BUILDING A SCHOOL GARDEN

Topic: got soil?
Grade Level: K-2
Time: 5 days

Standards: NGSS

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-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Standards: Georgia Science Standards

SKE2. Obtain, evaluate, and communicate information to describe the physical attributes of earth materials (soil, rocks, water, and air). a. Ask questions to identify and describe earth materials—soil, rocks, water, and air. b. Construct an argument supported by evidence for how rocks can be grouped by physical attributes (size, weight, texture, color). c. Use tools to observe and record physical attributes of soil such as texture and color.

S1L1. Obtain, evaluate, and communicate information about the basic needs of plants and animals. b. Ask questions to compare and contrast the basic needs of plants (air, water, light, and nutrients) and animals (air, water, food, and shelter). c. Design a solution to ensure that a plant or animal has all of its needs met.

S2E3. Obtain, evaluate, and communicate information about how weather, plants, animals, and humans cause changes to the environment. (Clarification statement: Changes should be easily observable and could be seen on school grounds or at home.) a. Ask questions to obtain information about major changes to the environment in your community. b. Construct an explanation of the causes and effects of a change to the environment in your community.

Standards: Common Core State Standards - ELA/LITERACY

CCSS.ELA-LITERACY.W.K.2: Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

CCSS.ELA-LITERACY.W.1.2: Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.

CCSS.ELA-LITERACY.W.2.2: Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.

RESEARCH TO BUILD AND PRESENT KNOWLEDGE:

- With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- Participate in shared research and writing projects

Standards: Common Core State Standards - MATH

CCSS.MATH.CONTENT.K.MD.A.2: Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.

CCSS.MATH.CONTENT.1.MD.C.4: Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

CCSS.MATH.CONTENT.2.MD.D.10: Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems1 using information presented in a bar graph.

BUILDING A SCHOOL GARDEN

Justification

In order to start and have a sustainable garden that will be a good source of food and a great learning environment, we need to start from the basics of gardening which is soil. Studying the soil can easily be extended across the STEM content areas. Study of soil itself comes under earth science, and then collecting data on the pH balance of the soil and then putting it in the graph format will come under math. Geographically how soil is different from one place to another, comes under social studies. In math, we can do a lesson on creating charts or graphs using the data obtained from the experiment and analyze it. During social studies, same data can be used to study soils in different part of the country and the economical influence of farming in areas such as these.

Lesson Objectives:

- Recall parts of a plant
- Explain what plants need to grow
- Identify the importance of soil for healthy plants
- Identify which soil is good for plant growth and how they differ from place to place
- Identify the importance of plants to humans and their growth and survival
- Identify fruit and vegetable plants that the students would like to grow in their school garden
- K: Investigate the make-up of the soil by mixing garden soil and water in glass jar
- K: Report on what type of soil exists in the school grounds and identify if it is good for healthy plant growth
- Grade 1: Design and conduct an experiment using vinegar and baking soda to test the soil's pH level
- Grade 1: Report on how soil's pH level affects the nutrients in the soil and it's effect on the plants growth
- Grade 2: Observe the existing plant life and investigate the type of soil in the school ground
- Grade 2: Report on the condition of the soil due to the existing plant life in the school ground

Important Note: This lesson is built upon the basis that the students in the above mentioned grade level are either covering Plants and Living Things unit or they have already covered it. Their knowledge from this unit will be used to structure the questions and answers about soil and importance of soil for the plants.

BUILDING A SCHOOL GARDEN

Engage The purpose for the ENGAGE stage is to pique student interest and get them personally involved in the lesson, while pre-assessing prior understanding.	**Day 1:** Introduce the school garden project idea to the students and now show them the following video: https://vimeo.com/91446626 Once the video finishes, ask the students what are the steps needed to start their own school garden. Answers should include: assess the proper space for the garden, which area gets the most sun, condition of the soil, nearest water supply, etc. Also have the students select which fruit and vegetable plants would they like to grow in their school garden. Record their answers to use later in the 'Explain' part of the lesson. Begin the lesson by showing the following video: https://vimeo.com/77792712 about the importance of soil. Engage the students in a Q&A session from their unit on plants and living things and the above video. What are the parts of a plant? How plants grow? What do plants need to grow? What is soil and why is it important? Where can we find soil? Is there only one type of soil?

BUILDING A SCHOOL GARDEN

Explore The purpose for the EXPLORE stage is to get students involved in the topic; providing them with a chance to build their own understanding.	**Day 2 - 3:** The students should sit in groups. In the center of the table of each group, place samples of sand, silt, clay, and loam (an equal mixture of sand and silt and little less of clay with good amount of organic material) in condiment containers. Have the students investigate the samples by feeling the samples using their fingers and using a magnifying glass. They should write their findings about each sample in their 'Soil Mineral Investigation Table' sheet under 'Without Water" column (Appendix 1). Once all groups are done writing down their investigations, provide them with a small cup of water and a plastic teaspoon. Have them put two teaspoons of water in each of the mineral sample. Now have the students write down their observations on what happened to each soil sample when they put water in it. They will again observe the texture using their fingers and a magnifying glass and write their observations in their 'Soil Mineral Investigation Table' sheet under 'With Water" column. Once all groups are done with their investigations, do a Q&A session on what the students learned about each soil mineral. Now that the students have learned about the make-up of the soil and what a good garden soil is suppose to contain, tell the students that they will be exploring outside to see if the soil in the school yard is good for starting a school garden or not. Before heading outside, each group would come up with a name for themselves. Give each group of students three small jars, a small shovel, a plastic spoon, three popsicle sticks and a sheet of paper with a template for the flag and jar label (Appendix 2). Have the groups fill out the label sheet for the flags and the jars and then cut them out using scissors. Using tape, put the square labels on each of the jars, and triangles on the popsicle sticks to make flags. Take the students outside in the school yard and have them collect soil samples from various parts of the school ground by digging in the ground 4 to 6 inches deep. Each group will fill each of their jars half full with soil sample and then stake their flags in the ground from where they collected their sample so afterwards they can identify exactly which part of the yard the soil came from. Each group of students will observe their school garden soil using a small sand sieve and a magnifying glass. Sieve the soil sample to separate the layers. What did they find in their soil samples? Explain the condition of the soil samples by identifying sand, silt, clay or any other material they may find in it. What is the color of their soil? Does it feel gritty or smooth? The students will write down all their observations in their respective grade level observation sheet. **K students:** Doing the experiment: Fill the soil sample jars with water and close it tight with a lid. Shake the soil mixture well and let it sit overnight so the layers divide up. Once layers have settled, observe each jar and record your data. Sand being the largest particle would settle first at the bottom. Then it will be silt and then clay and floating on the water surface should be the organic material such as leaves, grass, etc. Using a permanent marker, on each jar, mark each layer's end point. Then using a centimeter ruler side, measure each layer from it's starting point to it's end point for each sample jar. Record the answers in the 'Kindergarten Observation Sheet' (Appendix 3). Complete the observation worksheet.

BUILDING A SCHOOL GARDEN

Explore
The purpose for the EXPLORE stage is to get students involved in the topic; providing them with a chance to build their own understanding.
	Grade 1 students: Doing the experiment: pH level tells us which part of the school ground has soil that is rich in nutrients that will be good for plant growth. We need to know this because some plants need soil that is neutral to very slight alkaline such as spinach and some plants need soil that is more acidic such as blueberries.
	Test the garden soil's pH level with vinegar and baking soda:
	• Put 2 spoonful of soil sample into a separate plastic cup.
	• Add 1/2 cup of vinegar to the soil.
	• Observe carefully. If you see bubbles forming then you have more of an alkaline soil, with a pH between 6 and 8.
	• If it doesn't bubble after doing the vinegar test,
	  ◦ then add distilled water into the soil sample jar until 2 teaspoons of soil is muddy.
	  ◦ Add 1/2 cup of baking soda.
	  ◦ Observe carefully. If lots of bubbles form, you have acidic soil, most likely with a pH between 4 and 5.5.
	• If your soil doesn't react at all it is neutral with a pH of 7.
	• For accuracy, do the pH level test 3 times on each soil sample. After each test, record the data in the sheet provided. (Appendix: 4)
	
	Grade 2 students: Doing the experiment: It is time to get down and dirty! Ask the students to take a handful of soil from their first soil sample. Have them add water to it, bit by bit, till the soil takes a shape of a ball. Once it is shaped like a ball, using both their hands, have them roll it out in a shape of a worm. Then have them press the soil worm using their thumb and index finger. If the soil worm crumbles right away and doesn't take shape, then the soil has more sand. If the soil worm doesn't crumble and molds in a shape of a long ribbon, then the soil has more clay. If the soil worm doesn't crumble and forms a medium size ribbon before breaking, then the soil has a good balance of sand, silt and clay. Students will record their findings in the data table provided in Appendix: 5. Repeat this test for each soil sample collected and record the data. To have accuracy of the result, each soil sample will go through 3 ribbon tests.

Explain The purpose for the EXPLAIN stage is to provide students with an opportunity to communicate what they have learned so far and figure out what it means.	**Day 4:** After students have tested their soil samples and collected their data, they will present their finding to their class. Each group of students in each K-2 class, will report their findings about the type of soil that exists in the school ground. Give each group 6 sewing pins (3 with yellow label and 3 with green label). Labels will have their grade and group name printed on it. Using the yellow label sewing pins, groups will mark where they obtained their samples from on a colored printed map of the school ground (Apppendix: 7). Using pins with green labels, groups will also mark which area they think has the best soil for starting a school garden. They will explain their result using their knowledge about what makes a good soil and the data they collected.
Elaborate/Extend The purpose for the EXTEND stage is to allow students to use their new knowledge and continue to explore its implications.	**Day 5:** Looking at the data collected, each group of student in each class will decide if the area they have selected for the school garden will need to be corrected for optimal plant growth. **KG and Grade 2** will need to see if the soil type needs to be corrected to have a loamy soil and **Grade 1** will need to see if the soil pH level needs to be corrected to have a more neutral level. Using their respective data collected and looking at the school ground map that has marking from K-2 classes, students must now decide if the area they have chosen has good source of sunlight and water to be the best spot for starting a school garden. Have the students visit the school ground again and figure out which area gets the most sunlight throughout the day and has a water source near by.
Evaluate The purpose for the EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.	Each group will present their findings to their class. They will make a poster about why they think a school garden is important? They will give their feedback on which fruit/vegetable will grow best in our school using the Appendix 6 list based on their and their peers data collection.

BUILDING A SCHOOL GARDEN

TEAM NAME: _____ **STUDENT NAMES:** _____

Appendix 1: SOIL MINERAL INVESTIGATION TABLE		
	WITHOUT WATER	**WITH WATER**
SAND		
SILT		
CLAY		
LOAM		

BUILDING A SCHOOL GARDEN

Appendix 2: Paper triangle flags for soil sample collection

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

Group Name:

Grade:

Sample #:

BUILDING A SCHOOL GARDEN

TEAM NAME: _____ **STUDENT NAMES:** _____

Appendix 3: KINDERGARTEN OBSERVATION SHEET FOR THE SCHOOL GARDEN SOIL INVESTIGATION

Draw what you found in the soil. (Ex: Rocks, leaves, sand, silt, clay, worms, etc)

Soil and Water Mixture Experiment - Record the size of each layer (sand/silt/clay)

	SAND (measure height in mm)	**SILT** (measure height in mm)	**CLAY** (measure height in mm)
JAR SAMPLE #1			
JAR SAMPLE #2			
JAR SAMPLE #3			

RECALL: Good soil has **same amount of** sand and silt and **less of** clay

From your data table above, which sample has **more of** sand and silt and **less of** clay?

_____

BUILDING A SCHOOL GARDEN

TEAM NAME: _____ **STUDENT NAMES:** _____

Appendix 4: GRADE 1 SCHOOL'S GARGEN SOIL pH BALANCE INVESTIGATION SHEET

Draw & write what you found in the soil. (Ex: Rocks, leaves, sand, silt, clay, worms, etc)

Soil pH Level Experiment - Record the pH level of each soil sample.

	TEST 1 (acidic/neutral/alkaline)	**TEST 2** (acidic/neutral/alkaline)	**TEST 3** (acidic/neutral/alkaline)
JAR SAMPLE #1			
JAR SAMPLE #2			
JAR SAMPLE #3			

RECALL: Soil that is good for gardening should be rich in nutrients that will help it grow healthy. Soil with neutral pH is best in nutrients. Soil that is too acidic can be poisonous for the plants, while too alkaline soil won't have nutrients for plant growth.

Using your data table above, more of what type of soil does the school ground have, **acidic, neutral or alkaline?**

_____

BUILDING A SCHOOL GARDEN

TEAM NAME: _____ **STUDENT NAMES:** _____

Appendix 5: GRADE 2 SCHOOL'S GARGEN SOIL CONDITION INVESTIGATION SHEET

Record your observations below!

What did you find in the soil?	Why is the soil's condition like that?

Soil Ribbon Test Experiment - Record the observations below.

	TEST 1 (crumbly/medium ribbon/ long ribbon)	**TEST 2** (crumbly/medium ribbon/ long ribbon)	**TEST 3** (crumbly/medium ribbon/ long ribbon)
JAR SAMPLE #1			
JAR SAMPLE #2			
JAR SAMPLE #3			

RECALL: Soil that is good for gardening should have more of sand and silt and less of clay.

Using your data table above, what type of soil is found in the school ground? (crumbly = sandy soil / medium ribbon = good mixture of sand, silt and clay / long ribbon = clay soil

_____

BUILDING A SCHOOL GARDEN

Appendix: 6 - Fruits, veggies, and herbs list according to pH level (https://harvesttotable.com/vegetable-crop-soil-ph-tolerances/)

ACIDIC SOIL < 7.0			NEUTRAL SOIL = 7.0			ALKALINE SOIL > 7.0		
FRUITS	**VEGGIES**	**HERBS**	**FRUITS**	**VEGGIES**	**HERBS**	**FRUITS**	**VEGGIES**	**HERBS**
Blueberry	Potato	Parsley	Watermelon	Carrot	Parsley	Peanut	Cauliflower	
Blackberry	Sweet Potato	Basil	Peanut	Cauliflower	Chive	Cantaloupe	Corn	
Cranberry	Carrot	Chervil	Cantaloupe	Corn	Endive	Strawberry	Garlic	
Peanut	Cauliflower	Dill	Watermelon	Cucumber	Oregano		Tomato	
Raspberry	Corn	Chive	Strawberry	Garlic			Artichoke	
Apple	Cucumber	Cilantro		Pepper			Arugula	
Cantaloupe	Eggplant	Endive		Radish			Asparagus	
Watermelon	Garlic	Fennel		Squash			Bean	
Strawberry	Pepper	Oregano		Tomato			Beet	
	Pumpkin	Sage		Turnip			Cabbage	
	Radish			Artichoke			Kale	
	Squash			Arugula			Okra	
	Tomato			Asparagus			Pea	
	Turnip			Bean			Spinach	
	Artichoke			Beet				
	Arugula			Broccoli				
	Asparagus			Cabbage				
	Bean			Celery				
	Beet			Kale				
	Broccoli			Lettuce				
	Cabbage			Okra				
	Celery			Onion				
	Kale			Pea				
	Lettuce			Spinach				
	Okra							
	Onion							
	Pea							
	Spinach							

BUILDING A SCHOOL GARDEN

Appendix: 7 - Using sewing pins, each group of student will mark where they got their samples from and what they found.

BUILDING A SCHOOL GARDEN

Appendix 8: Material List

KINDERGARTEN	GRADE 1	GRADE 2
A small bag of sand (https://agclassroomstore.com/soil-sample-sand/)	A small bag of sand (https://agclassroomstore.com/soil-sample-sand/)	A small bag of sand (https://agclassroomstore.com/soil-sample-sand/)
A small bag of silt (https://agclassroomstore.com/soil-sample-silt-loam/)	A small bag of silt (https://agclassroomstore.com/soil-sample-silt-loam/)	A small bag of silt (https://agclassroomstore.com/soil-sample-silt-loam/)
A small bag of clay (https://agclassroomstore.com/soil-sample-clay/)	A small bag of clay (https://agclassroomstore.com/soil-sample-clay/)	A small bag of clay (https://agclassroomstore.com/soil-sample-clay/)
A small bag of garden soil (loam)	A small bag of garden soil (loam)	A small bag of garden soil (loam)
Large condiment containers	Large condiment containers	Large condiment containers
Magnifying glass	Magnifying glass	Magnifying glass
Small cup with water	Small cup with water	Small cup with water
Plastic teaspon	Plastic teaspon	Plastic teaspon
Small mason jars with lid	Small mason jars with lid	Small mason jars with lid
Popsicle sticks	Popsicle sticks	Popsicle sticks
Small shovel for digging	Small shovel for digging	Small shovel for digging
Scissors	Scissors	Scissors
Tape	Tape	Tape
Small sand sieve	Small sand sieve	Small sand sieve
Permanent marker for marking the jars	White vinegar	Sewing pins
Sewing pins	Baking soda	Yellow Post-it labels
Yellow Post-it labels	Small plastic cups	Green Post-it labels
Green Post-it labels	Sewing pins	Large color printed picture of school ground
Large color printed picture of school ground	Yellow Post-it labels	
	Green Post-it labels	
	Large color printed picture of school ground	