2nd STEAM – Unit 5 (ENGINEERING)

Content Area: **ENGINEERING (Grades 2)**
Course(s):
Time Period: **Ongoing**
Length: **Ongoing**
Status: **Published**

Big Idea

Engineers are constantly confronted with societal problems that must be solved as thoroughly as possible. Many times the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task. Typically engineers start with a simple solution and then redesign it in order to make the solution more reliable and efficient. The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. The steps of the engineering design process are to: (Science Buddies, 2017)

- Define the Problem
- Do Background Research
- Specify Requirements
- Brainstorm Solutions
- Choose the Best Solution
- Do Development Work
- Build a Prototype
- Test and Redesign

Students should practice the engineering design process in the classroom. Just like engineers, students should design something, test it, identify issues or problems, and fix them. This way of working is called iteration.

Enduring Understanding

SWBAT understand the engineering design process. SWBAT identify the importance of using models and iteration in design. SWBAT empathize with stakeholders to improve design outcomes. SWBAT make connections between scientific concepts (such as chemistry, physics, and circuitry) and effective engineering practices.

Skills

- Students will practice cutting, pasting, measuring, and folding skills. Several lessons will be completed. These might include designing a catapult to launch Harry over the wall, designing a rocket for Harry to go to the moon, designing a kite, and designing a protective sun hat.
- Practice the engineering design process.
    - In a team environment, research an engineering problem. (For instance, Help our friend Harry fly over the castle wall.)
    - Compare things in nature to what you are going to design. (For instance, humans replicated the design of bird wings to make airplanes. Humans copied the design of bending coconut or apple tree branches to create catapults.)
    - Empathize with the stakeholders affected by the problem.
    - Draw a design of the solution to the problem.
    - Take a digital picture of the design and list the materials (resources) needed to build it.
    - Shop for materials and build a “working model” of the design.
    - Take a digital picture of the “working model” and reflect (in writing) on the building process.
    - Present the working model to the class. Explain what problem the invention solved. Describe how each part of the model is part of a working system.
- Use scientific concepts (such as chemistry, simple machines, circuitry, and magnetism) to plan projects.

Standards

K-2	The characteristics and scope of technology.	**8.2.2.A.1**	Define products produced as a result of technology or of nature.
		8.2.2.A.2	Describe how designed products and systems are useful at school, home and work.
	The core concepts of technology.	**8.2.2.A.3**	Identify a system and the components that work together to accomplish its purpose.
		8.2.2.A.4	Choose a product to make and plan the tools and materials needed.
	The relationships among technologies and the connections between technology and other fields of study.	**8.2.2.A.5**	Collaborate to design a solution to a problem affecting the community.

K-2	The attributes of design.	**8.2.2.C.1**	Brainstorm ideas on how to solve a problem or build a product.
		8.2.2.C.2	Create a drawing of a product or device that communicates its function to peers and discuss.
		8.2.2.C.3	Explain why we need to make new products.
	The application of engineering design.	**8.2.2.C.4**	Identify designed products and brainstorm how to improve one used in the classroom.
		8.2.2.C.5	Describe how the parts of a common toy or tool interact and work as part of a system.
	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.	**8.2.2.C.6**	Investigate a product that has stopped working and brainstorm ideas to correct the problem.

Assessments

- Teacher observation
- Successful completion of project
- Successful completion of portfolio
- Successful presentation of project to the class

Resources/Instructional Materials

DESIGN AND BUILD A RACE CAR TO TRANSPORT HARRY In this unit, students design bottle cap cars to transport the class pet Harry. The cars use the potential energy from being at the top of a hill to move. Students practice the engineering design process while building and testing the cars on the hill. At the end of the project, students measure the distance travelled by the cars. Students graph and analyze the data and try to ascertain what engineering practices resulted in the car that could travel the farthest distance. During testing, the students may not touch the car with their hands to make it move. The car must also safely hold the class pet, Harry.

SCIENCE BUDDIES BALLOON CAR. https://www.sciencebuddies.org/teacher-resources/lesson-plans/balloon-car. In this lesson, your students will follow the engineering design process. You will help them get started by showing them how to connect a balloon to a straw as shown in Figure 3, but then they will select their own materials to design and build the body, wheels, and axles of their cars. The engineering design process is an iterative process where students design, build, and test their cars. It is important for students to understand that there is no single "right answer" to an engineering project. There are multiple possible solutions to the problem, and it is OK if their cars do not work very well on the first try. Part of the process is redesigning, rebuilding, and retesting your container based on what you learn from your initial tests.

VIDEOS

- Sci Show Kids: Let's Get Rolling Wheel and Axle

MODEL AND DESIGN LANDFORMS AND CREATE EROSION CONTROL - MYSTERY SCIENCE. https://mysteryscience.com/water/erosion-earth-s-surface. This unit helps students develop the idea that water is a powerful force that reshapes the earth's surface. Students see that water isn't just something we drink. It carries sand to create beaches, carves out canyons and valleys and, as ice, scrapes entire areas flat. Students create models of various landforms. At the end of the unit, students engineer a way to stop a landslide.

- If you floated down a river where would you end up?
- Why is there sand at the beach?
- What's strong enough to make a canyon?
- How can you stop a landslide?

MODEL AND DESIGN A KITE THAT FLIES In this unit, students observe a kite and compare it to things that fly in nature. Students review the history of kites and learn that kite technology led to the invention of the airplane, the parachute, and the helicopter. Students learn about the physics of flight and about the importance of symmetry in design. Using recycled materials, students design and build kites. Students fly their kites on National Kite Day in June.

SCIENCE BUDDIES: LET'S GO FLY A KITE. https://www.sciencebuddies.org/science-fair-projects/project-ideas/Aero_p016/aerodynamics-hydrodynamics/fly-a-kite. In this aerodynamics science project you will make your own kite for testing how different variables affect flight. How does a kite fly, allowing Homan and the Wright brothers to accomplish their feats? As someone runs with a kite, the wind going head-on into the kite creates a force that pushes up on the kite. This force is called lift. This lift force goes perpendicular to the wind and it pushes the kite up into the air. At the same time, another force pulls the kite back. This force is called drag and is caused by the wind catching on the

kite itself, pushing the kite back in the direction that the wind is going. Altogether, these forces cause the kite to go back and up when you fly it.

SCIENCE FRIDAY: SUSAN'S DELTA KITE BUILDING INSTRUCTIONS.
https://www.sciencefriday.com/wp-content/uploads/2017/02/Susans-Delta-Kite-Building-Instructions.pdf.

VIDEOS

- Sci Show Kids Let's Make a Kite

WEB SITES

- Teachengineering
- EGFI
- Engineering is Elementary
- Science buddies
- Foss
- Smithsonian
- Design Squad PBS
- Discovery Education - Energy
- Mystery Science Curriculum
- South Carolina Science Curriculum
- Steve Spangler
- Science Bob
- Exploratorium Science Snacks
- Imagination Station Toledo.org
- http://globaldayofdesign.com/
- http://worlds-of-learning.com/
- Pbs learning media nj
- Siemens Lesson Plans
- Lesson Planet

Modifications

Individual accommodations

• Additional support

• Adapting lessons to meet various learning styles

Integration of 21st Century Skills

Focus on the development of 21st Century Content Skills:

- Global awareness
- Civic literacy
- Health and wellness awareness
- Environmental literacy

Focus on the Development of Learning and Thinking Skills:

- Critical Thinking and Problem Solving Skills
- Communication Skills
- Creativity and Innovation Skills
- Collaboration Skills
- Information and Media Literacy Skills
- Contextual Learning Skills

Focus on the Development of Life Skills:

- Leadership
- Ethics
- Accountability
- Adaptability
- Personal Productivity
- Personal Responsibility
- People Skills
- Self Direction
- Social Responsibility

Interdisciplinary Connections

- Academic and Technical Rigor - Projects are designed to address key learning standards identified by the school or district.

- Authenticity - Projects use a real world context (e.g., community problems) and address issues that matter to the students.
- Applied Learning - Projects engage students in solving problems calling for competencies expected in high-performance work organizations (e.g.,teamwork, problem-solving, communication, etc.).
- Active Exploration - Projects extend beyond the classroom by connecting to community explorations.
- Adult Connections - Projects connect students with the wider community.
- Assessment Practices - Projects involve students in regular, performance-based exhibitions and assessments of their work; evaluation criteria reflect personal, school, and real-world standards of performance.