ACTIVITY 2

WHAT ARE THE NEEDS OF PLANTS?

EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students learn about the nutritional needs of plants.

ESSENTIAL KNOWLEDGE

Matter:
- Characteristics of living things: metabolism of plants (nutrition)
- Transformations of living things: growth of plants

Energy:
- Sources of energy for living things: photosynthesis in plants

Appropriate language:
- Terminology related to an understanding of the universe
- Tables
- Drawings, sketches

SUGGESTED MATERIALS

Perishable non-scientific materials:
- Seeds (lentils, beans)
- Young plants (stems of about 5 cm)
- Soil
- Water

Household materials:
- Pieces of polystyrene
- Pots (small and medium)

School equipment:
- Cupboard or large opaque box

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

Have you ever looked around you—at school, at home, or outside—and noticed that some plants are very green while others are yellow or withered? Why? Do plants have specific needs to thrive?

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

Before starting the experiments, it is suggested to observe the plants and trees in the school yard and surrounding area and to describe the environments in which they do or do not thrive.

INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

Example 1
I predict that if I place a plant in a completely dark place it will die. I predict this because at home, the plants are placed near windows.

Example 2
I predict that if I do not water a plant regularly it will die of thirst. I predict this because when the dirt in a pot is completely dry, the plant is often withered out.

Example 3
I predict that if I put a plant in a pot of water without dirt, it will be just as healthy as if it were planted in dirt. I predict this because at home we put plant stems in a glass of water while waiting to plant them in dirt.

WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

Example A
The students place plants in a location without any light (e.g., a cupboard or a large opaque box) and observe them once or twice a week. They record the date of each observation and describe each plant according to criteria such as color, number of leaves, general condition (withered, yellow, etc.).

Example B
The students place plants in a bright area (e.g., near a window) and do not water them. They observe the plants once or twice a week, noting the date and describing each plant according to criteria such as color, number of leaves, general condition (withered, yellow, etc.). The students might suggest watering one of the plants regularly to compare it to the others.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

Example C
The students remove several plants from their pots and place them in pots without dirt. They determine in advance whether or not to water some of them or to place them in sunlight or darkness (experimental factors). They observe the plants once or twice a week, noting the date and placement of each one and describing each plant according to criteria such as color, number of leaves, general condition (withered, yellow, etc.).

EXPERIMENTAL FACTORS
To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Light
- Watering
- Condition of plant before experiment
- Lack of air (e.g., box closed to create darkness)
- Ambient temperature (e.g., near a radiator)

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The students will be better able to answer the initial question if they pool their results. Were they able to verify their hypothesis? Did they think their experiments were successful? Why? Each team could present drawings or descriptions of the plants done over the course of the experiment. The overall results could be compiled into a table.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

The students conduct further research to find plants with unexpected needs or that have special adaptations to survive in their environments.

SCIENTIFIC CONCEPTUAL CONTENT

Essential needs

Like all living things, plants must breathe and take in nourishment in order to grow. Plants need water, minerals found in the ground, carbon dioxide in the air, and a suitable temperature and amount of light. A plant's needs vary with its age.

Plants make their own food

Plants make food and produce energy reserves so they can thrive and grow through a process called photosynthesis. To engage in photosynthesis, plants need light (a source of energy) and carbon dioxide (CO_2). The plant's leaves are specially adapted to use energy from light to transform water and CO_2 into glucose (sugar) and release oxygen into the atmosphere. The glucose then travels out of the leaf and is distributed throughout the rest of the plant. Plants (green plants, phytoplankton and algae) make their own food and fulfill their own nutritional needs. These organisms are called autotrophs, or "primary producers," and they make up the first link in the food chain.

"1, 2, 3… sunlight"

While carbon dioxide is readily available in the air, light, on the other hand, is not always accessible. This is why plants "move" to seek out and capture as much sun as possible with their leaves. This is the case with climbing plants, for example.

Waterless, or nearly so

Some plants, such as those that grow in deserts, are highly adapted to a lack of water or even droughts. For example, cactuses have replaced their leaves with spines to limit their transpiration surface, and they carry out photosynthesis in their stems, which also store water. They capture the rare drops of water that fall to the ground or in the morning dew. Agricultural researchers are developing transgenic varieties of plants such as tomatoes and wheat that resist drought.

CULTURAL REFERENCES

Science and technology and other fields of human activity

Have you ever noticed that in a greenhouse, some plants grow in polystyrene? In fact, dirt is not really necessary for a plant to grow. Instead, it provides a support medium where the plant can grow roots and that contains air and nutrients. What is most important is the nutrients contained in the soil: minerals. In a greenhouse, plants soak in water that contains all the minerals they need to grow. The plants grow in an artificial environment that is completely controlled (minerals measured out according to the plant's stage of development.) This is called hydroponics. It would be interesting to visit a hydroponic greenhouse.

Impacts

Why do we say that forests are the lungs of the Earth? Because trees breathe in carbon dioxide (CO_2) that humans and animals emit into the air through respiration and other activities, transforming it into the oxygen we need to live.

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:

www.eclairsdesciences.qc.ca

REFERENCES

Cuerda, Joseph. *Atlas de botanique*. France: Gamma, 2004.

Collective. *Les plantes: Comprendre la diversité du monde végétal*.
"Guides de la connaissance" collection. Montréal: Collectif Québec Amérique, 2005.

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PROCESS OF ACTIVE DISCOVERY

GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

Context related to everyday life

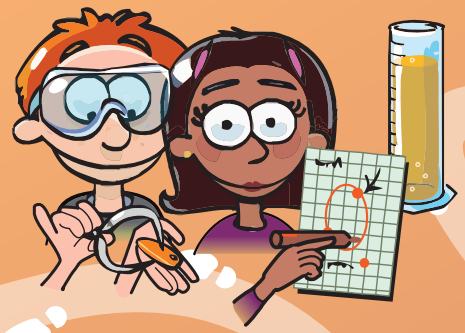
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

Initial ideas and hypothesis

My initial ideas:
- I share my own ideas.

My hypothesis:
- I predict that... I think that because…
- I imagine my prototype.
- I think it works like this…

Planning and carrying out



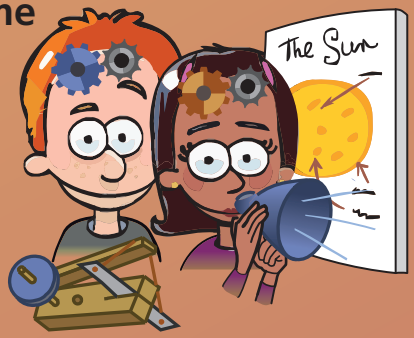
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

Carrying out my process:
- What will the steps be?
- What precautions should I take?

My actions:
- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

My results:
- What is my answer to the problem, question or need?

Outcome



My outcome:
- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

New question?

What I learned:
- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

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