ACTIVITY 6

HOW TO BUILD A VIABLE TERRARIUM?

EXPERIMENT OBJECTIVES AND CONTENT

The goal of this activity is to allow students to observe the interactions between plants and animals, along with their reactions to changes in their environment, in a terrarium. The activity also aims to foster the development of a more respectful attitude toward all living things.

ESSENTIAL KNOWLEDGE

Energy:
- Transformation of energy in living things: ecological pyramids

Systems and interaction:
- Interaction between living organisms and their environment: adaptation

Techniques and instrumentation:
- Use of simple measuring instruments
- Design and manufacture of environments (terrarium)

Appropriate language:
- Terminology related to an understanding of living things
- Tables
- Drawings, sketches

SUGGESTED MATERIALS

Scientific equipment:
- Empty aquarium or terrarium
- Lid with wire mesh or slots
- UV lamp (for reptiles)
- Scales

Perishable non-scientific materials:
- Small living organisms (plants, insects, spiders, snails, earthworms, amphibians, reptiles)
- Tap water
- Soil, dirt, sand
- Gravel, stones
- Pieces of bark
- Various types of food (apple cores, cut flowers, leaves, sugar cubes)

Household materials:
- Lamps
- Rubber gloves
- Shallow plastic dishes
- Water sprayers
- Gardening tools

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

While walking near your chalet, you encounter small animals: insects, salamanders, and frogs, and you wonder how they live and what they eat. So you decide to recreate part of the ecosystem these animals normally inhabit. How will you go about it?

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher begins a discussion about the students' personal experiences with keeping small animals in captivity or on the lives of animals in nature. Next, the teacher asks the students to go for a walk in the neighborhood to collect a few specimens. Special care should be taken to handle the collected organisms with respect.

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 I can create an environment that ants will like by using dirt and placing fruit on it. I predict this because I saw ants come out of the dirt and eat an old apple in a park near my house.

Note: Social insects such as ants and wasps are difficult to keep in captivity because of their very complex social structure.

Example 2
I predict that to keep amphibians, annelids (segmented worms) or mollusks, I will need water. I predict this because I often see frogs, earthworms and snails come out after it rains.

Example 3
I predict that I will need plants and flowers to feed insects. I predict this because I often see ladybugs and caterpillars wherever there are plants and flowers.

Example 4
I predict that earthworms need specific kinds of food. I predict this because my dog, my cat, my budgie and my fish don't all eat the same thing.

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 different substrata in the bottom of a terrarium (empty aquarium): dirt to the left, sand in the middle and gravel to the right. The students then put a small creature or insect inside. The animals should be able to access the three substrata without any obstacles. The students observe and record the animals' preferences and what they do with the different substrata available (dig tunnels, build nests, etc.). They could also prepare three identical terrariums and introduce a specific animal into each one (e.g., ants, worms and a small lizard).

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

Example B
The students use a water sprayer to humidify one half of the terrarium and place a small dish of water there, while they leave the other half dry and without water. They observe and record the behaviors of the snails.

Example C
The students place plants in the terrarium. They should try their best to create an environment that will allow insects to survive. They observe the behavior of the animals and record their interactions with the plants. Based on their observations, they adjust the different parameters of the terrarium to improve the environmental conditions for the inhabitants.

Note: To meet the nutritional requirements of plant-eating insects, it would be a good idea to put in the terrarium a plant of the same species on which the insect was found.

Example D
The students place different sources of food on the bottom of the terrarium: apple cores, dead leaves, green leaves, cut grass, cut flowers, or bits of branches. The students observe and record which of the food sources were eaten (or not) by the earthworms in order to determine which types of food they prefer.

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

- Amount of light
- Amount of warmth (be careful with heating devices)
- Level of humidity
- Stress level of captive animal
- Size of terrarium
- Maintenance of terrarium (clean dirt or soil and water, green plants)

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The students summarize their observations and learning in the form of a table or concept network. They may also draw or photograph their animal and its ecosystem. The activity may be enriched by comparing the conditions of their animal in the terrarium and those prevailing in nature.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

A fieldtrip with a naturalist in a regional or provincial part is an excellent way of making students aware of the intrinsic value of nature and of the fact that all living things depend directly or indirectly on one another. The students may also design a class project on the composition of the human ecosystem, inspired by the following questions: What do we need to live? What might an extraterrestrial think by watching us?

SCIENTIFIC CONCEPTUAL CONTENT

Terrarium

A terrarium is a closed environment that imitates a biotope (i.e., a natural environment). They are often used to raise reptiles, amphibians, or insects, and sometimes small mammals.

Building a terrarium

A terrarium should imitate the natural environment as closely as possible. It should contain:

Air: A wire mesh cover helps avoid the air becoming stagnant (which can lead to the development of unwanted moulds).

Water: A dish of clean water should be made available to animals in the terrarium and changed every day. The environment can also be lightly humidified with warm water in a spray bottle. It is suggested to check the humidity requirements for each species.

Soil: Garden or potting soil is fine for most animals (soil should be changed once a week for amphibians, reptiles and small mammals in order to remove their excrement).

Light and warmth: Light is vital for plants and diurnal animals. UV (ultraviolet) rays may be necessary for certain species for functions such as vitamin D synthesis. UV rays can come from neon bulbs emitting a mixture of UVA and UVB rays, or a sodium lamp. Light also provides warmth, which is very important for cold-blooded animals. Lights should be turned out at night to lower the temperature and allow diurnal animals to sleep and nocturnal animals to be active.

Shelter: Many creatures need places to hide (shelter beneath rocks, bits of bark, etc.). Such locations allow them to avoid the light of day (e.g., salamanders), conserve their body moisture (e.g., wood lice) or conserve body heat at night (e.g., snakes). Hiding places also provide shelter against potential predators.

Ecological pyramid

An ecological pyramid is a collection of several food chains within an ecosystem. The elements of a balanced ecosystem always form a "pyramid" because there are always more plants than herbivores, more herbivores than carnivores, and more decomposers than carnivores. At the base of these systems are four non-living elements vital to life: earth, water, light (heat) and air.

Ecosystem
An ecosystem is the interaction between biotic factors (living things) and abiotic factors (all physical and chemical factors such as salinity, temperature, light, grain size of soil, etc.) in a given environment.

Insects and small animals
Every species of caterpillar feeds from specific plants. Thus it is preferable to know the species of caterpillar captured in order to provide it with the proper food.

Snails and slugs eat a wide variety of plants; however, they require moisture.

Earthworms, wood lice and millipedes feed on decomposing matter (e.g., dead leaves) and require high moisture levels (not millipedes).

Ladybugs are carnivorous and prefer to eat aphids. Aphids eat plant sap.

Spiders are carnivorous and prefer small flying insects such as flies, mosquitoes and small butterflies.

The American toad, common garter snake and blue-spotted salamander prefer earthworms and insects, and require shelter to hide.

Note: For American toads, blue-spotted salamanders, common garter snakes, meadow voles and shrews, you are legally required to apply for a permit to keep them in captivity. The Québec department of natural resources and wildlife (*Ministère des Ressources naturelles et de la Faune*) issues what are called SEG permits for this purpose (i.e., science, educational and management permits). Applications must be made two weeks (10 working days) in advance.

TO OBTAIN AN SEG PERMIT, YOU CAN CONTACT THE WILDLIFE DEPARTMENT OF THE ESTRIE, MONTRÉAL AND THE MONTEREGIE AT: 450-928-7608.

CULTURAL REFERENCES

Science
Herpetology is the study of amphibians and reptiles. Herpetologists classify amphibian species according to their vocalizations. Students could try to identify amphibians using an audio compilation of different species' vocalizations. The CD *Les sons de nos forêts* (available at the *Centre de conservation de la faune ailée* and other nature stores) is an excellent tool.

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

www.eclairsdesciences.qc.ca

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Conception
GUEPE

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PROCESS OF ACTIVE DISCOVERY

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

Context related to everyday life

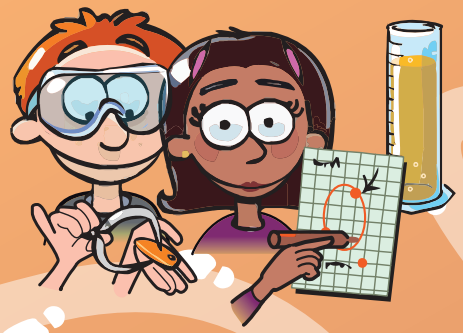
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

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



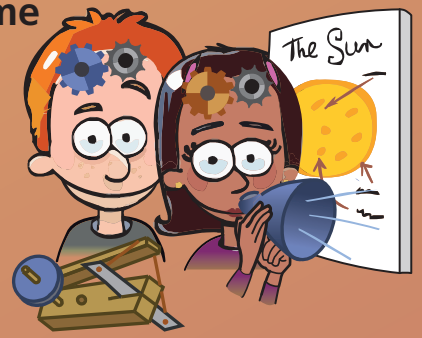
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

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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