups,

toothpicks

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| **The teacher will:** | **The student will:** |
| **Focus:**   * Play a video of roller coasters. * Have a constructed roller coaster displayed. * Display following questions above the roller coaster model.  1. Who likes to ride roller coasters? 2. Who designs roller coasters? 3. What skills does one need to design roller coasters? 4. How much money does a roller coaster designer make? | * Watch video, explore the roller coaster model and observe the questions |
| **Teacher Input (I Do):**   * Introduce students to a roller coaster creation game.   <http://www.hoodamath.com/games/rollercoastercreator.html>     * Pick a student to demonstrate how the roller coaster model works by placing the vehicle (ball) at the top and letting it freely travel the path of the roller coaster. * Discuss and answer the questions above the roller coaster model.  1. By a show of hands, who likes roller coasters? 2. Who designs roller coasters?   Architects, mechanical engineers, drafters, computer programmers   1. What skills does one need to design roller coasters?   Math, creativity, problem solving, physics   1. How much does an architect/roller coaster designer make?   Architects can make $73,000+.  Roller coaster designers make $45,000 straight out of college.   1. What are good architecture schools?   Rice University, University of Texas in Austin, Texas A&M | * Play roller coaster creator game. * Participate in the discussion and provide feedback. Students may use technology to search for the answers.  1. Raise hands if they like roller coasters. 2. Provide possible answers and discuss. 3. Provide possible answers and discuss. 4. Provide guesses 5. Research question using a device and provide answers. |
| **Guided Practice (We Do):**   * Explain to students that they are going to create there very own roller coaster. * Create teams of 4-5 students. * Provide instructions before giving students supplies. Instruct to take notes.  1. The vehicle must travel the entire length of track. 2. The roller coaster must have at least one hill. 3. Students can use provided cups to create hill(s). 4. Students can try different vehicles. 5. Use your imagination and have fun.  * Assign one team member to gather supplies. * Give students supplies. * Assist students in making the roller coaster if needed. * Have students locate where the vehicle has the most *potential energy/kinetic energy.* * Encourage students to explore what other teams have created. | * Listen and wait for instruction. * Form teams. * Listen and take notes. * Team member gathers supplies. * Team builds roller coaster. * Team demonstrates roller coaster. * Students locate where vehicle has the most *potential energy/kinetic energy.* * Students observe what other teams have created. |
| **Independent Practice (You Do):**   * Hand out roller coaster blue prints that explain to the teams that they are to rebuild their roller coaster combining following elements.  1. Two or more hills 2. 180º turn   Extra elements include:   1. Loop 2. Corkscrew  * Explain * Vehicle must travel the entire track without falling off (do not assist vehicle once started) * Teams are to experiment with various vehicles and record with a stopwatch which was the fastest, which ‘vehicle’ traveled the farthest. * With iPhone, make a video of the roller coaster to share with other classes. * Create a blueprint on graph paper of final roller coaster. Include the height of the starting point, hills, length, and other elements of roller coaster. | * Read and examine the blue prints * Ask questions * Construct roller coaster combining the listed elements. * Test roller coaster * Make modifications * Compare the different vehicles by recording the speeds with a stopwatch, and the length traveled. * Create a video with iPhone and send to teacher. * Draw a blueprint of the design of the roller coaster, including the height of the starting point, hills, length, and other elements of the roller coaster. |
| **Closure:**   * Instruct student to write in their journal a brief paragraph of what they have learned about the experiment. | * Analyze what they have learned by creating and modifying their roller coasters. |

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| ***Bloom’s Level(s)***  Applying/Creating:  “Construct roller coaster combining the listed elements.”  “Test roller coaster.”  “Make modifications.”  Analyzing:  “Analyze what they have learned by creating and modifying their roller coasters.” | ***Technology Integration***  Roller coaster creator game:  <http://www.hoodamath.com/games/rollercoastercreator.html> |
| ***Extension:***  Invite and architect and designer from Six Flags to visit the school.  Share the book *Walt Disney Imagineering: A Behind the Dreams Look at Making the Magic Real* with the class. Instruct students to design a themed amusement park ride. Students will explain how the ride operates and what inspired the design. | ***Reteach:***  The teacher will reteach architecture using dominoes. The teacher will demonstrate how the dominoes can climb stairs, fall from edge and hit another domino, restarting the domino pattern. |

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| **Accommodations / Modifications:**  Gifted/Talented – Students can design and create two roller coaster that are connected (interlocking loops, crisscross one another).  Learning Disability – Students are provided additional assistance from teacher or aid. A blueprint of a rollercoaster is provided to complete assignment.  Speech – Students may answer discussion question in their journals with extra time or linguistic supports. (Explanation of troublesome words in easy to understand terms.)  ESL – A handout of important vocabulary with definitions will be given to students.  Architecture  Engineer  Potential Energy  Kinetic Energy  Roller coaster  Vehicle  Images will be provided of a roller coaster, and the vehicles used on a rollercoaster.  Bilingual – Students will work with ESL students and assist them in constructing rollercoaster and calculating speed. | **References:** |