Lesson Planning Guide

Develop Lesson Plans for Instruction

Steps in developing NGSS-/standards-aligned, phenomenon-based lessons that are guided by the 5Es instructional model:

1. Complete the Lesson Plan Overview (Part A) to guide development of lesson plans.
2. Use the Lesson Plan Template (Part B) to create detailed lesson plans.

Lesson Overview Template (Part A)

Florida Sunshine State Standards

(SC.7.E.6.2) Describe the process of the rock cycle in terms of the different rock types: igneous, sedimentary and metamorphic.
(SC.7.E.6.2) Identify patterns within the rock cycle and relate them to surface events including: weathering, erosion and deposition.
(SC.7.E.6.6) Assess the ways in which human actions may impact on native populations.
(HE.7.C.1.3) Analyze how environmental factors affect personal health such as air and water quality.
(SC.7.N.1.1) Explain proper and safe behaviors for a science lab. Identify a testable scientific problem from the seventh-grade curriculum. Identify appropriate reference materials to support scientific understanding of the testable scientific problem. Describe the key parts investigations of various types, such as systematic observations or experiments.

These materials were developed by CIRES Education & Outreach at the University of Colorado Boulder.

1.b Identify a lesson-based anchoring phenomenon that builds towards understanding of the PEs/standards, and is engaging and relevant to students.
See more about phenomena and using phenomena with NGSS.

Students will investigate the causes and effects of plastic microparticles in the environment, particularly the sands bordering the Atlantic coastline and the Indian River Lagoon, local to the Treasure Coast of Florida.

1.c Ask a Driving Question, which is authentic and student-focused, that relates to investigating the PEs/standards and phenomenon.
See more about Driving Questions and using Driving Questions with NGSS.

Students will answer "Is there microplastic in my local marine environment as evidenced by sampling of beach and shore sands."

1.d Unpack the 3-D learning components of the Performance Expectations/standards in the table below.
For NGSS guidance, see the NGSS Topic Arrangements and NGSS DCI Arrangements. Use tools to unpack each PE separately.

Science and Engineering Practices (SEP) (skills)	**Disciplinary Core Ideas (DCI) (content)**	**Crosscutting Concepts (CCC) (connections)**
1. Students will collect sand samples from various locations, labeling each sample with GPS coordinates photographs. 2. Students will Research microplastics to discover its origins, decay processes and effects. 3. Students will be able to use a dissecting microscope and accompanying equipment to identify microplastics	1. Student will understand the processes for sedimentary rock (SC.7.E.6.2) 2. Students will be able to identify the processes of weathering, erosion and deposition (SC.7.E.6.2). 3. Students will discover how pollutants affect local populations (HE.7.C.1.3) 4. Students will determine how and where humans are affecting the local environment and brainstorm solutions	MAFS.7.SP.1.1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

1.e Determine students' prior knowledge about the lesson concepts. (e.g., pre-test, class discussion, exit ticket, 1-minute report, KWL chart, survey, etc.)
Review weathering, erosion and deposition using a classroom game, Jeopardy to determine students' level of knowledge. Reteach if necessary. Lesson: Pollution in our environment as given in textbook. Lab: Review proper use of a microscope Lab: Teach and practice smartphone GPS use
1.f Identify Lesson Topics and Learning Goals: List main lesson concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.
1. Weathering, erosion and deposition (answers where did our sand come from) 2. What minerals make up your Florida Sand Sample? Student will identify 5 basic minerals in Florida sand. 3. Students be able to use a smartphone GPS 4. Students will determine human impacts on pollution 5. Students will identify effected floral and faunal populations impacted by microplastics
1.g Select Lesson Resources: Identify resources to develop lessons that address the PEs/standards and investigate the anchoring phenomenon through a variety of sequenced activities; revise as needed (include title and URL).
The Science of Sand https://www.scienceofsand.info/sand/sandintro.htm Guide to Identifying Microplastics: https://www.ccb.se/documents/Postkod2017/Mtg050317/Guide%20to%20Microplastic%20Identification_MERI.pdf Society for Mining, Metallurgy and Exploration, Florida Edition mineral sample kit McGraw Hill Florida Course 2 textbook: https://connected.mcgraw-hill.com/connected/dashboard.do Microscopes and How to Use a Light Microscope video: https://www.youtube.com/watch?v=tVcEEw6qbBQ

Lesson Plan Template (Part B)

Grade and Subject	Grade 7 Comprehensive Science	**Instructional Time** (min.)	47 minute period, 5 days
Lesson Title (Topic)	Are there Microplastics in our sand?		
Anchoring Phenomenon (copy from 1.b)	Students will investigate the causes and effects of plastic microparticles in the environment, particularly the sands bordering the Atlantic coastline and the Indian River Lagoon, local to the Treasure Coast of Florida.		
Driving Question (copy from 1.c)	Students will answer "Is there microplastic in my local marine environment as evidenced by sampling of beach and shore sands."		

Lesson Overview

Lesson Summary (description)	**Lesson Topics and Student Learning Goals** (copy from 1.f)
This lesson will be a long-term project spanning the third quarter and comprise percentage of a student's grade. Student will have learned the earlier earth science curriculum and will be learning the environmental curriculum. The microplastics project will tie together both semesters of school by bringing together earth science and environmental awareness. We will review the earth science lessons of weathering, erosion and deposition along with sedimentary rock. During this time the environmental awareness lessons will be taught. Students will begin the project by researching microplastics and its effects on environment. Students will be given practice with microscopes. Students will be given a short course on GPS use.	1. Weathering, erosion and deposition (answers where did our sand come from) 2. What minerals make up your Florida Sand Sample? Student will identify 5 basic minerals in Florida sand. 3. Students be able to use a smartphone GPS 4. Students will determine human impacts on pollution 5. Students will identify effected floral and faunal populations impacted by microplastics

Students will then begin their field research, choose and collect their samples and begin their analysis. Students will determine the basic mineral content and their ratios. Students will then filter the material and search for microplastic. Students will determine the ratio of source material and amount of plastic. Students will prepare a lab report detailing their findings Using those findings, students will attempt to determine microplastics' effects on the local environment. They may interview local fishermen to determine if microplastics are found the food chain, and why or why not microplastics are present in their catch will create a final report tying together their research and communicating their conclusions.	

Lesson Resources Aligned with Standards	
Lesson Resource (copy from 1.g, sequenced with titles and links)	**Resource Standards Alignment** (copy from 1.d, standards notated, link optional)
Science of Sand www.scienceofsand.info/sand/sandintro.htm	Student will understand the processes for sedimentary rock (SC.7.E.6.2)
Guide to Identifying Microplastics: www.ccb.se/documents/Postkod2017/Mtg050317/Guide%20to%20Microplastic%20Identification_MERI.pdf	(SC7.N.1.1) Explain proper and safe behaviors for a science lab. Identify scientific problem from the seventh-grade curriculum. Identify appropriate reference materials to support scientific understanding of the testable problem. Describe the key parts of scientific investigations of various as systematic observations or experiments.
Society for Mining, Metallurgy and Exploration, Florida Edition mineral kit	Students will be able to identify the processes of weathering, erosion an Deposition (SC.7.N.1.1).
McGraw Hill Florida Course 2 Science textbook: connected.mcgrawHill.com/connected/dashboard.do	Students will determine how and where humans are affecting the local environment and brainstorm solutions Students will discover how pollutants affect local populations (HE.7.C.1.3)

McGraw Hill Florida Course 2 Math textbook: https://connected.mcgrawhill.com/connected/dashboard.do	MAFS.7.SP.1.1. Understand that statistics can be used to gain information population by examining a sample of the population; generalizations about population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative and support valid inferences.
Microscopes and How to Use a Light Microscope video: www.youtube.com/watch?v=tVcEEw6qbBQ	(SC7.N.1.1) Explain proper and safe behaviors for a science lab. Identify a scientific problem from the seventh-grade curriculum. Identify appropriate materials to support scientific understanding of the testable scientific problem. Describe the key parts of scientific investigations of various types, such as observations or experiments.

Teacher Preparation

Student Misconceptions (potential student ideas that are problematic when engaging in the lesson)	**Scientific Terminology** (vocabulary named once students "figure out" concepts of lesson)
Students mistaking a microscope for a telescope Students not realizing sand is sedimentary Student believes plastic decays quickly	Microplastic GPS Sedimentary rock Environment Mineral Population Renewable resources

Materials Preparation

Student Needs (activity sheets, data packet, etc.)	**Group Needs** (lab equipment, group data packets, etc.)	**Safety & Technology Needs** (unsafe materials, websites cued, etc.)
Sand sample(s) Smartphone notebook	Microscope Filtration Research resources Mineral sample sets	Safety equipment PowerPoints, websites available Research Resources

Supporting Information

References (links to cite sources of data, images, websites, etc.)	**Background Reading** (for teachers and/or students)
Geographic map of area **Data Manager** **Microplastics Identification** **www.ccb.se/documents/Postkod2017/Mtg050317/Guide%20to%20Microplastic%20Identification_MERI.pdf**	**Textbook: earth science/environment** **Article: Tiny Plastic, Big Problem :** **https://www.sciencenewsforstudents.org/article/tiny-plastic problem**

Complete the 5E Instructional Model section(s) that are relevant to the lesson:

Engage: *Interest in a concept is generated and students' current understanding is assessed.*

ACTIVATE interest: Introduce anchoring phenomenon and driving question.

- Engages students in the concepts through a short activity or relevant discussion
- Connects students' past and present experiences
- Creates interest and generates curiosity
- Uncovers students' current knowledge and misconceptions
- Initiates students' investigation into the anchoring phenomenon based on an observation, problem, or question

Phenomenon-based Driving Questions (questions students are likely to ask about the lesson topic)

Are there microplastics in our sand and water?
Are local animals eating it?
What does microplastic looks like?
How do students tell it apart from sand?

Lesson Activities (experiment, demonstration, video, visualization, reading, etc., coherently sequenced to help build understanding of PE/standard)
For each activity, provide details of the procedure including timing, teacher guidance, student prompts, strategies for discussions and differentiation, etc.

Teachers and students will review earth science lessons of weathering, erosion and deposition along with sedimentary rock. During this time the environmental awareness lessons will begin. The project will start by researching microplastics and its effects on the environment. Students will be given practice with microscopes. Students will be given course on GPS use.
Students will then begin their field research, choose and collect their samples and begin their analysis.
Students will determine the basic mineral content and their ratios. Students will then filter the material and search for microplastic. Students will identify the material and amount of plastic in the sample as a ratio with the sand.
Students will prepare a lab report detailing their findings.
Students will use those findings, students will attempt to determine microplastic effects on the local environment and

may interview local fishermen to determine if microplastics are entering the food chain, and why or why not microplastics are present in their samples. Students will create a final report tying together their research and communicating their conclusions. This lesson will be a long-term project spanning the third quarter and comprise a large percentage of a student's grade. Student will have learned the earth science curriculum and will be learning the environmental curriculum. The microplastics project will tie together both semesters of school by bringing together earth science and environmental awareness.
Formative Assessment (activity sheet, Venn diagram, summary, exit ticket, think-pair-share, etc. to check for understanding of lesson concepts)
Students will create 2 lab reports. Students will be graded on individual parts of the activity.
Consensus Discussion (claims, evidence, and reasoning on what students figured out in this lesson)
Discussions will include origins and effects of plastic in our environment. How widespread plastics are. Students will compare and discuss their sand samples in relation to content, geographic location, mineral ratios and plastic content. Students will present their interviews with fishermen or fish market owners on their interactions with microplastics.
New Questions and Next Steps (student-driven questions, ideas on what to investigate in the next lesson and how to investigate it, etc.)
Students will answer the question, "how can we help the environment" based on our research. Students will conduct studies of macroplastics on beaches and intracoastal waterways and research decay rates for the found plastics. How does this affect the beach environment? Are there beaches actually made of plastic? Has plastic become to endemic to the environment that is has become a form of sedimentary rock?