

LOESS INTEGRATED LEARNING SCENARIO TEMPLATE

Introduction

In [LOESS](#), the acquisition of soil health knowledge is facilitated using integrated STEM teaching and learning, which is carried out via the [Biology Science Curriculum Study \(BSCS\) 5E Instructional Model](#) by Bybee and colleagues (Bybee et al. 2006) as well as the application of innovative [pedagogical approaches](#) (PBL, IBL, etc).

Keywords

Soil health, Erosion, Biodiversity, Climate Change, Sustainable Agriculture

Title

The Secret Life of Soil: Understanding Soil Health and Its Impact on the Environment

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Summary

This learning scenario introduces 7th-grade students to the significance of soil health by integrating Geography and Environmental Science. Using the BSCS 5E instructional model, students will explore soil composition, erosion, and its impact on ecosystems. Through hands-on experiments, group discussions, and real-world applications, they will develop an understanding of how soil influences biodiversity, agriculture, and climate change.

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Subjects

Geography, Environmental Science, English (CLIL)

Real-life questions

- *How does soil composition affect plant growth and biodiversity?*
- *What are the causes and consequences of soil erosion?*
- *How can we protect soil from degradation and ensure sustainability?*

Learning objectives

- *Students will be able to identify different soil types and describe their properties.*
- *Students will understand the impact of soil erosion on the environment.*
- *Students will explore sustainable practices for soil conservation.*
- *Students will develop critical thinking skills through hands-on exploration and problem-solving.*



Link to curriculum

The learning scenario aligns with geography and environmental science curricula by incorporating physical geography concepts (soil formation, types, and erosion) and sustainability themes linked to UN Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action) and SDG 15 (Life on Land).

Age of students

12–13 years (7th grade)

Time

Preparation time: 2 hours

Teaching time: 5 lessons (45 minutes each)

Teaching resources (materials & online tools)

- Soil samples
- Water trays, spray bottles (for erosion experiments)
- Digital microscope or magnifying glasses
- Videos on soil conservation
- Concept mapping tools (paper or digital)
- Presentation materials (poster boards, digital slides, etc.)

STEM Strategy Criteria

Elements and criteria	How is this criterion addressed in the learning scenario?
Instruction	
Personalisation of learning	<p>Differentiated Activities: Students can engage in hands-on experiments, concept mapping, model-building, or digital presentations, allowing them to choose how they demonstrate their understanding.</p> <p>Student-Centered Learning: The 5E model encourages exploration and self-directed learning, enabling students to investigate soil-related issues at their own pace and based on their interests.</p> <p>Formative Feedback: Teachers provide individualized feedback during discussions, group work, and project development, helping each student improve their understanding.</p>
Problem and project-based learning (PBL)	<p>Problem-Based Learning (PBL): Students investigate real-world soil issues, such as erosion and conservation, by conducting hands-on experiments and analyzing soil samples. They explore causes, effects, and solutions through inquiry-driven activities, fostering critical thinking and problem-solving skills.</p> <p>Project-Based Learning (PBL): In the EXTEND phase, students design soil conservation strategies for their local environment. They create models, infographics, or experiments and present their solutions in the EVALUATE phase. The project promotes collaboration, creativity, and real-world application of knowledge.</p>



Elements and criteria	How is this criterion addressed in the learning scenario?
Inquiry-Based Science Education (IBSE)	<p>Encouraging Curiosity and Questions (ENGAGE): The scenario begins with an unusual soil sample and a thought-provoking video, prompting students to ask questions and make predictions about soil properties and its environmental role.</p> <p>Hands-On Investigation (EXPLORE): Students conduct soil analyses and erosion simulations, formulating hypotheses and testing them through experiments. They observe, record data, and analyze results, actively engaging in the scientific process.</p> <p>Constructing Explanations (EXPLAIN): Students develop concept maps and discuss findings, linking them to scientific explanations provided by the teacher and possibly an expert guest speaker.</p> <p>Applying Knowledge to Real-World Contexts (EXTEND): Learners design and propose soil conservation strategies, applying their understanding to a practical environmental issue.</p> <p>Assessing Understanding and Reflection (EVALUATE): Students present their findings and receive feedback, promoting self-reflection and deeper learning.</p>
Curriculum implementation	<p>The learning scenario aligns with the curriculum by integrating STEM and Geography topics. It follows the 5E Instructional Model, ensuring a structured learning progression. The activities address key educational goals, such as scientific inquiry, environmental awareness, and problem-solving skills, making the learning experience relevant to the subject standards.</p>
Emphasis on STEM topics and competencies	
Interdisciplinary instruction	<p>The learning scenario blends STEM with Geography, showing how soil composition, erosion, and conservation impact ecosystems and human activities. It also incorporates real-world environmental issues, linking science, engineering, and social responsibility to provide a well-rounded interdisciplinary approach</p>
Contextualisation of STEM teaching	<p>The scenario presents real-world challenges related to soil erosion and conservation, making STEM learning meaningful. Students apply scientific knowledge to local environmental issues, propose solutions, and engage with their community, ensuring the learning is practical, relevant, and applicable beyond the classroom.</p>
Assessment	
Continuous assessment	<p>The learning scenario includes formative assessment throughout all 5E phases. Teachers monitor students' progress using observations, group discussions, peer evaluations, and project presentations. Feedback is provided regularly, ensuring that misconceptions are addressed and learning is continuously reinforced.</p>
Personalized assessment	<p>The scenario allows for differentiated assessment by offering multiple ways for students to demonstrate their understanding (e.g., concept maps, models, infographics, and experiments). Students receive individualized feedback, and assessments consider different learning styles, ensuring that each student can engage at their own pace and capability.</p>
Professionalization of staff	
Highly qualified professionals	<p>The learning scenario incorporates expert input by suggesting the involvement of a guest speaker, such as an environmental scientist, during the EXPLAIN phase. This allows students to engage with a highly qualified professional, gain real-world insights, and ask questions about soil conservation challenges and solutions. Additionally, the teacher facilitates scientific discussions, ensuring that students receive accurate and up-to-date information.</p>



Description of activities

The LOESS learning scenario must include a **minimum of three lessons** as well as **indoor and outdoor activities**. In the below table add or delete lessons as required. Please, make sure to incorporate **all 5E phases** in the learning scenario following the [Biology Science Curriculum Study \(BSCS\) 5E Instructional Model](#) by Bybee and colleagues (Bybee et al. 2006)

Name of activity	Procedure	Time
1st Lesson		
5E Phase	ENGAGE: Exploring Soil's Hidden Wonders (45 mins)	
ENGAGE	Students examine mysterious soil samples and watch a short video on soil's role in biodiversity, agriculture, and climate change. Through observation and discussion, they share prior knowledge, ask questions, and spark curiosity about the importance of soil.	
Lesson Outline	<p>Objective: To ignite students' curiosity about soil by examining its diverse characteristics and understanding its critical role in biodiversity, food production, and climate change.</p> <p>Materials Needed:</p> <ul style="list-style-type: none"> • Types of Soil • Various soil samples with distinct properties: Sandy soil, Clay-rich soil, Loamy soil, Organic-rich soil, Compacted soil • Magnifying glasses or digital microscopes • Notebooks or science journals • Projector and computer for video presentation <p>Lesson Outline:</p> <p>Introduction (5 minutes): Begin by asking students what they know about soil and its importance. Document their responses on the board to assess prior knowledge. First, students are introduced to the topic of the lesson by watching a short video on the Types of Soil https://www.youtube.com/watch?v=G0JcVe_-yu0 Then, the teacher presents a mysterious soil sample with unusual characteristics (e.g., extremely sandy, full of organic material, or highly compacted) and asks students to make predictions about its properties, based on the video they watched.</p> <p>Hands-On Exploration (15 minutes): Divide students into small groups and provide each group with a different soil sample. Instruct students to observe and document the following characteristics of their soil sample: Texture (gritty, sticky, smooth), Color, Moisture content, Presence of organic matter (roots, leaves) Encourage students to make predictions about how their soil type might affect plant growth and water retention.</p> <p>Class Discussion (10 minutes): Have each group share their observations and predictions. Facilitate a discussion on the diversity of soil types and their potential impact on the environment, agriculture, and ecosystems.</p> <p>Video Presentation (10 minutes): Introduce a short, engaging video that highlights the significance of soil in supporting life, its role in food production, and its influence on climate change.</p>	



Name of activity	Procedure	Time
	<p>Recommended Videos: Title: "Soil is more than just dirt" https://www.youtube.com/shorts/Vlwj2_xyhxA This brief video emphasizes the multifaceted importance of soil, addressing issues like biodiversity loss, drought, and food and water insecurity. It also introduces sustainable soil management practices such as minimum tillage and crop rotation. Source: United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) Soil is more than just dirt (BBC video) https://www.youtube.com/watch?v=OILITHMVcRw Why soil is one of the most amazing things on Earth Reflection and Question Generation (5 minutes): After viewing the video, students are asked to reflect on the content and generate questions or topics they are curious about regarding soil. Document these questions to guide future lessons and investigations. Additional Notes: By immersing students in hands-on activities and multimedia resources, this lesson aims to foster a deep, inquisitive interest in soil science and its broader environmental implications.</p>	
Discussion and preparation for the next lesson	Assign students to collect small soil samples from their local environment (e.g., backyard, park) to bring to the next class. Encourage them to observe where they collected the sample and note any nearby vegetation or land use.	
2nd Lesson		
5E Phase	EXPLORE: Investigating Soil Composition and Erosion (45 mins)	
EXPLORE	Students conduct hands-on soil analysis by examining soil samples from different locations. They identify texture, color, and water retention properties. In groups, they simulate soil erosion using trays of soil, water, and wind to observe how different soil types erode.	
Lesson Outline	<p>Objective: Students will explore soil properties and investigate how different soil types are affected by erosion.</p> <p>Materials Needed:</p> <ul style="list-style-type: none"> • Soil samples (from students' collections and additional samples provided by the teacher) • Magnifying glasses or digital microscopes • Water bottles with spray nozzles (for simulating rain) • Trays or shallow containers • Small fans or hairdryers (to simulate wind erosion) • Measuring cups (for consistent water application) • Data recording sheets <p>Lesson Outline Part 1: Soil Composition Analysis (20 minutes) 1. Observing Soil Samples (10 minutes): Divide students into small groups and distribute different soil samples. Ask them to observe and record soil properties: Texture: Rub soil between fingers (is it sandy, silty, or clay-like?). Color: Compare samples to a soil color chart. Moisture Retention: Squeeze a damp soil sample—does it clump or fall apart?</p>	



Name of activity	Procedure	Time
	<p><i>Organic Matter. Look for visible plant material, roots, or decomposed matter.</i></p> <p><i>Students record their findings in their notebooks or on a worksheet.</i></p> <p>2. Water Retention Test (10 minutes):</p> <p><i>Each group places soil in a small cup with holes at the bottom. They pour equal amounts of water into each sample and time how long it takes for water to drain through.</i></p> <p><i>Discussion: Why do some soils retain water better than others? (Connecting to plant growth and agriculture.)</i></p> <p>Part 2: Soil Erosion Experiment (25 minutes)</p> <p>1. Wind Erosion Simulation (10 minutes):</p> <p><i>Set up three trays: one with dry, loose soil; one with moist soil; and one with soil covered in grass or mulch.</i></p> <p><i>Use a small fan/hairdryer at a low setting to simulate wind.</i></p> <p><i>Observe which soil is eroded the most.</i></p> <p><i>Discussion Questions:</i></p> <p><i>Which soil type resisted erosion best? Why?</i></p> <p><i>How does vegetation affect wind erosion?</i></p> <p>2. Water Erosion Simulation (15 minutes):</p> <p><i>Tilt three trays with different soil types at the same angle.</i></p> <p><i>Use a spray bottle to create "rainfall."</i></p> <p><i>Observe how much soil washes away and where the water collects.</i></p> <p>Discussion Questions:</p> <p><i>What happens when water hits bare soil compared to soil with plants or mulch?</i></p> <p><i>What does this mean for farming and land conservation?</i></p> <p>Class Discussion & Reflection (5 minutes)</p> <p><i>Each group shares their observations and conclusions about soil properties and erosion.</i></p> <p><i>Connect findings to real-world problems, such as deforestation, agriculture, and climate change.</i></p> <p>Preparation for the Next Lesson</p> <p><i>Students research ways to prevent soil erosion and bring examples for the next class.</i></p> <p><i>Possible topics: terracing, cover crops, afforestation, or engineering solutions.</i></p> <p><i>This lesson keeps students engaged with hands-on activities while deepening their understanding of soil composition and erosion.</i></p>	
Learning products	Data recording sheets	
3rd Lesson		
5E Phase	EXPLAIN: Understanding the Science Behind Soil Erosion (45 mins)	
EXPLAIN	Understanding the Science Behind Soil Erosion	
	<p><i>Students create concept maps linking soil types, erosion factors, and impacts on the environment. They present their findings to the class, and the teacher provides scientific explanations and corrects misconceptions.</i></p> <p><i>A guest speaker, such as an environmental scientist, may be invited to discuss real-world soil conservation challenges.</i></p>	
Lesson Outline	Objective:	



Name of activity	Procedure	Time
	<p>Students will synthesize their findings from previous lessons to develop a conceptual understanding of soil erosion. They will connect soil types, erosion causes, and environmental consequences while discussing real-world conservation solutions.</p> <p>Materials Needed:</p> <ul style="list-style-type: none"> • Large poster paper or whiteboards for concept mapping • Markers or sticky notes for brainstorming ideas • Digital tools (if available) for creating concept maps (e.g., Padlet, Google Jamboard, MindMup) • Printed images or case studies of real-world erosion examples • Projector for guest speaker (if applicable) <p>Lesson Outline</p> <p>Part 1: Concept Map Creation (15 minutes)</p> <p>Revisiting Past Lessons (5 minutes): Ask students to recall key takeaways from their soil composition and erosion experiments. Write guiding questions on the board: What are the main types of soil? How does wind and water erosion affect soil differently? What environmental consequences result from soil erosion?</p> <p>Building the Concept Map (10 minutes): In small groups, students create a concept map with three main branches: Soil Types – sandy, clay, loamy, organic-rich Erosion Factors – wind, water, human activities (deforestation, farming, urbanization) Environmental Impacts – loss of fertile land, desertification, increased flooding, climate change Encourage students to draw connections between ideas and include examples from their own experiments.</p> <p>Part 2: Group Presentations & Class Discussion (15 minutes) Each group presents its concept map to the class. The teacher provides feedback and clarifies any misconceptions: Example correction: If students believe only sand erodes, explain how clay can also erode when exposed to heavy rainfall. Discussion Questions: Which soil type is most resistant to erosion? How can human activities increase or decrease erosion? What solutions can we implement to reduce soil erosion?</p> <p>Part 3: Real-World Application – Guest Speaker or Case Study (15 minutes)</p> <p>Option 1: Guest Speaker (if available) Invite an environmental scientist, farmer, or soil conservation expert to discuss: Local erosion issues (e.g., farmland erosion, urban development) Real-world solutions (cover crops, terraces, windbreaks) How students can take action in their own community</p> <p>Option 2: Case Study Analysis (if no speaker is available) Show a short video or provide a real-world example of severe soil erosion (e.g., the Dust Bowl, deforestation in the Amazon, desertification in Africa). Students compare and contrast their experiment findings with large-scale erosion events.</p>	



Name of activity	Procedure	Time
	<p>Discussion Question: What solutions do these regions use to combat erosion?</p> <p>Closing Activity & Reflection (5 minutes)</p> <p>Students write a reflection:</p> <p>What was the most surprising thing they learned?</p> <p>What real-world problems does soil erosion cause?</p> <p>What solutions could they implement in their local environment?</p> <p>Preparation for the Next Lesson:</p> <p>Homework: Research a soil conservation technique (mulching, afforestation, no-till farming) and prepare a short summary for the next lesson.</p> <p>This lesson deepens students' scientific understanding of soil erosion while connecting it to global issues.</p>	
Learning products	Concept maps Student reflections	
4th Lesson		
5E Phase	EXTEND: Designing Soil Conservation Strategies (45 mins)	
EXTEND	Designing Soil Conservation Strategies	
	<p>Students apply their knowledge by designing and proposing solutions to prevent soil erosion at their schoolyard. They can create models, infographics, or experiments to demonstrate their ideas.</p>	
Lesson Outline	<p>Objective:</p> <p>Students will apply their understanding of soil erosion and conservation by designing practical solutions to prevent erosion at their schoolyard. They will use creative methods such as models, infographics, or experiments to demonstrate their ideas.</p> <p>Materials Needed:</p> <ul style="list-style-type: none"> • Art supplies: poster boards, markers, glue, printed images • Digital tools (optional): Canva, Google Slides, Padlet for infographics • Recyclable materials: cardboard, small rocks, sand, water, and plastic trays for model creation • Printed case studies of successful soil conservation efforts (e.g., terracing in Southeast Asia, windbreaks in the Great Plains, cover crops in sustainable farming) <p>Lesson Outline</p> <p>Part 1: Brainstorming Solutions (15 minutes)</p> <p>Quick Review (5 minutes): Ask students:</p> <p>What are the major causes of soil erosion?</p> <p>What strategies reduce erosion?</p> <p>What real-world examples of soil conservation have we discussed?</p> <p>Generating Ideas (10 minutes): In small groups, students, after examining the soil of their schoolyard, brainstorm solutions applicable to their school environment. They provide examples such as:</p> <ul style="list-style-type: none"> • Planting trees or grass to prevent wind erosion • Using mulch or cover crops in school garden • Building small terraces in sloped areas • Redirecting water runoff with barriers <p>Part 2: Project Creation (25 minutes)</p>	



Name of activity	Procedure	Time
	<p>Each group selects a format to present their soil conservation strategy.</p> <p>Model Demonstration: Build a mini-landscape model in a tray to simulate erosion prevention methods. Example: Pour water over bare soil vs. soil covered with plants to show erosion control.</p> <p>Infographic or Poster: Use images, diagrams, and simple explanations to teach soil conservation methods. Include steps to implement the solution in the real world.</p> <p>Mini-Experiment: Conduct a hands-on test showing how soil erosion can be prevented. Example: Compare water retention in soil with plants vs. without plants.</p> <p>Part 3: Presentations & Class Discussion (15 minutes) Each group presents their model, infographic, or experiment to the class.</p> <p>Discussion Questions: Which solution would work best in our school or community? How can we convince people to adopt these strategies? What are the challenges of implementing these solutions on a larger scale?</p> <p>Closing Activity & Reflection (5 minutes) Students write a short reflection: What is one new thing they learned about soil conservation? How can they apply this knowledge in their own life?</p> <p>Preparation for the Next Lesson: Optional Homework: Research a real-world soil conservation project and summarize its impact. Extension Activity: Organize a school-wide campaign to raise awareness about soil conservation. This lesson fosters creativity, problem-solving, and real-world application, ensuring students actively engage with soil conservation strategies.</p>	
Learning products	Models, infographics, experiments	
5th Lesson		
5E Phase	EVALUATE: Showcasing Soil Solutions (90 mins)	
EVALUATE	Showcasing Soil Solutions	
	Students present their conservation projects to peers, teachers, and potentially local experts or parents. The class engages in peer assessment, and the teacher provides feedback using a rubric focusing on scientific accuracy, creativity, and feasibility.	
Lesson Outline	<p>Objective: Students will present their soil conservation projects to an audience, receive feedback, and engage in self- and peer-assessment. This lesson will reinforce their understanding of soil erosion and conservation while developing their communication and critical thinking skills.</p> <p>Materials Needed:</p> <ul style="list-style-type: none"> • Students' projects (models, infographics, photos of mini-experiments) • Peer assessment rubrics (simplified for student use) 	



Name of activity	Procedure	Time
	<ul style="list-style-type: none"> • Teacher assessment rubric (focusing on scientific accuracy, creativity, feasibility) • Projector and laptop (for digital presentations) • Name tags and feedback forms (for visitors, if applicable) <p>Lesson Outline</p> <p>Part 1: Setting Up the Presentation Space (10 minutes) Classroom Arrangement: Students set up their projects at different stations. Posters and digital presentations are displayed, and models/experiments are ready for demonstration. Audience Preparation: If external guests (teachers, parents, or local experts) attend, assign student hosts to welcome them. Students receive peer assessment rubrics to evaluate their classmates' presentations.</p> <p>Part 2: Student Presentations (30 minutes) Each group presents their soil conservation strategy. 3–5 minutes per group to explain: The problem (erosion type and cause) Their proposed solution How their model, infographic, or experiment demonstrates the concept Real-world applications The audience (classmates, teacher, and possibly guests) can ask questions after each presentation.</p> <p>Part 3: Peer and Teacher Assessment (15 minutes) Peer Assessment: Students rotate between presentations and use a rubric to evaluate: Scientific Accuracy – Is the information correct and well-explained? Creativity – Does the project show innovation? Feasibility – Could this solution work in a real-world setting? Presentation Skills – Was it engaging and clear? Teacher Feedback: The teacher provides verbal feedback and scores projects based on the assessment rubric.</p> <p>Part 4: Reflection and Discussion (30 minutes) Whole-Class Reflection Questions: What was the most interesting solution presented? How could we apply these ideas in our school or community? What did we learn about soil conservation that we didn't know before? Final Student Reflection (Exit Ticket): One thing I learned today... One question I still have... One way I can apply this knowledge outside the classroom... Closing & Next Steps: Optional Community Engagement: Organize a school-wide soil conservation project, such as planting grass, creating a compost bin, or raising awareness through posters. Final Takeaway: Emphasize that soil is a valuable resource and that small actions can make a big difference in preventing erosion and protecting the environment. This final lesson not only evaluates students' learning but also encourages them to think critically about real-world applications.</p>	



Initial assessment

- *Pre-lesson quiz on soil types and functions.*

Formative evaluation

- *Interactive quizzes, group discussions, observation during activities.*

Final assessment

- *Project presentations on soil conservation strategies.*

Student feedback

- *Standardized short questionnaire*
- *Oral reflections*

Teacher feedback

- *Self-assessment of lesson effectiveness*
- *Reflection on student engagement and learning outcomes*

Reflection on the development process

Add here your personal reflection on the creation of your learning scenario (max 200 words). Here below are a few questions that can help you brainstorm.

1. *Describe where your initial ideas for the LS came from. What inspired you to choose the particular focus you have chosen?*
2. *Summarise the research you have conducted and resources you have found to inform your plan. How did those influence your thinking and creation process?*
3. *What did you learn about your own planning and development process?*

The idea for this learning scenario emerged from a growing concern about environmental sustainability and the role education plays in addressing real-world ecological challenges. I was particularly inspired by the relevance of soil health to climate change, food security, and biodiversity—topics that directly impact our future and resonate well with students' everyday experiences.

To inform the structure and content, I explored several educational resources, including the BSCS 5E instructional model, LOESS teaching guidelines, and case studies on soil erosion and conservation. Educational videos and scientific articles helped me translate complex environmental topics into age-appropriate, engaging learning experiences. The integration of project-based learning and hands-on activities was heavily influenced by best practices in STEM education and inquiry-based learning.

Throughout the planning process, I realized the importance of balancing structure with flexibility—allowing students the freedom to explore, create, and reflect while still guiding them toward clear learning objectives. This experience helped me grow in designing learner-centered, interdisciplinary scenarios that connect classroom content to global issues in a meaningful way.

