Future Ready Project - Lasers & Lighthouses

Teacher Name:		Duration (in minutes): 360 min.
Grade Level(s): 1st Grade	Subject/Course: Multi-Subject	Unit: Light & Sound, Life Long Ago, Shapes, Informational Writing
Resources needed: (On-site people, facilities, tools, technology, materials, community connections)	- Play Dough - Magnatiles - Makey Makey - Snap Circuits - Flashlights / Laser Pointers - Cell Batteries - Copper Tape - LED Lights - 3D Printer - Filament - Balsa Wood - Laser Engraver/Cutter - Honeycomb Working Panel - Laser Engraver/Cutter Ventilation Hood - UV Safety Glasses - Aluminum Foil - Masking Tape - Hot Glue Gun - Hot Glue Sticks - iPads - TinkerCAD - Poster Paper - Markers - Seesaw - Canva	
Learning Standards: (content + CS & DF)	**Computer Science & Digital Fluency:** **K-1.IC.1** Identify and discuss how tasks are accomplished with and without computing technology. **K-1.IC.6** With teacher support, identify different ways people interact with computers and computing devices. **K-1.CT.4** Identify a problem or task and discuss ways to break it into multiple smaller steps. **K-1.CT.10** Collaboratively create a plan that outlines the steps needed to complete a task. **K-1.NSD.1** Identify ways people provide input and get output from computing devices. **Next Generation Science:** **1.PS4.2:** Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated. **1.PS4.4:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. **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. **K-2.ETS1.2**: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
Big Idea:	For this project, students will be working to develop their own miniature lighthouse, understanding how technology can help us to produce an end product. Through 3D printing, laser cutting, and circuitry, students will design and develop their own functional lighthouse.
Authentic Purpose: (Why does this matter to your students?)	This project enables students to view themselves and engineers, and most importantly to view themselves as problem solvers. The project regularly challenges students to think critically and use creativity to reach a solution.
Future-Ready Competencies: ___Collaboration ___Communication _X_Critical Thinking & Problem Solving _X_Creativity & Innovation ___Other:	Objectives: Students will be able to describe ways that artificial light is used to assist humans. - Including: flashlights, laser light, and lighthouses. Students will be able to design a structure that amplifies and focuses light waves to travel in one direction.
Project Statement: (Include: issue, problem or challenge; student role, purpose, beneficiary, and desired outcomes)	In this project, students were tasked with outlining and completing the steps needed to make a functional model lighthouse. After learning about light and sound, students were given materials over the course of several lessons, and given the goal of creating a product that would solve a given problem. This project was able to deepen student's knowledge of the world around them, and provided information on topics that would not have been covered otherwise.
Empathy Anchor: (How will students develop empathy and care about this problem)	The introduction of new, hands-on materials will excite students and spark a desire to learn more and continue engaging with the project.
Public Audience & Reveal: (Experts, audiences, or product users students will engage with during and at the end of project)	This project will be revealed during a showcase in late February. Students, parents, other teachers, and administrators will be invited to learn more.

Knowledge Construction: (How are students going to construct content knowledge and practice it) Students will slowly build upon their knowledge to the point that they have everything they need to construct a full lighthouse. Background knowledge includes an understanding of how light comes from natural and artificial sources, and how focusing light rays using reflective materials can make light appear brighter. Students will learn about the function of lighthouses, and their uses both historically and today. They will also learn about circuits, and how to wire a lightbulb. Students will complete another lesson to design a reflective dome for their light bulb. Additionally, students will separately study the	Student Assessment: Students have been assessed continually throughout the lessons based upon their individual success with each task. Students are also assessed on overall understanding through their finished project creations.

function of both 3D printers and laser engravers/cutters.	

Design Process:

1. Discover
2. Research & Empathize
3. Brainstorm
4. Choose
5. Build
6. Test
7. Communicate
8. Redesign

Describe what (& how) students are going to do in each step:

1. Discover
    a. Students will begin learning about lighthouses by a combination of texts and videos. The story “Hello Lighthouse” by Sophie Blackall will be used to introduce the concept to students.
    b. Students will also watch the video: How Do Lighthouses Work?
2. Research & Empathize
    a. Students will begin their own research of lighthouses, being provided texts, short-read paragraphs, and pictures to begin learning more.
    b. Students will be introduced to the laser engraver/cutter, and shown a demonstration on how it works. Consider engraving a fun pattern or design that will pique students interest. Also consider showing a time lapse video of a laser cutter in action. This will boost excitement and create empathy for the project.
3. Brainstorm
    a. Students will be posed with two engineering challenges:
        i. Circuitry Challenge: provide students with cell batteries, copper tape, and a lightbulb. Prompt students that their challenge is to figure out a way to make the light work.
            1. Consider using a Makey Makey kit and Snap Circuits as part of free play ahead of time to introduce the concept of a circuit and a closed shape.
            2. Provide little guidance at first, allowing for productive struggle and independent problem solving.
            3. As students begin figuring out ways to get the light to work, allow them to collaborate and share with their peers.
            4. At the end, demonstrate for all students how to produce a working light bulb, and give students an opportunity to attempt on their own.
        ii. Reflector Challenge: explain to students that your lighthouse base will need a way to make the light beams seem brighter on the top. Provide students with play dough, and allow them time to create a shape that would direct all light waves in one direction.
            1. Provide little guidance at first, allowing for productive struggle and independent problem solving.
            2. Allow students to explain their thinking with the shapes they have made.

3. Show students some of the student's work that resembles a dome shape.
4. Prompt students to consider if there is an additional material that would make this more reflective - work towards the response of aluminum foil.
5. Demonstrate lining one of the dome shapes with aluminum foil, and shine a flashlight into it.
6. Now, direct students that we will be using wood pieces to assemble our reflectors, and each piece will be a triangle.
7. Show students 4 triangular Magnatiles, and ask students to consider how they could make a similar "dome" shape. Allow a student to demonstrate.
8. Prompt students to access TinkerCAD, and to add 4 triangles to their workplane. Then, demonstrate cutting 4 triangles of wood with the laser cutter.
9. Finally, tape together the 4 triangles to resemble the shape made with Magna Tiles, line with foil, and shine a light inside to show students the finished product.

4. Choose
    a. Allow students the opportunity to access Canva, and use the Magic Media feature to generate pictures with AI. Students will type, or teacher will type, different descriptors to create a fun lighthouse picture.
    b. Consider doing this in groups, or individually based on available technology and student independence.
    c. Print these designs to be used later on their research posters.
5. Build
    a. Posters - allow students multiple periods of time to construct a research poster about lighthouses. Possible topics to include will be the size of lighthouses, how they work, what they do, and who they help. Provide guidance as needed for spelling. Prompt students to include their AI-generated picture.
    b. Lighthouses - allow students work time with 4 wooden triangles, tape, and a teacher-held hot glue gun. Students will build their reflector as was designed in the "Brainstorm" portion. They will line with aluminum foil, and use their completed light bulb circuits to illuminate the inside. Alternatively, adhere flashlights or another light source inside their reflector based on student ability levels and independence.
        i. Teacher will need to pre-cut several wooden triangles to have 4 for each student (or group).
        ii. Teacher will need to pre-print a lighthouse base with a 3D printer. Consider allowing students to design

	lighthouse bases with TinkerCAD, or choose a pre-made design available online for download. 6. Test a. Provide a dark environment for students, and allow them to test their lighthouses, ensuring that the lights work and that their construction is sturdy. 7. Communicate a. Allow students to present their research posters with the class. Provide time for students to ask questions, and explain all of the components. b. Consider a science-fair style presentation of individual student lighthouses. They will demonstrate how they work, and what the process was like to build them. 8. Redesign a. Prompt students to consider the changes that they would make if they were to attempt the project again. b. Consider having students write, draw, or verbally explain what they would change using Seesaw.