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(The following unit plan for Eighth Grade presents activities and worksheets based upon Kelly Sears's participation on a research cruise to New Zealand under the supervision of Dr. Clark Alexander, Skidaway Institute of Oceanography, Savannah GA.

Unit Title: Our Earth's Changing Surface

1. Big Idea:

Our Earth's surface is constantly changing over time.

2. Standards

The following NCSCOS standards will be accomplished upon completion of this unit:
1.09, 2.01, 5.01, 5.02, 5.03, 5.04

3. Key Understandings

- The Earth's surface can change over time.
- Geology is the study of how the Earth's surface changes over time.
- Researchers studying the processes that cause the Earth's surface to change are called geologists
- Some changes occur on the surface due to erosion, weathering and deposition.
- Some changes to the Earth's surface occur from tectonic plate movements along boundaries.
- Plate boundaries can cause mountains or subduction zones.
- Earthquakes and volcanoes are located along boundaries.
- Convection currents within the Earth's mantle move the Earth's tectonic plates.
- The Geological Timescale encompasses a very long period of time.

4. Focus Questions	5. Desired Results
What changes to the Earth's surface have you seen over time?	The student will describe short-term changes they have seen due to erosion and deposition. Use examples covered when studying NC coastal environment. Use the hill behind our school to mirror Dr. Alexander's fieldwork.
How do geologists study the Earth's surface?	The student will be able to describe sampling techniques used to create maps of the ocean floor and sampling techniques used to determine soil composition.
How have humans caused the Earth's surface to change?	The student will be able to describe how urbanization has caused deforestation and as a result has caused the land to erode and over time made it more susceptible to landslides.
How would you explain the way the Earth's tectonic plates move?	Convection currents within the mantle cause the tectonic plate movement.
What data was used to prove the theory of continental drift?	The student will describe that fossils record, climate change and the shape of the continents are used to support Wegner's theory of continental drift.
What explanation can you give for changes in sediment levels that Dr. Alexander is researching on New Zealand's continental shelf?	The student will describe how deforestation caused by European settlers has increased the sediments that are dumped out onto the continental shelf over time. They will also discuss how the shape/elevation of the ocean floor causes sediment deposition to be greater in some areas and not as great in others.
How would you generate a plan to stop erosion on the hill behind our school?	The student will describe how best management practices like water breaks and vegetation can be used to stop sediments from eroding from our hill into Jolly Branch Creek.

6. Lesson Outline and Blooms Taxonomy Sequence

Lesson	Description	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
1	Teacher on Board blog to communicate with students and other teachers while in New Zealand	Use the activity as way of opening the unit. Bringing a personal story home to my students					
2	What changes to the Earth's surface have you seen changed over time? Use photos of NC coast and our schoolyard to show the Earth's Surface changes over time.		Lead class discussion using the following questions: 1. Look at the picture of the beach now and before the hurricane. Describe what happened to cause this change? 2. What caused the erosion to occur? 3. Have you noticed similar changes to areas that you have visited each year?				
3	Dr. Alexander's S2S project. PPT of the Nov 2006 mission combined with class discussion.	Use the PPT to show students how oceanographers work in the field.	Why did Dr. Alexander get sediment samples using a mutlcore sampling devise and a piston core sampling devise?	How would you develop a system of sampling that would allow you to return to the same location? Why might it be important that you return to the same location?		How would you generate a plan to study sediment movement on the hill behind our school?	
4	Show video of the hill behind the school and our water quality-testing site after a heavy rain.	What surprised you about the video?	What did you think caused the water to flow in some areas and not in others?	How would you design an experiment to study this problem?			
5	Soil Sampling Lab	The students will use soil samplers to take core samples.		The using a dissecting scope and hand lenses the students look at core samples from the hill and observe compare and contrast soil samples from the top, middle and bottom of the hill.			
6	Outside class at Hill behind school and students made field notes and sketches	Identify signs of erosion on the hill?	How would you describe the erosion of the hill?	Think about how you would design an experiment that would prove to others that erosion is taking place.			
7	Students worked in small groups to design a procedure to study sediment eroding from hill.			How would you develop a experimental procedure to study sediment eroding from the hill?			

8	As an eighth grade we decide the procedures to study sediments eroding from the hill	Posted large sheets with each groups procedure and reviewed the different procedures as a class			Focusing questions for our class discussion. What procedure will best illustrate the process of erosion? Will our data really illustrate that erosion is occurring?	After reviewing individual group procedure we developed a revised class procedure to be presented to the eighth grade.	
9	Implemented 8th grade procedure	Review 8th grade procedure and collect data			What explanation can you give for our results?	How would you compile result for the Lowe's Grant?	What data would you use to determine that best management practices are necessary?
10	Write a Lowe's grant to stop erosion and to set up an outdoor classroom	The students will write a general project overview		The students will make a detailed budget of materials and services needed for the project		How would you compile result for the Lowe's Grant?	What data would you use to determine that best management practices are necessary?
11	The Amazing Earth	The students will take notes on the video that shows changes in the Earth's surface that have occurred over time.					
12	The students research changes in the Earth over time.	The students will complete a crossword of geology vocabulary	The students will use books and PPT to research the theory of continental drift.				
13	The students will used 3 big idea questions (we will be returning from winter break)	The students will sketch and describe the layers of the earth	The students will describe how has earth's surface changed over time?	The students will describe how is earth's surface continuing to change?	The students will describe what causes earthquakes and volcanoes? How does rock change over time?	.	

Unit Activities-- What I shared with my students from the research cruise.

The Blog:
Before I left for New Zealand I told my students about Dr. Alexander's S2S project. I outlined the research that Dr. Alexander was doing and asked my students to write down questions that they may have for Dr. Alexander. I wrote down the student questions and responded to them when I returned to the classroom. During the research cruise in November 2006, Smith Middle School Media specialist, Nancy Cowal, posted my e-mails and pictures to a blog, "Teacher on Board," to communicate with students and teachers. This allowed my students to feel part of my adventure. It was posted on our Smith Media Center website.
The following entries were posted while I was away.

Week # 1 I like to design inquiry-based lessons that lead my students through the process of scientific exploration. As a result, I share with my students a base of information and then I develop a project that allows the students to use their creativity and choose the direction the project will take. Recently, I shared my experience in New Zealand working with Dr. Alexander on the S2S project in the field. His project looked at sediment movement from the land to the continental shelf in New Zealand.

After seeing how oceanographers work in the field, I took my students to the hill behind our school and we discussed how sediments were moving down the hill into Jolly Branch Creek. We discussed as a class where sediments were eroding from and the signs of erosion on the hill. Then I facilitated a class discussion on how we could develop a experiment that would allow them to document that erosion that is taking place. In small groups, the students first came up with an experimental design that would show that erosion was taking place. During this time, I contacted Dr. Alexander and asked him how we could study the erosion of sediment behind our school. Each of the small groups shared in class and the entire eighth grade decided on an eighth grade experiment. *Interestingly enough, my students came up with a plan that was similar to Dr. Alexander (constructing sediment filters).* However, they expanded on his plan and took pictures of quadrates along a transect to study the percent composition of erosion causing conditions (no vegetation, clay soil, loose sediments) verses percent composition of sediment stabilizing conditions (rock, vegetation, and roots).

I loved their idea because it was using a random sampling technique that we had used for looking at coral cover earlier this year. During this lesson I worked as a coach giving the students creativity and freedom of choice while working through the scientific method. This takes a great deal of work and couldn't be accomplished without collaborating with colleagues like Melinda Fitzgerald and researchers like Dr. Alexander.

Week #2 During the second week, we worked on data analysis and grant writing. This was very difficult for the students, but the fact that they were collect data for a purpose really motivated them to do their best. The grant writing was only touched during this week. I could see that some students really had a vested interest while others wanted to return to more structure in the classroom. As a result Melinda and I decided to give students who wanted to continue with grant writing and the other students an opportunity to continue on with our geology unit. This worked out well and both groups worked very hard before the holidays.

Week #3 We will return in January 2007. I will do a review and use "United Streaming"--ETV to give some visuals that will help the students recall and remember geological terms. I will also be compiling the students' work and submitting the Lowe's proposal by the end of January.

Procedures, Evaluation and Worksheet Report forms

A. Procedures

1. Transects With Quadrates on Hill to Find % Exposed Clay, % Rock and %Vegetation

- Set up Transect on hill next to Jolly branch
- Place a quadrat .5 m by .5 m quadrat every 1m and alternate the sides of the transect that the quadrat is placed
- Take a picture of each quadrat along the transect
- Use random sampling method to determine % exposed clay, % rock and % vegetation
- Record data in table and graph data

2. Sediment Filters along Jolly Branch Creek

- Build 'fish friendly' sediment filters out of PVC piping and nylon
- Install filters every 1m along Jolly Branch Creek bed
- Collect and wiegh filters
- Record the mass of the sediment collected each day and also record whether it has rained in the last 24 hours.

3. Capture system with petri dishes

- Set up a transect on the hill next to Jolly Branch
- Place a petri dish every 1m and alternate the sides of the transect that the petri dish is placed
- Collect and weigh the sediment captured by the petri dish
- Record the mass of the sediment collected each day and also record whether it has rained in the last 24 hours

Please note that the purpose of this project is to record sediment movement (erosion) into Jolly Branch Creek. We need to make sure that our experiments don't affect this process. Therefore we need to pay special attention to our field work and not loosen or compact the sediment along the hill.

B. EVALUATION

Pop Quiz- Answer the following questions on a separate piece of paper

Part A: Your Understanding

For the last week, we have been studying the land surrounding Jolly Branch Creek, what is the purpose of our 8th grade project?

1. Why did we take pictures of quadrats on the hill beside Jolly Branch Creek?

2. Name the process that is causing sediments to move down the hill into Jolly Branch Creek.

3. What is causing the sediments to move down the hill into Jolly Branch Creek?

4. Why are we trying to get a Lowe's Grant by writing a proposal?

Part B. Personal Survey Questions:

1. How interested are you in pursuing the Lowe's Grant? (circle your answer)

Very interested Interested Not very interested Not interested at all

2. What questions/concerns do you have about this project?

C. Worksheet forms

1. Core Sample Lab Name: _____

The purpose of this lab is to learn how to use a soil sampler and how to use data from core samples to illustrate (show) sediment movement in our study area.

Core sample--sediment collected in the field to be studied by scientist.

Lab Stations	
Station #1 Core soil sampler - Push Soil sampler into dirt and remove. Briefly describe your core sample.(remember to include texture of soil, color and amount of water in the soil) Sketch the core sample:	
Station #2 Use tape to make a slide of core sample. Take a tape sample every 3 cm and describe each tape sample. Sketch each sample as viewed under a microscope.	Describe 1. 2. 3. Sketch slide

Station #3 Look at core sample A, B, C These cores were taken from the area we would like to study behind Seawell School. Describe and sketch each of the cores.	A. B. C.
Extension: Take tape samples of one core sample from station 3 and look at them under the microscope. What did you notice about your samples? Report out findings to whole class.	1 cm: 3 cm: 5 cm:
Station #4 Return to your seat and answer the following: Our goal is to write a proposal to set up a system of water brakes to improve the water quality of Jolly Branch and Bolin Creek. How can we use core samples to show changes in sedimentation loads? What would you expect to be the difference between core samples collected at the top of the hill and core samples collected at the bottom of the hill?	

Lab notes – The lab kept students engaged. The core samples may be difficult to get depending on the soil within your area you may have to modify the distances for station #2 and the extension. I would also modify the last question to focus on your school area.

2. Data collection sheet from spread sheet

Percent of Rock Preventing Erosion

Meters	Position 1	Position 2	Position 3	Position 4	Average
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!

Percent of Vegetation Preventing Erosion

Meters	Position 1	Position 2	Position 3	Position 4	Average
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!

Percent of Exposed Clay Confirming Erosion

Meters	Position 1	Position 2	Position 3	Position 4	Average
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!

Percent of Loose Sediment Confirming Deposition

Meters	Position 1	Position 2	Position 3	Position 4	Average
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!
					#DIV/0!

For more information about this Unit, please contact Kelly Sears at Smith Middle School, Chapel Hill, NC (email: ksears@chcc.k12.nc.us)