Every Drop Matters STEM Unit

Content Area: **STEM**
Course(s): **Generic Course, TAG Language Arts 3**
Time Period: **1 marking period**
Length: **Length of unit**
Status: **Published**

Unit Overview

Every Drop Matters engages young learners in hands-on inquiry and design as they explore one of the greatest challenges of the twenty-first century — universal access to clean water. This third grade ***Building Block*** in the ***TEEMS Integrative Curriculum for Elementary STEM*** integrates concepts of science, technology, engineering, and mathematics through the environmental context of water resource management and conservation. Science and mathematics concepts that are reinforced include properties of water, the water cycle, the interaction of water and earth, fractions, measurement of volume, and the use of data. By utilizing an experiential approach, students collaboratively investigate global water issues and learn that stewardship and innovation can make a difference in solving the world's problems. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they develop methods to conserve and reuse water at a pet wash. A *Grand Challenge for Engineering*, identified by the National Academy of Engineering —**Provide Access to Clean Water**— serves as a real-world inspiration for students to connect their learning with both the present and the future.

Transfer

1. Technology has benefits and consequences.
2. Engineering design is a creative process, which may result in new inventions and innovations.
3. A technological world requires that humans develop capabilities to solve technological challenges and improve products for the way we live.
4. Science uses different types of investigations to answer questions about the natural world.
5. Matter has observable and measurable properties.
6. The earth system is part of a larger system.
7. Science and engineering are interrelated, in which science is concerned with the natural world and engineering with the human-made world
8. Some questions can be answered by collecting, representing, and analyzing data.
9. Information to gain or expand knowledge can be acquired through a variety of sources.
10. Writing is a process that conveys and documents ideas, thoughts, and opinions.

Meaning

Understandings

Students will understand that...

-the difference between scientists and engineers.

-the steps of the scientific method and the engineering design process.

-global water issues.

-the interaction of water and earth.

-the interdependence of water and humans.

-think outside the box to solve problems.

Essential Questions

Students will keep considering...

-What thought provoking questions will foster inquiry, meaning making and transfer?

-Why do we need to reduce, reuse, and recycle water?

-Where does water come from?

-Is there a difference between how nature and humans clean water?

-What is an engineer?

Application of Knowledge and Skill

Students will know...

Students will know...

What facts and basic concepts should students know and be able to recall?

-steps of the water cycle

-how to build a water filter

-what a water shed is

-difference bewteen point and nonpoint source pollution

-how devices impact flow rate

-how water enviornments change over time

-global water issues

Students will be skilled at...

Students will be skilled at...

What discrete skills and processes should students be able to use?

-following the scientific method and engineering design process

-Working collaboratively

-oral presenations

-defend a position

-filter water

-use tools to complete tasks

-think outside the box

Academic Vocabulary

Accumulation – water from precipitation and runoff that settles back in lakes, rivers, etc.
Aeration – introducing air into a material

Aquifer –a large deposit of groundwater that can be extracted and used

Chemical property - a property or behavior of a substance when it undergoes a chemical change or reaction.

Coagulation – to change particles to a solid or semisolid state (chemical change)

Condensation –When a vapor or gas changes to a liquid

Data – facts and statistics (numbers) gathered for analysis

Design – a plan or drawing produced to show how something looks or works before it is built (blueprint)

Disinfection – to clean something to destroy bacteria

Fresh water – water that does not contain salt; situated inland

Filtration – the act or process of filtering something (removing particles)

Ground water – water held in underground soil or in pores and crevices in rock

Hypothesis – a proposed explanation make on limited evidence; educated guess

Infiltration – when a liquid permeates (soaks in or enters) something

Milliliter – one thousandth of a liter: used in measuring volume of a liquid

Nonpoint source pollution – a source of pollution that comes from widely distributed sources (anywhere)

Physical property - a change the arrangement of matter, but not the structure of its molecules

Pollutant – a substance that pollutes something, esp. water or air

Point source pollution – pollution that comes from a stationary source

Precipitation – Rain, snow, sleet or hail

Scientist - a person who investigates the natural world to learn

Sedimentation – the act of settling matter to the bottom of a liquid

Surface Water – water that collects on the surface of the ground

Volume – the amount of space a substance occupies in a container

Watershed – an area of land that drains into a river, lake bay or other body of water

Water treatment – the act of cleaning water so that it is clean enough to drink

Wetland - land consisting of marshes or swamps; saturated land.

Learning Goal 1

Design a solution to an engineering problem, and conduct a scientific investigation.

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
3-5-ETS1-3.ETS1.B.1	Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
3-5-ETS1-2.ETS1.B.2	At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
3-5-ETS1-3.ETS1.C.1	Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Target 1

Students identify and describe relationships between engineering and science.

Target 2

Students compare and contrast science, as a way of answering questions and explaining the natural world, and engineering, as a way of inventing tools and techniques to solve human problems.

Target 3

Students design, conduct, and/or describe the steps of an engineering challenge or experiement to test one variable.

Target 4

Students analyze data to form and defend a conclusion.

Learning Goal 2

Analyze ways engineers are involved with 3RC (reduce, reuse, recycle, conserve) in terms of water availability.

MA.3.NF.A.3	Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

MA.3.MD.A.2	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.
MA.3.MD.B.3	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs.
MA.3.G.A.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.
SCI.2-ESS2-1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
SCI.2-ESS2-3	Obtain information to identify where water is found on Earth and that it can be solid or liquid.
SCI.2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
SCI.2-PS1-3	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
SCI.2-PS1-1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
SCI.4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
SCI.5-ESS2-2	Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
SCI.5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.
SCI.5-PS1-3	Make observations and measurements to identify materials based on their properties.

Target 1

Students use fractions and equivalent parts of shapes to investigate how little fresh water there is available on Earth.

Target 2

Students compare and contrast the design challenge scenario, Pet Wash, to the real-world Grand Challenge of Engineering #5, Provide Access to Clean Water.

Target 3

Students describe how water environments change over time.

Target 4

Students conduct research and create postcards about the environmental health and human usage of rivers around the world.

Target 5

Students investigate and diagram the movement of water through the water cycle and the role of aquifers.

Target 6

Students research global water issues as they examine the inequality of water throughout the world.

Target 7

Students analyze drainage patterns by constructing a model of a watershed to learn about point and nonpiont source pollution.

Target 8

Students experiment with ways to physically and chemically "clean" water by constructing a water filter.

Target 9

Students experiment with methods and devices to measure and modify the flow of water to reduce usage, but maintain performance.

Target 10

Students write a narrative nonfiction story to show understanding of the water cycle and vocabulary.

Target 11

Students annotate text during a close read about inventor Dean Kamen and his water purification invention — the SlingShot.

Target 12

Students organize real-world data about water usage and create bar graphs to represent the information.

Target 13

Students design model of a boat that holds a certain weight.

Target 14

Students create a solution to the Pet Wash design challenge in order to conserve, reuse, or manage water.

Summative Assessment

Pet Wash Design Challenge

Unit Test

21st Century Life & Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.

CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Formative Assessment and Performance Opportunities

Think-Pair-Share

3-2-1 Reflection

Exit Ticket

Teacher Observation

STEM notebook

Quick-writes

graphic organizers

oral presentation

class participation

Differentiation/Enrichment

As this is a TAG class, rigor is already increased. Students have the opportunity to participate in:

invention convention

STEM night

self-directed research

WordMasters Competition

Poetry, art, and writing competitions

Unit Resources