Appendix A
Sample Student Artifacts

Makerspace Inquiry Project - Documentation

Key Objectives:

In this project, you will:

- Explore various ways that precipitation can change over seasons and how water can cause damage if it is not controlled.
- Create and program a floodgate to control the water level of a river.
- Present and document multiple solutions designed to prevent water from changing the shape of the land.

1. Explore Phase: Max and Mia are considering different kinds of precipitation in their area. They want to know how to keep precipitation from impacting the land in their area.

Explore Max’s and Mia’s Questions:

1. Can you describe precipitation levels of each season in your area using a bar graph?

Student Response:

![Bar graph showing average precipitation levels of each season in an area.](image-url)
2. How does precipitation influence river water levels?
   **Student Response:** The more precipitation or rainfall, then the higher the water level in rivers.

3. What are some different ways you can prevent a flood?
   **Student Response:** The use of effective drainage systems, retaining walls, and vegetation are some different ways in which a flood can be prevented.

4. Can you imagine a device that can prevent a flood from happening?
   **Student Response:** A device that could prevent a flood from happening could be a floodgate.

2. Create Phase
   - Use the bricks:
   Build a floodgate that can control the level of water in a river.

**Create Phase Student Documentation:** The chart below includes important screenshots of programming for the iPad, as well as my personal creation with the Lego’s. The documentation does not show every individual step of creation, but rather the essential steps in which visible progress is noted.

<table>
<thead>
<tr>
<th>Screenshot</th>
<th>Personal Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Screenshot" /></td>
<td><img src="image2.png" alt="Personal Creation" /></td>
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</tbody>
</table>
- Connect your Smarthub
  Turn on the Smarthub and connect it your device.

- Program your Model
  Program your floodgate to open and close at the appropriate time according to your bar graph.

**Program Model Student Documentation:**
My task was to create a floodgate that would open and close at the appropriate time according to my bar graph. I could not include the entire code in one screenshot, so I broke the code down based upon each season. I programmed the floodgate to stay open the longest amount of time in the spring because that's when my area receives the most precipitation. I programmed the floodgate to stay open the shortest amount of time in the fall because that's when my area receives the least precipitation. Lastly I programmed the floodgate to stay open for the same amount of time in the summer and winter because that's when my area receives about the same amount of precipitation. Note that it is rather difficult to spot the differences in the amount of time the floodgate is actually open due to the small difference in precipitation each season receives. The video features the entire code for each season opening and closing in one segment.
<table>
<thead>
<tr>
<th>Season</th>
<th>Individual Code for Each Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter (4 Seconds)</td>
<td><img src="image" alt="Winter Code" /></td>
</tr>
<tr>
<td>Spring (5 Seconds)</td>
<td><img src="image" alt="Spring Code" /></td>
</tr>
<tr>
<td>Summer (4 Seconds)</td>
<td><img src="image" alt="Summer Code" /></td>
</tr>
<tr>
<td>Fall (2 Seconds)</td>
<td><img src="image" alt="Fall Code" /></td>
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</table>

I haven’t completed this lesson before so it was really great to see how it was organized and the process involved. I love the functionality of creating a movable gate controlled remotely by programming - can help students see the functionality in the real-world.

- **Design a Solution (Extension)**
  Consider one of the following:
  1. Add a Tilt Sensor handle to operate the gate.
  2. Add a Motion Sensor to detect water rising.
  3. Add a Sound Sensor Input to activate an emergency protocol.

**Student Response:** At this point, I went over my 90 minutes in order to complete the extension portion of the lesson.
3. Share Phase

- Share your findings: Present in your own words how a floodgate can prevent water from changing the shape of the land:
  
  **Student Response:** The goal of a floodgate is to control water flow in flood barriers, rivers, streams, and other bodies of water. Water can cause the land to change shape by carrying soil and rock to new places and depositing them in other areas. If a floodgate is present, then there will be a decrease in water overflow that alters the shape of the land.
Reflection

I completed the Makerspace Inquiry Project using the LEGO Education WeDo 2.0 kit and app. The LEGO Education WeDo 2.0 kit and app could be used in a variety of ways in the elementary classroom. When implementing this tool, students are forced to use a variety of skills and learned tasks such as following directions in order to build the creation, organizing and documenting their steps in a logical way, problem-solving various prototypes and extended features of their model, and basic coding and computational skills. Science, math, and technology are all subjects that would lend themselves to being useful for this tool. However, this makerspace tool could be implemented in almost any subject, as long as the framework of the lesson is adapted to what is being studied. The teacher must prepare the information necessary for the given task, allow students time to create, and have students share what it is that they created and why. I personally think that the lessons LEGO WeDo 2.0 provides are great for STEM. Any lesson selected lends itself to a variety of science topics involving technology and mathematical aspects. My particular lesson involved the exploration of flooding and how to prevent a flood, problem-solving, following directions, coding, and engineering and design. I think that this lesson would be very practical to implement in the elementary education setting as it teaches a multitude of skills. Just based on my own exposure to this makerspace tool, I know that it challenged me to follow directions, put my coding skills to the test, and organize my thoughts and data appropriately. Therefore, this lesson would be very beneficial in the elementary classroom as well.
In this activity, students get to explore science and math with Dash. Students are to write a hypothesis about how speed will affect the distance that Dash will go and experiment to prove whether their hypotheses are true or false. Students will be learning about how speed equals distance over time and how they can solve these math equations. During this activity, a worksheet will be available for students to fill out to record their work about speed setting, time, and the distance Dash traveled. For this activity, I had to construct a racetrack (start and finish line), form a hypothesis, and experiment by coding the Dash, using a stopwatch, and measuring distance. I had to code using Blockly to make Dash move forward in a straight line. However, there were different speed settings that could be adjusted that helped me prove my hypothesis was true: The higher the speed setting, the farther the distance.

Video Demonstration:
https://drive.google.com/open?id=1Yeli7zKjgbK11QE1eWPUtz3oC0_3heQ1
How Dash can be Used in the Elementary Classroom:
Dash can be used in the elementary classroom by students learning science, math, and coding. Students have to code Dash to set him at a certain speed or for a time frame. Students use coding to measure and distance, time, and speed. This is great for elementary classrooms that are covering these topics, and they could incorporate math and science together for children who dislike one subject over the other. The students are able to create experiment and solve for solutions. Most children like playing with Dash, so I believe they would enjoy this lesson as much as I did.