KINDER STEAM – Unit 4 (ENGINEERING)

Content Area: **ENGINEERING (Grades kinder)**
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 physics) and effective engineering practices.

Skills

- Students will practice cutting, pasting, measuring, and folding skills. Several lessons will be completed. These might include designing things that fly, engineering structures, engineering playgrounds, engineering planters, engineering a sun shade, and copying how fossils are created in nature.
- 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.
    - Build a “working model” of the design.
    - Draw 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 physics) 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

Aerospace Engineering of Things that Fly. In this unit, students learn about things that fly. Students compare things that fly in nature to things that fly that are man-made. Students learn about the physics of flight. They practice fine and gross motor skills by folding, cutting, and pasting. Students engineer paper hoop gliders, paper airplanes, paper helicopters, and parachutes. The final challenge is to design a parachute to help the class pet, Harry, make a soft landing in Ocean City during the air show.

VIDEOS

- SciShow Kids Make a Paper Airplane
- Reggie Roo Things That Fly
- Reggie Roo Helicopters

SCIENCE BOB THE INCREDIBLE HOOP GLIDER. https://sciencebob.com/the-incredible-hoop-glider/. The hoop glider may look weird, but you will discover it flies surprisingly well. The two sizes of hoops help to keep the straw balanced as it flies. The big hoop creates “drag” (or air resistance) which helps keep the straw level while the smaller hoop in at the front keeps your super hooper from turning off course. Some have asked why the plane does not turn over since the hoops are heavier than the straw. Since objects of different weight generally fall at the same speed, the hoop will keep its “upright” position.

CURIOUS GEORGE PAPER AIRPLANES.
http://www-tc.pbs.org/parents/curiousgeorge/activities/pdf/Curious_George_Airplanes.pdf Students build and fly the classic paper airplane and the dart airplane. As engineers they compare how the planes fly and use their knowledge of forces to explain why one of the planes flies more efficiently.

DISCOVER PRIMARY SCIENCE PAPER HELICOPTERS.
http://www.primaryscience.ie/media/pdfs/col/paper_helicopters.pdf When we talk of flight we can mean a number of things. Some things actually fly while others glide or float. What do these do – aeroplanes and birds, gliders and flying foxes, balloons? Have pictures of things in flight so that children can compare and contrast. Discuss aeroplanes – how they have to keep moving in order to stay in the air. So how do helicopters stay still in the air? (The spin of the rotor blades keeps them up.) What do sycamore seeds do when they fall off the tree? Describe what happens. TRIGGER QUESTIONS What makes a good helicopter? Can you make some different helicopters and decide which one is best? What do we mean by best? Is it the one that spins the most? Or is it the one that takes longest to fall to the ground?

Agricultural Engineering of Greenhouses, Seeds, and Recycled Planters. In this unit, students learn about the basics of agricultural engineering. They discover what plants need to grow. They also think about what reusable containers can be used to start seeds.

VIDEOS

- Sci Show Kids Grow Your Own Plans
- Sci Show Kids How Does a Seed Become a Plant?
- Brainpop Jr. Plant Life Cycle
- Brainpo Jr. Parts of a Plant

SCOUTER LIFE WINDOW GREENHOUSE.
http://www.scouterlife.com/blog//2014/03/baggie-greenhouse-printable.html Design a plastic bag greenhouse for a bean seed. Hang in the window.

EDUCATION.COM SPROUTING SEEDS. https://www.education.com/lesson-plan/sprouting-seeds/ In this lesson, students plant seeds in recycled milk cartons, care for them, and document their growth. Students discuss

what plants need to grow. Then they provide these nutrients to the seed.

Civil Engineering of Playgrounds. In this unit, students learn about simple machines. They begin working in teams to design and build playground equipment for the class pet, Harry. While utilizing fine motor skills, students learn to cut, paste, and stabilize projects. Students learn construction techniques, such as materials choices and shape choices. Students understand that changing the shape of an item can make it stronger. Using recycled materials, students design perches, slides, bouncy seats, merry-go-rounds, swings, zip lines, etc. The equipment must mimic the motions of a life sized version while holding the class pet, Harry, safely.

VIDEOS

- Sci Show Kids Swings, Slides, and Science
- Sci Show Kids Super Simple Machines: Levers
- Sci Show Kids Super Simple Machines: Ramps
- Sci Show Kids Super Simple Machines: Wheel and Axle
- Sci Show Kids Super Simple Machines: Need a Lift? Use a Pulley
- Brainpop Jr. Simple Machines

LOYOLA UNIVERSITY CALIFORNIA/PLAYA VISTA ELEMENTARY SCHOOL. Building an Ideal Playground: An Engineering Project-Based Learning Unit. https://www.stemcalifornia.org/cms/lib/CA01929101/Centricity/Domain/35/Building%20an%20Ideal%20Playground-%20An%20Engineering%20Project-Based%20Learning%20Unit.pdf In this unit, students will learn how forces affect our daily lives and how we can create simple machines to make work and life easier if we know how to use the principles of force. Students will then explore the community by critically observing playgrounds to learn how engineers use force to create fun and safe playgrounds and playground equipment. Once students make these observations, they will work in groups of two to engineer models of several playground structures that highlights what they have learned about force. Then, they will design the ideal playground that is not only fun, but also, safe for all children.

Civil Engineering of a Sunshade for a Popsicle. In this unit, students learn about the sun and its effect on society. Students discuss how the sun affects living things on Earth both positively and negatively. Students talk about how humans protect their bodies and food from the damaging effects of the sun. Students are challenged to work in teams to design a sun shade for a popsicle. At the end of the project, students take their popsicles and sun shades outside to test them. Successful students eat their popsicles, unsuccessful engineers drink them.

VIDEOS

- Brainpop Jr. Sun
- Brainpop Sun Protection

BETTER LESSON.COM: A Place in the Shade-An Engineering Challenge. https://betterlesson.com/lesson/644795/a-place-in-the-shade-an-engineering-challenge. In this lesson, students will have the experience of developing and creating models. To begin this lesson, we start by discussing what it means to be shaded. I say to the students, When it is really hot outside, I like to find some shade. What does the "word" shade mean? That's right, it means to have the sun blocked. So, on a hot day, I am cooler if I am in the shade. What types of things might provide shade? The students come up with a list. I help them with prompts when needed. This is the list they come up with: trees, lotion, swimsuits, rash guards, hats with brims, umbrellas, buildings, canopies, umbrellas, tents, gazebos, thermos, and cooler. Students create structures whose function is to provide shade. You will have the task of protecting an ice cube (popsicles are more fun) that is out in the sun from melting.

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
- Better Lesson.com
- Loyola University STEM
- Boy Scouts of America
- Primary Science

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.