SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Underground coding	Grade 3 – Soils in the Environment

Lesson Plan

Coding Tool	Offline coding
Cross-curricular	N/A

Big Ideas

- Soil is made up of living and non-living things
- The composition, characteristics, and condition of soil determine its capacity to sustain life

Soil provides a base for forests, fields, farms, and gardens and is necessary to many different kinds of animals and plants. Through investigations, students will learn that soils are composed of a variety of living and non-living things and earth materials; that there are different kinds of soil; and that the unique characteristics and composition.

Specific Expectations

2.2 investigate the components of soil, the condition of soil, and additives found in soil, using a variety of soil samples from different local environments, and explain how the different amounts of these components in a soil sample determine how the soil can be used

2.3 use scientific inquiry/experimentation skills, and knowledge and skills acquired from previous investigations, to determine which type(s) of soil (e.g., sandy soil, clay soil, loam) will sustain life

Description

Students will learn about soil characteristics while applying coding concepts. Using pseudo-code representing a coding algorithm, students will sort soil samples and understand how the mind of a computer works. Programmers and computers use conditional (If Else) statements to accomplish various tasks and your student will explore these conditions in this lesson.

Materials

For entire class or for each group (group number is to your discretion)

- Sand sample
- Natural clay sample
- Loam sample
- Silt sample
- Spray bottle with water
- Magnifying glass
- Spoons or tweezers
- Fine mesh strainer
- Spare containers (per student/group)

Computational Thinking Skills

- Conditional (If Else) statements
- Algorithms
- Pseudo code
- Flow charts

Introduction

- Using pseudo-code helps your students understand the process of deduction.
- Computers use the If Else statement in order to accomplish a task. This involves going through a series of possibilities and eliminating what doesn't apply.
- By using the handout provided, your students can visualize the pseudo-code.
- Your students will examine the different soil samples and use the flow chart and/or the pseudo-code to arrive at a conclusion in order to identify the type of soil.

Action

- This activity can be done individually or in groups.
- All soil samples should be labeled as sample A, B, C…
- It is recommended that there are multiple samples of the same soil (for each group and in case of cross contamination)
- Use the Underground Coding Handout (or you and your students make your own) to complete this activity.
- As your students go through the flow chart of various samples, they will attempt to identify what the sample is.
- The pseudo-code is to show the same process they are doing, but in a mindset of a computer.
- In the pseudo-code, emphasize on the If Else Condition. Ie: If the first condition is false, another condition is presented.
- Encourage your students to use the magnifying glass, strainer, tweezers to examine each sample.
- Your students can first refer to the flow chart to identify the samples then use the pseudo-code.
- For a challenge, have multiple samples of the same soils for your students to examine the characteristic rather than use deductions as they go through.
- To test:
    - **Air:** your students will insert one finger into the sample to determine the density. If it is difficult to insert, then the density is higher. When the density is higher, the air content is low since there is not a lot of space in between the particles.
    - **Particle:** using the magnifying glass, your students with examine the size of particles of each sample. They can also take a small amount between their fingers to feel the particles. Smaller particles are very fine and difficult to see and feel.
    - **Water:** your students will take a small amount of the sample and put it in the strainer and place it on top of the spare container. With the spray bottle, they will spray the sample 10x. as the water travels through the sample, your students can see the amount that drips into the container. If a lot of the water drips, then the soil does not retain water.
    - **Colour:** colour varies depending on the soil sample you have. Generally, sand is light tan, silt is dark brown or red, clay is light brown or grey or light red and loam is dark

brown or even black.

Consolidation/Extension

It is possible to modify this lesson depending on the coding skill-set of the students. For beginner coders, it is recommended that you simply follow the flow-charts and pseudo-code to identify the soils. With more experience however, students can start creating their own flow-charts and pseudo-code based on the table of properties. One method would be to analyze the pseudo-code as a group for one of the soil tests. With this familiarity, create a second algorithm together for a different soil test, then for the third or fourth soil test, let the students try to make their own pseudo-code.

Additional Resources

Definitions

- **Soil** is a mix of minerals, water, air, organic matter, and organisms that are decomposing dead organism.
- **Sand** is loose granular material that results from the disintegration of rocks, consists of particles smaller than gravel but coarser than silt. Sand is formed by fragmentation of rocks (granite, limestone and quartz).
- **Silt** is loose sedimentary material with rock particles deposited by river
- **Clay** is composed mainly of fine particles of hydrous aluminum silicates and other minerals, and that is used for brick, tile, and pottery
- **Loam** a soil consisting of a friable mixture of varying proportions of clay, silt, and sand