Eyes on Earth Lesson
Wendy Martinez
November, 2022

5E Integrated STEM Lesson Plan –

Lesson Title: Every Breath You Take - Thank a Prochlorococcus

Author: Wendy Martinez

Topic: To introduce the Biosphere, we will start with the importance of plant life in supplying our Earth with much needed oxygen. In addition, energy flow in organisms begins with the sun.

Humans' most basic needs are air, water, and food (starting with plants).

Our planet is 70% water. These lessons are taught after Hydrosphere.

We get 100% of our oxygen from plants, we get 50%-80% of that oxygen from plants in the ocean.

Targeted Grade Level: Grade 5

Time Needed: 5 days minimum, day 6 would be for peer editing of writing, and adjusting to new data retrieved post-culture growth. 70 minutes for each lesson. This will need to be scheduled so that

Subject Integration: Science, math, art, literacy and writing.

Justification: My justification around this series of lessons is to add more to the curriculum we already teach each spring with The Algae Academy. This will cause kids to have better understanding, and more buy in. Additionally, our students missed a lot during Covid and many are far behind. It is important to weave in reading in math every afternoon when we teach science and social studies.

Engage: phenomena, notes, read, write

Explore: game, math , write

Explain: review, read, draw

Elaborate: lab, math, discuss

Evaluate: discuss data, design, write

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Standards: 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. Secondary science goal **-** 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.

NGSS Performance Expectations 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K– 2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Support an argument with evidence, data, or a model. (5-LS1-1)	LS1.C: Organization for Matter and Energy Flow in Organisms Plants acquire their material for growth chiefly from air and water. (5-LS1-1)	Energy and Matter: Matter is transported into, out of, and within systems. (5-LS1-1)

Common Core State Standards:

Math:– *MP.4 Model with mathematics. (5-LS1-1)*

5.5.G.1 Graph points on the coordinate plane to solve real-world and mathematical problems.

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ELA: *ELA/Literacy* – *RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)*

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)

Other Standards

ELA - Writing: Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related.

Measurable Student Learning Objectives: E1 - Student will be able to explain how matter is transported into, out of, and within systems., RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1), CA-Writing: Use precise language and domain-specific vocabulary to inform about or explain the topic. Provide a concluding statement or section related. E2 RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. E3 (5-LS1-1) MP.5 Use appropriate tools strategically. (5-LS1-1), 5.5.G.1Graph points on the coordinate plane to solve real-world and mathematical problems. E4 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. Support an argument with evidence, data, or a model. (5-LS1-1).**Writing**: Use precise language and domain-specific vocabulary to inform about or explain the topic. Provide a concluding statement or section related.

Teacher materials necessity: Many lessons that make this series relevant are all via Algae Academy curriculum. It is important to sign up early for this curriculum to be arranged at a designated week during the school year. It is free, but needs to be arranged so that kids have access to the hands-on parts of this lesson.

Teacher Background: Teacher should already have taught lessons on opinion writing, discourse around phenomena, quoting from sources, photosynthesis and food webs. Teacher should read over all sources and watch all videos to preview lesson details. Teacher will need full understanding of the Algae Academy series of lessons so that they can

blend seamlessly with this content. The students will have already learned about water on Earth, but review is necessary because we are talking about plant life in water.

Engaging Context/Phenomena: *The engaging phenomena I will use is from NASA is Chlorophyll in the Ocean*.

Data Integration: Data in this project will include the most data on the days that aren't included here because they live within the Algae Academy lessons. On day 3 of Algae Academy lessons the student will set up algae cultures and then measure and track data across 5 days. During that time, students will use the data to understand and explain how algae grows

Differentiation of Instruction: Prior to this series of lessons, the groundwork will have been laid for strategic grouping in the classroom. Table groups are created using student levels, strengths, and areas of need. Partnerships within those groups are also set up carefully so that students can play off of each other's needs. Objectives are written on the board, slides are available to students at all times, and notes and scaffold are available to students who need more time. All of the work and assessment in this lesson will be completed in school and teacher, intervention and resource can support students in need.

Real-life Connection: The reason for this series of lessons is two-fold. One reason is that students will be taking part of the Algae Academy simultaneously during this series of lessons and need context as to how this set of experiences relates to algae globally - which is hard to grasp. They see it as seaweed that turns into sushi, and harmful algal blooms that make their dog sick. The Academy asks them to discover the benefits of algae in the 21st century for its uses. Another reason is that the misconceptions around photosynthesis learning in elementary school causes kids to most often miss all ocean plant life. See below for details.

Possible Misconceptions: When we learn about all energy beginning with the sun, and then photosynthesis, students see a very small footprint. The lessons in ecosystems, food chains and even Earth's systems usually show a photosynthesis model involving a land plant or tree. This creates the misconception that all oxygen is created on land. They look at plants that grow their food, and their front lawn. This will expand their view of what actually is credited in making oxygen for our planet.

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Lesson Procedure: Each lesson will have a different flow in order to incorporate science, and at least reading or writing.

5E Model	5E Objectives
Engage NASA Chlorophyll maps, video and discussion. Student exploration of lake food web model. **Day 1**	**Procedure:** *Phenomenon*: Students will observe a satellite video that tracks the amount of chlorophyll on earth across a 20 year period. I will display the Earth Observatory via the student file and ask students to jot down any observations while I plan the video a few times. Next I will have them turn to a partner and use the think-pair-share model to discuss what might be happening in the video. Once pairs have discussed, we will discuss as a class. *Teacher led discussion*: ● What did your pair agree was being modeled in this video? ● What were you unsure of? ● What did you wonder, but remains unclear? ● What else did you notice about the video? ● Is there anything here that is familiar to things you have already learned this year? Students will have noticed the word chlorophyll in the video, and will likely make some use of this term in their discourse. None of the theories here will necessarily be confirmed, just considered as a group. *Notes*: Students will use scientific notebooks to write down some key vocabulary from the student file, it will be key that they know what chlorophyll and phytoplankton is, and key to review photosynthesis before moving on. *Clarify*: Watch Ted Ed and discuss the difference between phytoplankton and plankton.

	Read: Distribute article: How acid rain affects a food web and read/annotate together as a class. *Activity:* Students will view the diagram of a lake ecosystem which includes phytoplankton. As an assessment, they will have to write/draw an exit ticket to explain how/if acid rain could cause a problem in the food web here. They will be required to use the word phytoplankton in their description. **Modifications** Students will start lesson with thoughts on their own and then be asked to discuss as a pair. Students are paired carefully making sure to have practiced the think-pair-share strategy before the lesson. Students have practiced discourse around phenomenon, and understand they are encouraged to take risks in this - no "wrong" answers environment. Vocabulary is scaffolded, and handouts are available for kids who need more time with note-taking. **Standards Addressed** (5-LS1-1) Matter is transported into, out of, and within systems., RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1), CA-Writing: Use precise language and domain-specific vocabulary to inform about or explain the topic. Provide a concluding statement or section related. **Formative/Summative Assessments** Teacher will listen to student discussion and check for understanding. Teacher will use exit ticket to see if students understand the importance of phytoplankton in any ecosystem. **Resources** Chlorophyll distribution, Ted Ed video, and copies of acid rain article, copies of exit ticket day 1, see resources below.
Explore Game - Earth's Water. Adapted from JPL Ocean World: Earth Globe Toss Game **read through lesson for teacher background**	**Procedure:** *Introduction:* A few images of Earth will be displayed and the discourse will surround observations and identification of what we know. The first image Students will be asked to just think about the quote and the image for a minute ● What do the colors mean here? ● What was the perspective of the photographer? Who might this be? ● Can you name anything specific?

Day - 2	• Specifically: What are the “swirling veils of white”? *Cloud cover.* What is the “thick sea of black mystery”? *Space appears black because it cannot reflect any light from the Sun.* Why can’t we see the lower half of Earth? *It is the nighttime side of Earth.* **The blue marble - no clouds** *Game:* Show students the inflatable globe. Explain that they will be tossing and catching the globe, recording where their right thumb lands (on water, on land, or for advanced students on a particular ocean or continent) to get an idea of how much of Earth is covered by water. Appoint a data recorder and have that student stand near the tally chart with a marker, ready to tally the data. Draw this chart to track data on the whiteboard or chart paper. 1. Students will predict whether the final tally of the game will have more points for land or water. Students stand by their desks or in a circle around the room. Toss the globe to one student. Have the student report where their right thumb lands. The data recorder should tally this on the appropriate chart. 2. The student holding the globe gently toss it to another region of the room. Whoever catches the globe will report where their right thumb lands and the data recorder will add it to the tally. 3. Students keep tossing the globe and adding to the tally until a sizable sample (at least 50 data points for land vs. water, or more for specific oceans and continents) has been obtained. 4. Count up the number of data points for land and the number for water and compare as a group. Have older students compute percentages if capable. 5. Ask students - what the results indicate about the amount of land and water on Earth. Students should come up with an estimate of about 70% water to 30% land. 6. Discuss whether their predictions were accurate. If there is time for extension, see fraction modification below. If there isn’t time now, add this activity in the next day/period. *Assess:* Students will complete the Earth, Water, Planet worksheet

	Modifications Extension - ask students if they can think about these percentages as a fraction, can they convert that fraction to represent our classmates as air and water. For every 10 students in our room, 7 would be water and 3 would be land. RSP and intervention students will have the opportunity to finish the Earth, Water, Planet worksheet in small groups. **Standards Addressed** *MP.5 Use appropriate tools strategically. (5-LS1-1),* 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. **Formative/Summative Assessments** Teacher will grade and return Earth, Water, Planet worksheet **Resources** chart to track data , inflatable globe, Earth, Water, Planet worksheet
Explain Where does our oxygen come from? Bumper sticker art. **Day 3 - And day 1 of Algae Academy** **Check on timing of kit arrival**	**Procedure:** *Introduction:* Teacher will begin with a discussion reviewing photosynthesis using a diagram on page 10 in the Student File • The left hand side of the model shows the necessary input for photosynthesis. What do you see? *students see sunlight, carbon dioxide and water. Some may say soil (misconception alert).* • The right hand side of the model shows the output in photosynthesis, what are the products of the cycle? *students see oxygen, and sugars or glucose to feed the plant.* • Why do we think the author of this diagram didn't label the soil? Is this an error? • Is it possible to grow a sunflower without soil? • Can you think of any other plants that can survive without soil? Teacher shows slide 9 in student file with different plants growing without soil. Students discuss what they see, and then back to the photosynthesis model. *Teacher led discussion:* Review - we've discussed in previous lessons that all energy and our survival begins with the sun. We understand that the photosynthesis cycle allows plants to make or produce their own food, which is why we call them producers. Based on our experiences in the school garden, we have no question that plants require water, but today we find that all plants don't

	necessarily require soil. We also learned that the respiration part of the cycle breathes in carbon dioxide, and exhales oxygen for our planet. Today we are going to investigate where our oxygen comes from. ● First I have a question: If only 30 percent of our earth is land, are the plants on land enough to make oxygen for our entire planet? ● Talk as a table group about the oxygen on earth, and come up with a percentage of oxygen produced on land and in water. Use two post it notes labeled land and water with a percentage on each once your group has come to a consensus. *Share Out:* Teacher will then field answers around the room and estimates will stay at table groups. *Read*: Students will access the student file and find links for reading on page 10. NOAA How much oxygen comes from the ocean? There are extensions in this slide for early finishers. *Class Discussion*: What did you find about the amount of oxygen produced by our ocean? Was that a surprise? Can you explain the Chlorophyll distribution video from day 1 a little bit better now? *Activity*: Phytoplankton bumper sticker - students have just learned the importance of phytoplankton and algae in our survival. Each student will make a bumper sticker creatively depicting the importance of these oxygen factories. I will use the student file to show examples of: first - what is a bumper sticker, and next - how might a person create a motto that might get others attention on the road. The objective is to creatively show others the importance of phytoplankton. **Modifications** Student groups have been chosen carefully to have a range of levels and gifts. Students are allowed to collaborate and use resources for the project. Extra time given when needed. **Standards Addressed** *RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)*

	Formative/Summative Assessments Teacher will check in to informally assess student understanding during classroom discussion and peer discourse. The bumper sticker assignment will be graded on the scale included on the assignment slide. **Resources** The Student file is necessary for slides and links, students will need a 11" x 4.5" piece of construction paper and markers or colored pencils in order to complete the art project.
Elaborate How does algae grow? Experiment - students build and measure algae cultures **Day 4 - and day 2 of Algae Academy**	**Procedure:** Follow the Algae Academy instructions on procedures for day 2: *Overview:* "Today students (working in groups of 5) will set up their algae cultures. There are several video resources included to provide as much direction as possible for students. Following the instructions on Worksheet 1, each group will add specific measurements of algae/media to their flask. After making their culture, students will take measurements to determine the starting biomass. Each student will take their own reading using the Secchi Stick. After determining starting biomass, place flasks in a well-lit, room temperature area. Make sure they do not get direct sunlight or get too hot/cold. Students will revisit their cultures on Day 4." Algae Academy - All resources and materials for today come directly from the Algae Academy that is shipped to our classroom in the Spring. The only adjustment made here is about group size, which will be slightly different in each class. This lesson plan was created so that students have a much better understanding of how important water-borne plant life is to human survival. **Modifications** Teamwork will make the dreamwork here and each group will need to support all members to get this culture carefully prepared. Strategic grouping is key, and students will have roles already prescribed based on classroom management norms. The math here is specific and tricky, lots of checking in by teacher and probably expert helpers (high math kids). **Standards Addressed** *MP.5 Use appropriate tools strategically. (5-LS1-1), 5.5.G.1Graph points on the coordinate plane to solve real-world and mathematical problems.* **Formative/Summative Assessments** Students will be taught to measure out, mix and then measure again algae biomass to create their own culture to grow algae. I will formatively assess

	each group as they share out biomass measurement results for the class chart - see slide 13 of the Student File. **Resources -** Algae Academy kit resources. Print Day 2 Student Worksheets, Print Biomass Estimators (1/group), Watch Day 2 videos while reviewing worksheets: "Setting Up your Algae Culture" and "Prep (How to use a Secchi Stick and Biomass Estimator)", Prep Materials listed on Day 2-Worksheet 1 (1 of each/group of 4), reference Kit Key, make sure Student file is open and ready to take data points on page 13.
Day 3, 4, and 5, of Algae Academy will have to take place before this lesson **Evaluate** We now know how algae grows, and how fast. We know how important phytoplankton and algae is, time to explain **Final day**	**Procedure:** *Teacher led discussion*: Discuss as we review the student file and lessons in preparation for assessment. ● We will start by looking back at the phenomena from day 1 Earth Observatory and describing what we see using academic language. The teacher will write a vocabulary bank on the whiteboard and leave up for the duration of the day. ● We will review what we know about a problem in the food chain, and how pollution in air or water has far reaching effects. ● Next we will review the photosynthesis model and point out the necessary inputs (excluding soil) and students will reveal (with prompting) that plants get the materials they need for growth chiefly from air and water. ● We will review that we learned between 50%-80% of our oxygen comes from phytoplankton in Earth's water. ● We will review the Algae Academy and how algae grows (air and water). Students completed an assessment piece around how they could save the planet by designing an algae business. *Assessment:* Teacher will show students through the Google form they will be completing as an assessment. Questions will be fielded and students will be encouraged to take as much time as needed, and to use any and all resources we have used during this series of lessons. Students are reminded to use PQA - Put words from the Question in your Answer, and to make sure to give a source name if they paraphrase from any source.

	Students will be assigned This assessment created using our classroom objectives and the NASA mini lesson maps questions. **Modifications** Intervention and RSP students will work on this in small groups. All resources are available, students are able to voice to text, and use, grammar and spelling assistance within the Google suite. **Standards Addressed** No new content standards addressed here, students will be able to explain that plants get the materials they need for growth from air and water. They also will be able to explain what harm may come by introducing pollution to air or water. **Summative Assessments** 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. Support an argument with evidence, data, or a model. (5-LS1-1).**Writing**: Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Provide a concluding statement or section related. Math- MP.2 Reason abstractly and quantitatively. (5-LS1-1). **Resources** Earth Observatory video, the Student File and the The Adapted Analysis assessment adapted from a NASA lesson.