SCIENCE IN 3D APPROACH: UPSA LTER

Long Term STEAM project

Submitted by Rebecca Gibson

5th Grade

3D Phenomenon will first be presented to get the students thinking about the coast.

These pictures were taking on Cabretta Beach on Sapelo Island. What is your hypothesis of how this happened?

This location is also on Sapelo Island. This is a creek flowing up into the marsh area. What has happened to the trees that are close to the water? Any ideas?

Current Event: Detachment of a glacier the size of Delaware in July 2017.
http://www.cnn.com/2017/07/12/world/larsen-c-antarctica/index.html

(Students will have a group folder journal specifically for this project to record data.)

Week One Discussion/Research:

- What type of water is in the rivers? What type of water is in the lakes? What about the ocean? Where does this water come from?
- Do all plants survive in all waters? Do some plants need certain types of waters? Any ideas why?
- **RESEARCH**: Allow students to research plants that grow on/near fresh water, brackish water, and salt water. Record researched information in STEAM journal, to include types(names) of plants and where they grow.
- Create a T-Chart on the board. (students must copy in their journals)
    - Students will come back together and put names of plants on the T-Chart.
    - This mainly helps the students see that there are indeed different plants that grow in different types of water.

Week Two Discussion/Research:

- **QUESTION**: Teacher says: "Okay, now we know certain plants grow in certain areas, but, what if the plant is already grown, would it be able to survive if the water changed?" (Question)
    - **HYPOTHESIS**: "In your journal, write down what you think. What process in the scientific method is this?"

****EXPERIMENT** STARTS BY FIRST PLANNING, AND THEN SETTING UP THE EXPERIMENT

- We have our question, some research from day(week) one, and now our hypothesis. It is time to start the experiment. Teacher says, "We will create an experiment to help us research what would happen to an already growing plant if the water changed."
- GROUPS: The teacher will first create research groups. 4 or 5 groups depending on the number of students. The groups will allow students to work collaboratively; also it will help if a student or two is absent the partners can catch them up on the project." Teacher says: "Scientists, discuss in your groups what type of items we would need to get our project together.
    - After the students brainstorm, write the information on the board. As the teacher, use what they have and what you know is needed to write a materials list. Groups will also write the materials list into their journals.
    - Teacher says, "How can we go about getting these materials?" Listen to their ideas, there might be some good ones and go with it. (Otherwise, the teacher will of course get them all.)

MATERIALS LIST:

- Fresh water plants/seeds (Riverbank Habitat) (10 or so)—Have an extra one to use for experiments with standards.
- Containers to plant the plants in (10 or so)
- Enough of the same soil to fill all of the containers
- Measuring cups for water
- Measuring tools for salt

- Salt (Can be bought throughout the year as needed)
- Tools to measure height and width of plant (might even measure the leaves.
- Variable is the amount of salt added.
- Pallets to put the containers on outside
- Fencing/wiring to surround the pallets to keep out predators (Chicken Wire)
- Drill – to drill holes in containers to let the excess water out
- Popsicle sticks to label each pot (or some other type of labeling)
- Cutters for the fencing (to bend or cut if needed)
- Stakes to put in the ground to secure the fencing to (string or a hook to hook the fencing to the stakes, but that can be easily undone when fencing needs to be taken off.
- Wire ties for fencing?

**Students will discuss why we need to put the plants in different containers, and have them discuss why it might be important to put holes in the containers. (or do we even need holes?) **

Week Three Discussion/Research:

- All of the materials are at the school, now students will start **PLANNING** to set up the experiment.
- Groups should research and take notes on the type of plant used. (If time permits, show them the plant, and see if they can find out the name through research before giving them the name.)
- Groups will also research to find out how much sun this type of plant needs and how much water this plant needs. They should also find a fun fact about the plant to share with the class. (This will go in their folder journal.)
- SHARE
- Students should then go outside one in the morning, then once at the end of the day to help determine the best placement of the plants. (This way they can see where the sun is most of the day.)

Week Four Discussion/Research:

- Re-potting, watering, setting up the site, placing experiment in the field (school yard). The teacher should assign tasks for each group. (Remind them that even a single scientist does not do all the work; they have other people to help them.)
- DISCUSSION: If we are planning to have 1 control and 3 variables, why do we need 8 to 10 plants and containers?
- Once the site is set up, groups will record everything they did in the journal to include drawing an illustration of what the site looks like. (Labeling the containers will take place once the experiment has officially started.)

Weeks Five & Six EXPERIMENT/DATA COLLECTION:

- I WOULD LIKE TO WATER THE PLANTS WITH FRESH WATER FOR A COUPLE OF WEEKS FIRST, TO MAKE SURE THEY MADE IT THROUGH THE RE-POTTING PROCESS BEFORE EXPERIMENTING ON THE PLANTS.

- Each afternoon, during afterschool, students will go out and check on the plants and water them as needed. This is just for the first couple of weeks.
    - At least one person from each group will keep a record of data during these two weeks and report back.
- One class day, groups will discuss and write a CONSTRUCTED RESPONSE answering the following question. Why do you think Mrs. Gibson decided to water the plants with fresh water for a couple of weeks before starting the experiment? (Try to name at least 3 reasons why.) **SHARE**

Week Seven EXPERIMENT/DATA COLLECTION:

- After a couple of weeks, the plants (hopefully) should be doing okay. Now to start the experiment. Groups will write in their journals what the "CONTROL" factors are and what the "VARIABLE" is.
    - Groups may need to do a little bit of research on what a control is and what a variable is.
    - **CONTROL:** Type and amount of soil, type of plant, type and size of container, location (weather and sun might change, but these changes occur with all of the plants), amount of water/solution given. All of the plants will occasionally get lots of fresh rain water, but this is typical for any outside plant, to include plants along the fresh water river banks close to the brackish water river banks.
    - **VARIABLE**: Water/solution will be the only variable since our question is asking if a plant will survive if the plant starts getting a 'different type of water'. In this case, our 'different' water will include water with different levels/amounts of salinity.
    - SEAWATER is about 3.2% to 3.5% salt. A gallon has 128 ounces, so 3.2% of 128 is 4.096 or about 4 ounces. A cup has 8 ounces, so this means a gallon of water would need a half cup of salt (4 ounces) to simulate seawater. **(This could be used as a math lesson with multiplication and discussing the Kingdom of Gallon.)**
        - Control--- Tap water only (2 containers)
        - Variable A – 1/8 cup of salt to 1 gallon of water (brackish)
        - Variable B – 1/4 cup of salt to 1 gallon of water (brackish)
        - Variable C – 1/2 cup of salt to 1 gallon of water (seawater)

      ****Math lesson: 1/8 is half of ¼, and ¼ is half of ½**
    - Three groups will be selected to label each gallon of water correctly and add the correct amount of salt. Then all students will go outside (one person from each group needs to bring their journal.)
    - The group(s) that did not mix the water will take the fencing off and put it back on.
    - Each group will be assigned one or two containers that they will be responsible for. Before watering, students will measure the height of the plant. Students will also look for the largest leaf (if there is one) and measure its length. **Both customary and metric units will be included in their data sheets.** After measuring the lengths, groups will measure out the correct amount of water (determined based on the type of plant) and water their assigned containers.
- We can either sit by the plants, sit at the butterfly garden, or just stand around, but groups will now officially start their experimental data recording in their journals. Students/groups will share data for the containers they measured.

- (The teacher will have a data sheet already created and printed off for students so they know exactly what needs to be recorded each time. This data sheet will also include a space for students to write their general observations.)

Week Eight-→ Last Day EXPERIMENT/DATA COLLECTION:

- **DATA RECORDING**: Depending on the plant's water needs, groups will go out at least once a week, or more to water the plants with their specifically labeled gallon of water. Groups will record the date and time every time the plant is watered.
- At least twice a week, groups will observe the plants, measure the plants, and record the data on their data sheets. (This should be done in conjunction with going outside to water the plants.)
- DISSCUSSIONS: At least once a week, have a discussion about what is being observed and what the students are thinking about the experiment. Discuss the importance of keeping up with the data, and making sure to be consistent with the data. Discuss how this is similar to what is being asked for the science fair.
- Towards the end of the experiment, or at least around February, if it has not already been discussed, have students research and come up with an **ARGUMENT** answering the following question.
    - **"Why should we care about the effects of sea level rising if we do not live anywhere near the sea?"**
        - Here is a good video to watch in case some students are struggling with this argument. **https://www.youtube.com/watch?v=msnOHuPep9I**
- By the 12th week, have the students **graph the data taken**. (Example: Groups will complete a bar graph of the heights of the plants, and the lengths of the leaves for each container on poster paper to be hung up. Have students either add to the graph each week, or wait 4 more weeks and add the additional 4 weeks of data)
- Sometime in March or April (earlier if the plants do not last that long) have students **ANALYZE** the data. (The bar graph will be part of this analysis.) Then have the students start writing up their **CONCLUSIONS** of what happened during the experiment.

****After Georgia Milestones testing is over with, groups will work together to write an extended response to the following scenario:**

Over the past 20 years, scientists have been collecting data along the coast and have discovered that the sea level is indeed rising. Dr. Gibson, a scientist doing research along the coast, is predicting that the rising sea will eventually reach far enough up the rivers to reach the _____ plant. If the salty seawater reaches the _____ plant, what effects will this have on the plant and the surrounding areas, to include any houses that may be built near the river bank?

(Hopefully by this point, students will discuss erosion in their explanation.)

5TH GRADE SCIENCE, MATH, AND ELA INTEGRATION

Below is a listing of how I will use this project/experiment with other subjects. More ideas may be added after the experiment actually starts.

(Anything we integrate that is not specific for the research and data collection will go in the students' STEAM journal, math journal, or other journal. The only information that will go into the students' group folders is the information needed to complete the LTER project using the scientific method.)

SCIENCE STANDARDS

S5P1: Obtain, evaluate, and communicate information to explain the different between a physical and chemical change.

Students understand that the saltwater we mix and add is a physical change. We can also discuss, as the plant takes in the water, what happens to the salt? This shows that the mixture can be separated. (We could mix some salt water and leave it out in a clear cup so students can see the salt left behind after the water has evaporated.) When discussing the how the water evaporated, we can tie in the States of Matter.

S5P2: Obtain, evaluate, and communicate information to investigate electricity.

We can determine if our plant is a conductor or an insulator.

S5P3: Obtain, evaluate, and communicate information about magnetism and its relationship to electricity.

We can determine if our plant is magnetic or not.

S5L3: Obtain, evaluate, and communicate information to compare and contrast the parts of plants and animal cells.

Students can think about their plant to help them determine if all organisms have the same type of cells, and the same parts of the cells.

The teacher can attempt to take a sample of the plant leaf and let students look at it under the microscope.

S5L4: Obtain, evaluate, and communicate information about how microorganisms benefit or harm larger organisms.

Students can research to find out if there are any microorganisms that harm or benefit their plant.

S5L1: Obtain, evaluate, and communicate information to group organisms using scientific classification procedures.

Students can use their potted plants to discuss the plant kingdom and what is needed for all plants in the plant kingdom.

Students can use their potted plants to discuss if it is a seed producer or a non-seed producer. They can also include it in their model of plants. This allows them to have in depth experience with one type of plant.

S5L2: Obtain, evaluate, and communicate information showing that some characteristics of organisms are inherited and other characteristics are acquired.

Students can use their potted plant to discuss some characteristics of plants and discuss which of the characteristics are inherited and which are learned. Again, this allows them to have in depth experience with one type of plant.

Discuss: Do plants have instincts?

S5E1: Obtain, evaluate, and communicate information to identify surface features on the Earth caused by constructive and/or destructive processes.

By this point in the year, we can start making conclusions about our plants and the effect of the salt water. While students discuss constructive and destructive processes that cause erosion to beaches and river banks, we can discuss the idea of sea level rise and what additional effect this might have on the beaches, river banks up river, and different organisms. (Hopefully, students will be like, PLANTS are affected.)

The questions then might be asked, who/what else can be affected by the sea level rise if the plants are affected. Our discussion of deltas can help students understand that if the sea level is rising, then the salt water is getting further up into the rivers.

If the plants die, what happens to the soil in that area? What if someone lives close by, what can happen? What happens to the animals?

We can then research what scientists are putting in place to stop different destructive forces like this. Allow students to research what scientists are doing regarding sea level rise.

4-H Camp Overnight fieldtrip: This will help the students to actually see and experience many of the things they have researched.

READING, WRITING, AND LANGUAGE STANDARDS:

ELAGSE5W10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline specific tasks, purposes, and audiences.

Students will have several opportunities to write in a single sitting and will have one opportunities to write in an extended time frame. (Writing their arguments and their final conclusions.)

ELAGSE5W2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Writing their arguments and their final conclusions.

ELAGSE5L2: Demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing

Group members are to proof reread what has been written and check for correct conventions of Standard English.

ELAGSE5W6: With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others;

demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.

Students will type up their final arguments. Students will research several topics throughout this project. Students will collaborate with their group members every step of the way.

ELAGSE5W7: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic

This will not be a short project, but students will have several short research opportunities to build their knowledge of the topic.

ELAGSE5RI8: Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence supports which point(s).

To make it applicable to something they know, I could create a 'mock' resource discussing the plant experiment and students can determine if the reasons given are adequate. The students can determine what points are being made and what evidence is actually supporting those points. This does not have to be a long text.

ELAGSE5L5: Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

Students can make up figurative languages that go along with their plant experiment. (Maybe?)

ELAGSEW1: Write opinion pieces on topics or texts, supporting a point of view with reasons.

As this experiment goes on, students may start to form their own opinion about Global Warming, Sea Level Rises, and the possible future effects of these topics. Students can then write an opinion piece supporting a certain point of view.

Looking back at the original phenomenon pictures, students could write an initial opinion on what they think, then after months of research for this experiment, they can revisit their opinion piece and re-write it including any changes to their opinion and their reasons for the opinion.

ELAGSE5SL2: Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Students can summarize several things throughout this experiment. They can research the plant used and write a summary of the information found. Students can write a summary of the experiment at the end.

ELAGSE5SL3: Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence

In March, students could be required to write an extended response discussing what happened in their experiment and they can make a claim about how knowing this information will affect _____. The student, or group will give/read their speech/claim and the 'audience' will then summarize the points the speaker made.

MATH STANDARDS:

MGSE5.MD.1 Convert among different-sized standard measurement units (mass, weight, length, time, etc.) within a given measurement system (customary and metric).

Students will measure the height of their plant in both customary and metric units.

Students will use the Kingdom of Gallon to determine the number of ounces of salt to add to a gallon of water to simulate seawater.

MGSE5.NBT.7 Multiply decimals to the hundredths.

Students must use multiplication to find out how many ounces of salt need to be added to a gallon of water.
(3.2% x 128 ounces)

MGSE5.NF.1 Add and subtract fractions and mixed numbers with unlike denominators by finding a common denominator and equivalent fractions to produce like denominators. &&&&&&&&
MGSE5.NF.2 Solve word problems involving addition and subtraction of fractions, including cases of unlike denominators

Story problems could be made regarding the amount of water being added or the fraction of salt being added.

MGSE5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers

We can refer back to the amount of salt over time to determine the total amount used for the experiment up until that point. (Ex: We used ½ cup for each gallon of water and we used 6 gallons of water so far, so how much salt have we used?)

MGSE5.MD.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

We will have containers that are almost rectangular in shape, so the students can ESTIMATE the volume of what the whole container can hold, the volume of the soil in the container, and the difference of the two volume. –I could even have the students write a numerical expression to represent this information. **MGSE5.OA.2**

MGSE5. G.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plant, and interpret coordinate values of points in the context of the situation.

Students will graph the height of the plants. X-axis can be the dates we measured the plants, and the Y-axis can be the height in inches or centimeters. Students can then graph the control measurements, then graph one of the variable. If there is room on their graph, they can graph all of the variable and label or color code the lines to show the changes in the heights over time.