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Subject / grade level: Science / 5th Grade

Materials:

- EnviroScape model, carrying case and associated pieces
- Water
- Water pitcher
- 3-4 spray bottles for rainmakers
- Pollution sources
 - Cocoa powder and water– dog poop, cow waste, motor oil and sewage sludge
 - Kool aid and water–fertilizers and pesticides
 - Paper towel–litter
 - Sand and kosher salt–road salt and sand
 - Cocoa powder-dirt from erosion
- Pencil (one per student)
- Worksheet (one per student)

Location:

- An area outside
- A folding table
- A hose (or some sort of water source for clean-up)

NGSS Essential Standards:

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Iowa Core Standards (Social Studies):

SS.5.5: With teacher direction, construct responses to compelling questions supported by reasoning and evidence.

SS.5.6: Identify challenges and opportunities when taking action to address problems, including predicting possible results.

Potential Iowa Core Standards (Social Studies):

SS.6.22: Explain multiple causes and effects of events and developments in the past.

SS.6.23: Compare Iowa’s geography, natural resources and climate to other regions of the world.

Lesson objective(s):

1. The students will be able to actively participate in the Enviroscape activity through completing their individual roles assigned by the teacher.

2. The students will apply vocabulary and academic language in whole-class discussions by responding to questions from the teacher and applying both prior knowledge and observations from the activity to their understanding.
3. The students will be able to apply understanding of topics related to watersheds in order to determine how they can both individually and as a community reduce pollution in the environment by verbally expressing how they can reduce pollution, as well as writing down two solutions that they can incorporate into their daily lives.

Differentiation strategies to meet diverse learner needs:

Whole class differentiation

- Talk loudly so every student can hear clearly.
- Talk slowly so every student can clearly understand.
- Encourage each student to participate in the watershed activity for a hands on learning experience.
- Engagement activities including: "Turn to your neighbor and discuss..." "Put your hand on your head if you think that..."

Individual differentiation

- ADHD: Students with ADHD will be assigned their individual task, but will be reminded that they must pay attention to make sure they don't miss their role. The teachers will give unobtrusive cues to the student, such as a tap on the shoulder, to reguide their attention. The student will be allowed "listening breaks" by being able to participate in the activity. The teachers will allow students to move around, but will remind them of their tasks and that they must respect their friends who also need to see the Enviroscape. Students may be asked to repeat directions, or important parts of the directions.
- ELL: The teachers will talk slowly and loudly, and will clarify any vocabulary necessary with students.
- Autism: Students with autism will be assigned their individual task, however the teachers will determine the most appropriate roles for these students to ensure they are included, but have responsibilities appropriate to their needs. This includes looking for behaviors, such as sensory issues, and assign the students roles appropriate for their needs, such as spraying the water rather than using cocoa powder. The teachers will also support this students in engagement using receptive language tools, such as allowing processing time and giving clear and concise directions.

ENGAGEMENT

- Describe how the teacher will capture students' interest.
- What kind of questions should the students ask themselves after the engagement?
- Norman Borlaug took care of the environment by taking actions to produce fresh crops to increase food production. Today, we are going to learn about ways that we can also protect our crops and our environment by keeping it clean of pollutants.

- Have students turn and talk with a partner to identify and explain the various ways that we use water in our everyday lives.
 - How do living things rely on water in order to survive?
 - Why is it important to keep our water clean?

EXPLORATION

- Describe what hands-on/minds-on activities students will be doing.
 - List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration
- Process of the enviroscape activity
 - Explain that this model is a “watershed”: an area of land that drains into a particular body of water.
 - Identify the various areas in the watershed model: the construction area, farm, subdivision, industrial plant, riverbanks, and golf course.
 - Explain that everyone lives in a watershed and has a watershed address.
 - What body of water is closest to your home?
 - Discuss the different areas and what they are representing in the EnviroScape
 - What different environments, places, etc, do you see in your environment? In the EnviroScape?
 - Construction site
 - Deforested areas
 - Homes
 - Lake
 - Farm fields
 - Discuss the type of pollutions, where they come from and how they affect the watershed.
 - What is point source pollution? (Cocoa sludge)
 - What are examples?
 - Industrial plant, sewage treatment plant
 - What is nonpoint source pollution? (Fertilizer, pesticides, loose soil)
 - What are examples? Where are these examples found?
 - Farm Fields: The farmer wants his crop to stay free of pests and to grow well so that he has a crop to sell.
 - Homes: The homeowner would like their yard to look nice and green and to get rid of all the weeds and bugs.
 - Golf Course: Golf course owners want their golf courses to look attractive and green.
 - Driveways: Sometimes people wash their cars in their driveways. When they do this, all the dirt and grime on their car and the soap they use to wash their car runs off into the stormwater drains.
 - Roads and Bridges: When cars aren’t properly maintained, they can leak oil, transmission fluid, and antifreeze as they drive around.

- Parking Lots: If cars are leaking, they will leak their liquids onto the blacktop where it will wash away into our rivers and lakes.
- Storm drains: pollutants from the curbing in neighborhoods and along all streets which are designed to allow rainwater to flow off of the pavement.
- Animal waste: farm animals and pets produce waste products which can build up.
- Litter: irresponsible people may throw trash into the environment.
- Discuss the impact of rainfall on pollution and watersheds
 - What happens when it rains?
 - Runs down roofs, down streets, goes in drains, etc
 - Predict where the pollutants will go. What is the impact?
 - Will end up in rivers and streams which lead to the lake
 - Will carry pollutants into bodies of water
- Discuss how Norman Borlaug had to think of solutions to preserve water quality through his farming techniques in order to preserve water sources in countries with limited drinking water.
- Students will each be assigned an individual role throughout the lesson, such as spraying water, sprinkling cocoa powder, adding the trees, etc.
- Conceptual Question:
 - How does pollution affect our water on a local and global basis?
 - What can you do to decrease pollution?

EXPLANATION

- Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination?
- List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.
- The students will verbally respond to questions from the teacher related to the activity, using both prior knowledge and related concepts that can be applied.
 - This will occur prior to different aspects of the engagement activity, in order to assess knowledge and challenge students' thinking before participating in the activity.
- The students will be encouraged to brainstorm questions that they have about issues related to the activity, which will be answered in elaboration.

ELABORATION

- Describe how students will develop a more sophisticated understanding of the concept.
- What vocabulary will be introduced and how will it connect to students' observations?
- How is this knowledge applied in our daily lives?
- Vocabulary
 - Pollutants: harmful substances deposited in the air, in the water, or on the land

- Watershed: an area of land that drains into a particular body of water
- Fertilizers: nutrients that help plants grow nicely and help yards become greener.
- Pesticides: used to get rid of bugs and other pests.
- Point Source Pollution: pollution can be traced back to specific source
- Nonpoint Source Pollution: Nonpoint source pollution originates from many sources

- Why is this activity important?
 - Pollutants affect water quality and aquatic life.
 - Fertilizers and pesticides contain chemicals, which cause algae to grow that can be harmful to the environment for aquatic life.
 - Pesticides are toxic to humans and animals, which can also travel up the food chain.
 - Loose soil adds sediment to water which can build up and affect both water quality and the amount of oxygen in the water.
 - Animal waste adds harmful bacteria to water which can make people and animals sick.
 - Litter can harm people and animals, and can also back up storm drains.

- Application of knowledge to daily lives
 - How can we fix these pollution issues?
 - Household Activities
 - Do not litter
 - Clean up litter
 - Do not pour anything down a storm drain
 - Be a smart shopper
 - Dispose of chemicals and other waste properly
 - Pick up after pets
 - Maintain waste tanks
 - Lawns and Golf Courses
 - Use fertilizers and pesticides properly
 - Do not fertilize right before a rainstorm
 - Plant trees, shrubs, and vegetation
 - Use organic fertilizers (manure or compost)
 - Compost grass clippings, leaves, etc
 - Driveways/Parking Lots and Roads
 - Keep cars properly maintained
 - Use public transportation when possible
 - Streambank, Lakeshore, and Forest
 - Planting trees, shrubs, etc.
 - Farm
 - Place fencing around the farm animals to keep them out of the stream

- Create berms
- Use manure containment
- Use contour farming techniques
- The students will make these changes on the Enviroscape to quickly demonstrate how they might impact pollution control.
- The students will write these changes they can make on a piece of paper that they can bring home as a reminder.
- Why is it important to fix these pollution issues?
 - Keep animals and humans both safe and healthy, through water quality, etc.
 - Keep our planet as clean as possible.
 - Limit factors that increase issues related to global warming.
 - Be responsible citizens of the Earth.

EVALUATION

- How will students demonstrate that they have achieved the lesson objective?
- This should be embedded throughout the lesson as well as at the end of the lesson
- The students will demonstrate the ability to use vocabulary and academic language in whole-class discussions by responding to questions from the teacher and applying both prior knowledge and observations from the activity to their understanding.
 - The teacher will informally assess this by listening to students' responses and both engaging in the conversation and correcting misconceptions.
 - Because of the limited time constraints of this activity, the teachers will not be formally assessing students on their learning.
- The students are able to come up with concrete and reasonable changes that they can make in order to reduce their pollution in their environment.
 - The students will write these changes they can make on a piece of paper that they can bring home as a reminder.
 - This will not be assessed, but will be provided as a resource to students in order to reduce their environmental footprint.

RESOURCES

- http://www.cleargeneseewater.org/assets/enviroscape/enviroscape_water_pollution_lesson_plan.pdf
- https://web.uri.edu/riss/files/Envir_lesson_teacher.pdf
- <https://www.nps.gov/common/uploads/teachers/lessonplans/Explore%20your%20Watershed%20Outline.pdf>