

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, 17 SDGs, In-door & Out-door activities, awareness

Title

'Soil Health: What is this all about and why is it a timeless and infinite must?'

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Summary

The main learning objective of this learning scenario is primarily to raise awareness upon the value of soil. Students examine soil composition, learn how organisms contribute to soil health, and measure soil properties like pH and moisture. Plus, it is aimed for students to recognise the term and benefits of soil health and its ecosystem services as well as to engage to soil health and real-world dilemmas. The LS evolves through in-door and out-door activities based on specific pedagogical theories and innovative pedagogies. Hands-on experiments and real-world applications enhance their understanding of soil's critical role in ecosystems, agriculture, and sustainability, fostering interdisciplinary learning and environmental awareness. It is also aligned and based upon the 5E Instructional Model throughout its structure.

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Subject (s)

*Please list the STEM subjects taught in this learning scenario. Note that you must integrate **at least two STEM** subjects in your learning scenario.*

Biology

Chemistry

Geography

Geology

Philosophy



Real-life questions

Please list the real-life questions your learning scenario tackles e.g.:

- What is soil health, and why is it important for ecosystems and human life?
- What local environmental factors are affecting soil health in your community?
- What can you do to improve or restore soil health in a specific area?
- What actions can you take to enhance sustainability and soil health in your community?
- What actions can you take to express your arguments/objections about soil environmental issues?

Learning objectives

- Students will be able to identify and describe the different layers of soil.
- Students will be able to explain how soil supports plant growth and the importance of soil in ecosystems.
- Students will learn about the composition of soil and its main substrates that are necessary for life on earth.
- Students will learn about the primitive elements of nature and the importance soil in life even from ancient times.
- Students will come to realize that soil plays a major role in many areas of sustainability, when it comes to food security, biodiversity or clear water.
- Students will come to address and contextualise soil challenges and tackle real-world soil-related issues connecting classroom activities to real-world sustainability issues.
- Students will learn about SDGs and Sustainable Development and understand how SDGs relate to Soil health as a sub-aspect of them.
- Students will learn to use online resources to gather and share information about soil and soil properties.
- Students will work collaboratively on projects, foster teamwork, communication and critical thinking.
- Students will evolve their responsibility and empathy upon environmental and societal issues and act.
- Students will learn to visually present information and their findings/conclusions about soil ecosystems

Link to curriculum

Please briefly describe (max 150 words) how the activities of this learning scenario are linked to the curriculum, STEM skills¹ and specific UN Sustainable Development Goals (SDGs)².

In this LS, the activities are linked to the curriculum (Chemistry, Biology, Geology, Geography) and STEM plus STE(A)M. They are implemented in aim to examining soil composition and soil health to support learning outcomes related to understanding ecosystems, biodiversity, and the importance of maintaining environmental health. In addition, they support the

¹ See the list of STEM skills in UNESCO's document *Exploring STEM Competences for the 21st Century* (from page 18) > <https://unesdoc.unesco.org/ark:/48223/pf0000368485.locale=en>

² UN SDGs > <https://sdgs.un.org/goals>



development of critical thinking skills, problem-solving abilities, and collaborative learning, all of which are emphasized across curricula. This learning scenario is also connected to several United Nations Sustainable Development Goals (SDGs)¹. We can specifically highlight the connection with Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), and Goal 15 (Life on Land). If our students better understand soil and the processes that take place within it, we will certainly have better conditions for achieving all these goals.

Age of students

16-17

Time

Preparation time: 4 & 1/2 hours

Geography (1 h)

Chemistry (1 h)

Biology & Geology (2 h)

Philosophy (1/2 h)

Teaching time: 5 hours approximately

- **Subject 1: Biology, Geology, Chemistry**
- **Subject 2: Biology, Geography, Geology, Philosophy**
- **Subject 3: Chemistry, Biology, Geology**

Teaching resources (materials & online tools)

Material for all lessons

- Computers/tablets/Mobile apps
- Internet connection
- Soil samples from different locations (e.g., garden, roadside, schoolyard)
- Beakers or glass jars
- Pots or bags

Material for Lesson 1

- Worksheets
- Printed images of different soil samples
- Coloured pencils
- A4 Paper for drawing
- Printed Image 1 (Annex 1)
- Lab
- Petri dishes
- Soil samples
- Magnifying glasses
- Stickers/Labels
- Beaker
- Water
- Sieves (different mesh sizes)
- PH



- Microscope
- Litmus paper (for ph testing)
- Slides for the Microscope examination and Droppers
- Role-cards
- Annex 1 – Multiple choice quiz

Material for Lesson 2

- Moist or any kind of Soil samples
- Question notebooks
- Different Types of Soil Samples
- Jars containers
- Coloured ribbon
- Printed Image 2 (Annex 2)
- Worksheets
- Gloves
- Sieves
- Pots/Jars
- PH
- Distilled water
- Indicator
- Washing up liquid
- Lids for the jar
- Mobile Camera (for photos)

Materials for Lesson 3

- Soil Samples
- Spoons
- Jar containers
- Vinegar
- Distilled water
- Baking powder
- A large wide-necked glass jar with a screw lid
- Detergent

Online tools:

Lesson 1.

- Why soil is one of the most amazing things on Earth (BBC video)
<https://www.youtube.com/watch?v=OiLITHMVcRw>
- A short video on the importance of soil can be used as an alternative to the video above <https://www.youtube.com/watch?v=K-4owWBe9fQ> (Swedish video in English subtitles)
- <https://www.loess-soil-map.eu/map>
- Tricider.com
- Mentimeter.com

Lesson 2.

- Mentimeter.com



- <https://ejatlas.org/> Global Atlas for environment justice e.g. <https://ejatlas.org/conflict/gold-mining-in-chalkidiki-greece>
- <https://soilhealthbenchmarks.eu/case-studies/>
- Soil and SDGs infographic (see link below or Annex 2 Image- SDGs) <https://openknowledge.fao.org/items/456f7cf7-8bab-441c-a0b3-15a9d68a6773>
- EarthExplorer <https://earthexplorer.usgs.gov/>
- Google Earth <https://earth.google.com/web/>
- Emaze.com (for Visual presentation)
- Padlet.com
- Google Form
- Worksheets
- Coloured markers and crayons
- A3 paper

Lesson 3.

- <https://nt7-mhe-complex-assets.mheducation.com/nt7-mhe-complex-assets/Upload-20190715/InspireScience6-8CA/LS12/index.html> (Visual Plant Growth)
- <https://delisoil.eu/participate-in-delisoil-stakeholder-survey/>
- AI Song <https://suno.com/> Suno: An AI music creation platform, on condition that students are familiarized and acquainted with the responsible use of AI platforms. If not, an A4 paper is provided to each student group by the teacher, to write down their own lyrics and phrases/mottos related to soil.
- Images/posters <https://chatgpt.com/> related to 'The image 1' which is created by the teacher before the learning process and, particularly, Lesson 3, via platform chatgpt.com).

STEM Strategy Criteria

Developing the LOESS learning scenario will help you and your school comply with the [STEM School Label criteria](#). Please indicate which STEM School Label criteria your learning scenario fulfils: fill in the table, adding information for the criteria your learning scenario tackles; you can delete rows for the criteria that are not included: <https://www.stemschoollabel.eu/criteria>
Example: see table.

Elements and criteria	How is this criterion addressed in the learning scenario?
Instruction	
Personalisation of learning	The learning scenario includes a variety of activities, such as brainstorming, think-pair share, hands-on experiments, discussion, virtual activity, role-playing game, quizzes, self-reflective portfolios, artful thinking, debate, real-world dilemma which cater to different learning preferences and abilities. This variety allows to be differentiating and moderating instructions based on individual student needs.
Problem and project-based learning (PBL)	The LS enables students to cultivate creative and critical thinking, problem-solving abilities, and teamwork. This approach is adapted using the 5E model by presenting a



Elements and criteria	How is this criterion addressed in the learning scenario?
	<p>real-world problem connected to the lesson, allowing students to investigate the problem and propose solutions.</p> <p>Plus, the creation of a clear 'product' to address a specific problem shows the implementation of project-based learning method. In this regard, it includes in each lesson a final product that is implemented e.g. the visual presentation with Emaze platform. Also, it incorporates PBL by having students work on open-ended, well-defined questions that require them to collaboratively derive solutions to preserve soils' health</p> <p>Additionally, role simulation playing games encourages critical thinking, debate, and problem-solving while helping students understand real-world issues related to soil health and land grabbing.</p>
Inquiry-Based Science Education (IBSE)	<p>Students are encouraged to discover or construct information by themselves. In-door and out-door activities are assigned to group of students enabling them to make observations; posing questions; examining digital sources, planning investigations; considering experimental evidence; They use any kind of tools to gather, analyse, and interpret. They propose answers, explanations, and predictions; and communicate the results to reveal the information</p>
Curriculum implementation	<p>The learning scenario is designed to be easily implemented within most of the national curricula with activities that align with the educational standards and objectives commonly set in schools all over Europe. Specifically, it combines STEM subjects (Biology, Chemistry, Geology) with non-STEM subjects (Geography, Philosophy) and SDGs. Plus, it involves the integration of various pedagogical approaches, including the BSCs 5E Instructional Model, to ensure effective learning.</p>
Emphasis on STEM topics and competencies	
Interdisciplinary instruction	<p>In this Learning Scenario, we examine and implement a variety of activities by connecting Geography with Biology, Chemistry and Geology and even Philosophy in specific national curricula. The scenario emphasises interdisciplinary instruction by uniting subjects to provide a holistic understanding of soil health timelessly and its real-life challenges</p>
Contextualisation of STEM teaching	<p>Contextualization of STEM teaching is obtained by linking soil health to real-life challenges. The activities relate to local case studies and field experiences.</p>
Assessment	
Continuous assessment	<p>The scenario includes continuous assessment, such as formative evaluation during the BSCs 5E Instructional Model phases and summative assessment through multiple choice quiz, to monitor student learning and make necessary adjustments.</p>
Personalized assessment	<p>Personalised assessment is addressed by using a variety of assessment methods, discussions, quizzes, activities, self-reflection portfolio adapted to individual student needs and learning styles.</p>
Professionalization of staff	
Highly qualified professionals	<p>The LS requires the involvement of highly qualified professionals who can facilitate the complex pedagogical approaches, have the adequate knowledge, use and apply innovative pedagogical methods required for the proposed learning activities.</p>
Existence of supporting (pedagogical) staff	<p>The presence and contribution of supporting staff is recommended to assist in the implementation of the learning activities, ensuring that students receive the necessary support. Scaffolding tools and approaches (guiding questions) are also suggested</p>
School leadership and culture	
School leadership	<p>School leadership is necessary to foster a culture that supports the implementation of the pedagogical approaches on which the Learning scenario is based, and the necessary resources for their success.</p>



Elements and criteria	How is this criterion addressed in the learning scenario?
High level of cooperation among staff	The scenario encourages cooperation among staff to ensure the interdisciplinary nature of the planned activities is well-executed and that all necessary support is provided. Collaboration among teachers of different subjects is of main prerequisites.
Inclusive culture	Engaging all students in the learning process and providing personalised assessment to accommodate diverse learning needs and differentiate activities, make this lesson plan inclusive.
School infrastructure	
Access to technology and equipment	Students have access to modern technology and equipment that support hands-on learning and experiments related to soil science, and the school has a student-run garden or schoolyard that enhances their practical experience.
High quality instruction classroom materials	The school provides quality instructional materials, including textbooks/notebooks/worksheets, lab equipment, and interactive resources that enhance the learning experience.

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 Brainstorming and Discussion 15-20 min	<p><i>Engage, Explore, Explain, Elaborate, Evaluate</i></p> <p>Students are asked to watch the video https://www.youtube.com/watch?v=K-4owWBe9fQ A secret Universe – A little film about soil (a 2020 Swedish film with English subtitles). The objective of the film is to increase awareness about the soil ecosystem and the importance of protecting and effectively managing soil resources or alternatively https://www.youtube.com/watch?v=OILITHMVcRw Why soil is one of the most amazing things on Earth BBC Ideas</p> <p>The teacher applies the educational technique of Brainstorming to find out what the students already know about the properties of the soil and its influence on the development of the vegetation cover. Brainstorming will be supported by the following questions:</p> <ul style="list-style-type: none"> • What are the main components of soil? • What role does organic matter play in soil fertility? • How important is soil biodiversity for ecosystems? • How can agricultural practices affect soil health and the vegetation that grows on it? <p>Students working in pairs may use tricider.com to answer those questions or they just answer the questions on a worksheet by providing simple and few key - words. They vote for the best applying idea by thumbs up or oppose against, providing adequate reasons for why or why not.</p>	



Name of activity	Procedure	Time
<p>Engage (Spark Interest) Subject 1: Biology, Geology, Chemistry In door Activity: "Mystery Soil Sample Investigation" 30-40 min</p>	<p>In this phase students raise their interests in soil, assess their prior knowledge and pre-existing ideas. Hence, three images of different soil samples (e.g., sandy, loamy, clay) are presented. Alternatively, they can draw different samples of soil. What soil elements are expected to include or not in their designs? Why? They might also use https://www.loess-soil-map.eu/map to find out more information about dry soil, wet soil, sealed soil, soil erosion and soil degradation in specific areas in Europe. This inquiry-based discussion (Engage phase) will focus on what students already know about soil and what they are curious to learn. Some of the brainstorming questions that teacher can propose are:</p> <ul style="list-style-type: none"> • What is soil? Is soil alive? • What do you think soil is made of? • Are all soils the same? • Why do you think soil is important for living things? • What are some uses of soil that you can think of? • What do you already know about soil and its properties? • What makes soil healthy or unhealthy? • Does soil need digging? Why? • How does soil impact plant growth, water retention, and organisms? <p>In addition, students could engage in a mentimeter.com answering the question as a warm-up activity 'What word comes to their mind when thinking of 'soil'? They use their tablets or mobile apps to contribute to this activity by applying three words related to 'soil'. They share the results, comment and reflect on them. Which is the commonly used word? Why? What does it show?</p>	
<p>Explore Hands-on learning Outdoor Activity DIY Soil testing: 'The finger smear test: Soil Health Investigation' 15-20 min</p>	<p>This phase incorporates the main inquiry-based activity which enables students to develop skills and concepts. Students in groups of 3-4 go outside to a garden nearby or schoolyard or a park. They take some moist soil or any kind of soil and rub it between their fingers. Two thematic questions are given in a notebook to answer and fill in the gaps.</p> <ol style="list-style-type: none"> 1. If it feels smooth and silky, then..... (i.e. it is probably pure clay). 2. If it is very gritty and coarse, then (i.e. it is pure sand). 3. What else do they observe according to smell, color, moisture, microorganisms, insects, worms etc.? <p>Alternatively, in an indoor activity students can take image 1 (Annex 1), observe and write down the differences between fertile/healthy and infertile/unhealthy soil.</p>	
<p>Explain Indoor Activity</p>	<p>The main objective of this activity is to identify and explain the components of soil (minerals, organic matter, air and water) by conducting a simple laboratory test.</p>	



Name of activity	Procedure	Time
<p>Soil Component Analysis Lab 45 min</p>	<p>Firstly, students work in groups of 3-4 and use previous soil samples in petri dishes. With the aid of magnifying glasses, they can observe soil colour, texture and smell. Using stickers, they classify the samples based on their visual characteristics.</p> <p>The next stage is the soil preparation test.</p> <p>Students in groups place a small amount of soil in a beaker and add water. They stir it and let it settle for a few minutes. They observe the formation of layers (organic matter floating, sand settling at the bottom, etc.). They discuss why different components settle differently. Each group gives their answer and writes down on the worksheet.</p> <p>The sieve soil analysis will be as following.</p> <p>Students pass different types of soil through sieves of different mesh sizes. They observe and record the proportion of small/large particles (gravel, sand, fine silt/clay). The question is to explain now how particle size affects soil texture.</p> <p>Ph testing and microscope examination is following and concluding the lab activity</p> <p>Students take a small sample of soil, mix it with water, and dip litmus paper into the solution. They now discuss whether the soil is acidic, neutral, or basic and how it affects plant growth.</p> <p>The Microscopic Examination</p> <p>Students place a small soil sample on a slide, add a drop of water, and examine it under a microscope. They look for organic matter, tiny organisms, and different mineral particles. They write down their findings in different soil samples.</p> <p>Questions that may arise:</p> <p>What are their findings? Why? In what type of soil do they find microorganisms? They discuss and share their ideas. Hence, they explain the role of each soil component (minerals for nutrients, organic matter for fertility, air for root respiration, and water for hydration). They connect their findings to real-world applications (e.g., farming, plant growth, and environmental impact).</p>	
<p>Elaborate Case study Simulation and Game-role activity on land grabbing “The great land deal – Conflict or cooperation?” 1 ½ hour</p>	<p>Students elaborate the impact of land grabbing on soil health, local communities, and environmental sustainability by role-playing different stakeholders. The aim of this role-playing simulation is to explore the conflict between economic development, soil health, and local communities when large companies or governments engage in land grabbing. Students take on different stakeholder roles and debate the future of a large piece of farmland in a developing country</p> <p>Students in groups of 3-4 are assigned different roles i.e. multinational agribusiness company, local farmers and indigenous people, environmental activists and scientists, government officials, journalists – international media- NGOs, Bank investors.</p> <p>Here are the stages of the activity:</p> <p>Students in groups receive a worksheet on their activity and an exact role play card. The scenario of the activity:</p> <p>A multinational agribusiness company is negotiating with the government to acquire a large portion of farmland for large-scale crop production. However, this land is currently used by local farmers and indigenous groups. Environmental activists and NGOs warn about soil degradation and sustainability concerns. Media and international organizations are closely watching the debate. A final decision must be made through discussion and negotiation</p> <p>Each group discusses its interests, arguments and proposals for negotiation.</p> <p>The agribusiness company presents its plan. The economic pros of land exploitation, the increase in local income, the reduction in unemployment, secure land for large scale</p>	



Name of activity	Procedure	Time
<p>Evaluate Assess Learning Reflective activity Exit ticket and reflection 20–30 min</p>	<p>agriculture to grow profitable crops, advanced farming technology, willing to implement some environmental protection etc.</p> <p>Local farmers present their arguments and objections i.e. the right to their ancestral land, their concern about soil depletion and degradation, food security, life sustainability, fear loss of traditional culture and livelihood</p> <p>Environmental activists and Scientists express their arguments on soil health, biodiversity, life sustainability, and industrial farming that leads to deforestation and pollution on water resources and ecosystems.</p> <p>International Media- Journalists raise awareness on environmental and human right issues, report and influence public opinion whereas at the same time they interview different stakeholders and investigate both sides.</p> <p>Government officials and Bank Investors support economic growth, social stability and environmental responsibility. They promote investment, fund projects and assess risk towards rewards.</p> <p>After the role play activity students reflect on their roles and evaluate through discussion. Questions that may provoke a fruitful discussion:</p> <ul style="list-style-type: none"> • Who benefited the most from the decision? • What compromises can be or were made? • How did soil health impact negotiations? • Could there be a better long-term solution? <p>Each group is assigned on a short reflection on the role-playing game and whether their perspectives have or might have changed. Plus, they suggest a long-term policy solution to address and balance economic growth, environmental health and social justice and vote for the best solution.</p> <p>They also take the multiple quiz/true or false working individually or in pairs/groups (See Annex 1).</p>	
2nd Lesson		
5E Phase	Engage, explore, explain, elaborate, evaluate	
Subject 1	Biology, Geography, Geology, Philosophy	
<p>Introduction Warm- up In door Activity (Also, for students that are familiarized with ancient Greek Philosophy)</p>	<p>The Teacher asks the question ‘What do you think makes up everything around us?’</p> <p>Students may answer this question orally or by using a web tool like mentimeter.com or tricider.com. The teacher writes on the whiteboard their answers or shares the results of mentimeter/tricider.com in class.</p> <p>Then, the teacher introduces Empedocles, an ancient Greek philosopher before Socrates, and his idea of the four components that constitute, i.e. the world, earth, water, air and fire. Second question is given: “What do you think EARTH was considered an essential element?”</p>	15–20 min



Name of activity	Procedure	Time
Engage Indoor Activity 'Touch and Guess'	<p>Students in groups have prepared small jars containers with different types of soil i.e. sand, clay, loamy soil, rocky soil and asks for a group of 3-4 students as volunteers. The teacher blindfolds with a coloured ribbon the volunteers and lets them touch the samples, describe their texture and guess what type of soil it is and where it might be found.</p> <p>A question might arise and a brief discussion about how and why people used in ancient world and still nowadays use different type of soil i.e. in pottery, farming and construction.</p>	10 -15 min
'Soil and SDGs' Indoor Activity Explore & Explain	<p>The main purpose of the activity is to raise awareness among students about the importance of taking care of the soil and to find the connection between soil health and sustainable life and development (SDGs).</p> <p>The teacher introduces (See Annex: image 2) 17 Sustainable Development Goals and asks for the connection among SDGs and Soil. 'Which one/ones do they think have strong connection with Soil? Why?'</p>	10-15 min.
Indoor Activity Discussion evaluation	<p>Students discuss the vital role of soil in promoting sustainable development by sharing their ideas and answering the questions provided via a web tool like padlet.com or alternatively, are written on the whiteboard by the teacher or delivered on worksheets for each student group.</p> <p>How can soil quality and its sustainable use influence poverty reduction (SDGs 1 & 2)? How can soil conservation contribute to improving food security (SDGs 3 & 6)? How can soil degradation affect human health (SDGs 3)? How does soil management influence water quality and access to drinking water in communities (SDGs 6)? Why is sustainable land management important to ensure responsible production and consumption (SDGs 12)? How can proper soil management help mitigate the effects of climate change (SDGs 13)? Why is it crucial to conserve soils to protect biodiversity (SDGs 11)?</p> <p>Students make an evaluation of their answers and express their agreement /disagreement upon the ideas/statements.</p>	20 min.
Explore Soil and water erosion Virtual Activity (Google Earth): Indoor Problem based learning	<p>The activity aims at showing the impactful effects of water erosion on soils. Students explore satellite images of the Earth (e.g., using Google Earth) and investigate if the soil in their locality is fertile (there is vegetation cover, crops...). They take down their conclusions and findings on a worksheet and they investigate the connection between water-soil-vegetation.</p> <p>The question given is: Does soil support vegetation? Why? Why not? What if water erosion takes place in their location/environment? What are the possible beneficial or detrimental interactions? (e.g. the contribution of water to soil formation, the harm caused by water in soil erosion, the effect of sediments on land, the movement of pollutants from soil into water bodies). Teacher imposes thought-provoking questions on the effects of</p>	30 min.



Name of activity	Procedure	Time
<p>Outdoor Activity Engage & Explore</p>	<p>water erosion on soil that engage students and stimulate critical thinking, such as the following ones:</p> <ol style="list-style-type: none"> 1. How does the force of rainwater impact different soil types, and why do some soils erode more quickly than others? 2. What long-term effects does water erosion have on the fertility and structure of soil in agricultural areas? 3. How do human activities, such as deforestation and urbanisation, accelerate the process of water erosion? 4. What roles do vegetation and root systems play in preventing or reducing water erosion? <p>Students are divided into small groups of 3-4 and go outside classroom to the schoolyard, or garden or a field nearby. Each group and each member of the group are given a specific role and a small task: Using gloves and sieves, to find and collect into jars small samples of soil, rocks, sand or plants growing in the soil. They observe their findings (i.e. colour of soil, roots, leaves, moisture/no moisture, smell, insects, dirt, plastic elements etc.) they take snaps and write down their observations on notebooks. They return to class, share their findings and discuss them. 'How soil supports life and stability?' What are the required presuppositions for maintaining life? Why?'</p>	<p>20 min.</p>
<p>Sequel Outdoor activity 'What kind of soil is beneath our feet?'</p> <p>Explain</p>	<p>The aim of this activity is students to test different soil types and recognize its different layers.</p> <p>Students in groups go outside classroom to collect soil samples from different and various locations- schoolyard, a nearby park, a garden, under a tree or even a field. They put samples in pots or bags. Students analyse pH level and recognize the different layers of soil texture.</p> <p>Step 1:</p> <ol style="list-style-type: none"> 1. Each group add some distilled water in the pot or bag of soil and drop in a few drops of universal indicator. They observe the color it goes. They record the pH score on a recording sheet. <p>Step 2:</p> <ol style="list-style-type: none"> 2. They pour all of the soil and water into a jar, and they add more water to cover the soil. They add a few drops of washing up liquid and they put the lid on the jar. They shake the jar and then leave it to settle for the next 24 hours. 	<p>20 min.</p>



Name of activity	Procedure	Time
	thoughts investigating pros and cons on padlet.com. They vote for the best solution and sustainable action.	
Learning products “Soil Stories: A digital exhibition”	<p>The Emaze.com visual presentation. Alternatively, if there is an insufficient access to the internet or no devices provided, students in groups may use a A3 blank paper to create a poster with coloured markers and crayons. They can think and write mottos about soil protection and care. They can share and present their posters in the classroom or in various places inside and outside school. As an extensive activity that requires more time e.g. three or four months, and in collaboration with the teacher of Arts, students may draw pictures/graffiti, representing different types of soil or anything that relates to soil and its protection, on the walls in the schoolyard.</p>	
3rd Lesson		
5E Phase	Engage, explore, explain elaborate, evaluate	
Subject 2	Chemistry, Biology, Geology	
Engage & Explore In door Lab Activity “Soil Testing for ph”	<p>The main objective of this activity is students to engage and explore an approximate Ph of their soil sample.</p> <p>Students working in pairs take two spoonful of soil and put one in each of two containers. First, they add enough vinegar to cover the soil. If it fizzes or bubbles the soil is alkaline.</p> <p>Second, they add some distilled water until they have a thin slurry. Now, they add a couple of spoonsful of baking powder. If it fizzes the sample is acidified. If neither sample reacts, then they have neutral soil.</p>	10 min.
Explain Indoor activity	<p>The aim of this activity is students to investigate and explain the relative amounts of sand, silt and clay.</p> <p>Students working in groups take a large wide-necked glass jar with a screw lid. They fill half with soil samples.</p> <p>And then they fill the jar with water, add a little detergent and shake to break up any soil lumps. They stand the jar in a well light area and watch as the sand fall to the bottom of the jar.</p> <p>They make their explanations and come to their conclusions.</p>	10-15 min.
Explore & Elaborate	<p>https://nt7-mhe-complex-assets.mheducation.com/nt7-mhe-complex-assets/Upload-20190715/InspireScience6-8CA/LS12/index.html</p> <p>Alternatively, in a laboratory the teacher performs the experiment and delivers each student group to answer related questions to the</p>	25-30 min.



Formative evaluation

The LOESS learning scenario must include formative assessment. Formative assessment occurs during the learning experience, and is used to monitor student learning, provide ongoing feedback, and adjust teaching as needed.

Laboratory work

- Poster/Image.
- Multiple Choice quiz.
- Visual presentation
- Self-reflective portfolio

Final assessment

The LOESS learning scenario must include final assessment. Final assessment is used at the end of the learning experience to evaluate students' overall understanding and mastery of the learning objectives. It provides a final measure of what students have learned e.g.:

- Presentation where groups of students present findings from their soil investigations.
- Multiple-choice quiz and open-ended questions on topics like soil properties, functions, and soil health.

Student feedback

Add here the method with which your students will be able to give you feedback and discuss the lesson

Students' Feedback –

- Self-reflective portfolio
- Worksheets.
- Oral comments and observations

Teacher feedback

My initial inspiration for this learning scenario comes from a deep interest in the intersection between environmental issues and soil health, particularly its role in ecosystems. Recognizing soil as a critical yet often overlooked resource, students are expected to understand its importance for both environmental sustainability and human activity. Multiple kind of resources are accompanied with discussions, observations, hand-on activities and experiments. All of these encourage, engage and empower students to investigate real-world problem and make connections between soil health and broader environmental issues. Throughout the learning process, the 5E Instructional Model is used, which enhances problem-based and inquiry-based approach. This model and the integration of interactive platforms enables to create a dynamic, student-centred learning environment that promotes communication, collaboration, critical thinking and creativity (4Cs) plus problem-solving skills. With the help of digital resources and hands-on tasks, a rich, interdisciplinary learning experience can be well evolved succeeding its predefined learning objectives and contribution on raising students' environmental awareness (See also Teacher's Feedback rubric - Annex 3).



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 initial idea for this learning scenario comes from the importance of soil in our daily lives and its direct connection to sustainability and environmental education. In this LS the focus is on soil because it is often overlooked, yet it plays a crucial role in supporting plant growth, water filtration, and ecosystems. I wanted to design an engaging and hands-on activity to help students understand these concepts better and the importance of soil health in our daily lives. Plus, educational resources on soil science are used and best practices for teaching STEM concepts to young learners. All activities included are simple to understand and implement even by teachers who are not teaching STEM subjects. Planning and developing this scenario are a well strategy to refine our skills in creating structured yet flexible lesson plans and estimating the value of connecting classroom learning to real-world issues, which makes the lessons more meaningful and engaging for students.



Annex 1 – Add here the title of your annex

You can add in Annexes the necessary materials that can be printable, etc.

Lesson 1

Soil Health Evaluative Quiz (Working individually)

Name: _____

Date: _____

Class: _____

Multiple Choice (Circle the correct answer)

1. Which of the following is a characteristic of healthy soil?
 - a) High in organic matter and microbes
 - b) Compact and hard with no root penetration
 - c) Dry and cracked with little water retention
 - d) Lacking in earthworms and other organisms
2. What is the main function of microorganisms in the soil?
 - a) To compete with plants for nutrients
 - b) To break down organic matter and improve soil fertility
 - c) To remove water from the soil
 - d) To make soil more compact
3. Which farming practice improves soil health?
 - a) Over-tilling the soil frequently
 - b) Planting cover crops and using compost
 - c) Using only chemical fertilizers without organic matter
 - d) Removing all vegetation from the land
4. How does soil erosion negatively affect the environment?
 - a) It helps plants grow better
 - b) It increases the soil's ability to hold nutrients
 - c) It removes the topsoil, which is rich in nutrients
 - d) It has no real impact on plant life

True or False

5. ___ Soil with a balanced pH and good structure promotes plant growth.
6. ___ Earthworms and fungi are harmful to soil health.
7. ___ Cover crops can help reduce soil erosion and improve soil nutrients.
8. ___ Compacted soil allows water and roots to move freely.

Short Answer (Working in pairs)

9. Explain why organic matter is important for soil health.

10. Describe two human activities that can degrade soil health and how they can be prevented.

Case study simulation (Working in groups of 3-4):

11. Imagine you are a soil scientist. What steps would you take to improve unhealthy soil in a community garden?





Image 1 created by the teacher via <https://chatgpt.com/>

1. Formative Assessment:

- Make comparisons and list the differences between healthy and unhealthy soil.
- In groups, answer in brief words the following questions:
 - What do you notice in the healthy soil that is missing in the unhealthy soil?
 - How do these differences affect plant growth and ecosystems?
- First think and make a google research to examine why these differences occur. Share your findings in class.

2. Soil Health Debate/Dilemma

Students are divided into two groups. One group argues why soil health should be prioritized in agriculture, while the other argues for short-term intensive farming.

3. Storytelling with Soil (Creative Thinking)-Role playing



- Write an essay about your soil story: e.g. Imagine you are soil and describe your life, the creatures living in you, and how human activity affects you.

SUSTAINABLE DEVELOPMENT GOALS



Image 2 Sustainable Development Goals, derived from

<https://www.un.org/sustainabledevelopment/news/communications-material/>

Lesson 2

Multiple choice quiz

What are the three main soil textures?

- A) Rocky, Smooth, Hard
- B) Sandy, Clayey, Loamy
- C) Wet, Dry, Muddy
- D) Organic, Inorganic, Mixed

2. What determines the color of soil?

- A) The type of plants growing in it
- B) The amount of moisture present
- C) The minerals and organic matter in the soil
- D) The season of the year

3. Which type of soil is best for farming?

- A) Clayey soil
- B) Sandy soil



- C) Loamy soil
- D) Rocky soil

4. How does moisture affect soil texture?

- A) It makes the soil smoother but does not change its texture
- B) It can make the soil feel sticky, crumbly, or compact depending on the type
- C) It changes the color but has no impact on texture
- D) It makes all soil types feel the same

5. What does it mean if soil has a high clay content?

- A) The soil will drain water quickly
- B) The soil will hold water and feel sticky
- C) The soil will be loose and dry easily
- D) The soil will be full of large rocks

6. How can human activity negatively affect soil quality?

- A) Adding compost to improve nutrients
- B) Cutting down trees and exposing soil to erosion
- C) Using crop rotation to keep soil fertile
- D) Allowing plants to grow naturally

7. Which process causes soil erosion?

- A) Planting more trees
- B) Excessive rainfall and wind removing soil particles
- C) Adding fertilizer to the soil
- D) Burying rocks under the soil

8. Why is soil important in the water cycle?

- A) It absorbs and filters rainwater before it reaches underground sources
- B) It blocks rainwater from entering rivers
- C) It prevents plants from taking up water
- D) It stores water permanently without releasing it

9. What is one way to improve poor soil quality?

- A) Remove all organic matter
- B) Add organic compost and minerals
- C) Cover it with plastic sheets
- D) Burn the topsoil layer

10. Which factor has the most impact on soil fertility?

- A) The type of rocks under the soil
- B) The number of insects in the area
- C) The amount of organic matter and nutrients in the soil
- D) The color of the soil

Annex 3- Teacher's feedback rubric

Criteria	Excellent	Good	Satisfactory	Non-Satisfactory
Soil Health Understanding				
Application of Knowledge				
Critical Thinking				



