



SPACE 
awareness

PLANET EARTH

TERRAFORMING

DIDACTIC COURSE FOR PRIMARY LEVEL

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Information about the course

Brief description: The activity deals with both extra-terrestrial worlds and our home planet, Earth. By educating children about the life-essential conditions and life forms here on Earth and comparing them with those of other worlds, they learn that this is the only place in the universe that is suitable for life as we know it up to now. That promotes respect for the environment and a sense of a global community.

The students have the opportunity to review the habitats and the life forms adapted to a specific habitat. This activity is part of the school project *The Space Explorers*, inspired by the 6-7 year old children from the Discovery Kids Primary School, Ramnicu Valcea, in Romania.

Curriculum topic:
Planet Earth. Habitability.
Integrated Science,
Language and Art

Category:
Our fragile planet

Keywords:
Terraforming, space,
planet, Earth, climate,
survive, wet, cold, warm,
rainy, algae, fauna,
animals, snow, ice,
vegetation, plants,
habitat, habitability,
adaptation.

Age range:
6-10

Education level:
Primary

Language:
English

Students' prior knowledge:
Animal habitats, life
beings, life-cycles, food
chains

Didactical hours:
1

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Educational Objectives:

Types of Knowledge	Cognitive Objectives	Affective Objectives	Psychomotor Objectives
Factual	to remember Children describe different types of habitats and name animals/plants which live in a specific habitat.	to pay attention Pay attention to the teacher and to their classmates.	to imitate and try Act like <i>scientists</i> .
Conceptual	to understand Children understand the adaptation of animals/plants to their environment, describe the features of life forms as a result of adaptation. Understand life cycle sequences, food chains.	to respond and participate Answer the questions, participate in the activity, complete the tasks.	to perform confidently, following instructions Act like <i>scientists</i> .
Procedural	to apply Relate new information to previous knowledge and to the problem at hand. Compare the environmental factors of the new planets with specific habitats on Earth. Choose animals and plants suited to specific environmental conditions from these extraterrestrial worlds. Make models/terra-formations of these worlds.	to recognise values Develop an environmental awareness and a sense of global citizenship.	to perform independently, skilfully, and precisely Model the extraterrestrial habitats.
Meta-cognitive	to think critically and creatively Thinking critically and creatively, children add/remove/ animals and plants to/from their models. Describe their work, talking about the life forms they selected for these extraterrestrial environments.	to form and follow a system of values Improve creative thinking. Practise effective teamwork. Pay attention to classmates' reactions, feelings. Promote respect for the environment. Promote respect for hard work and commitment.	to adapt and perform creatively Improve and modify their models according to new ideas/ specifications.



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ORIENTATION

Terra = the Earth, forming = shaping. Even the 6-year-olds realised what the term means: making a planet Earth-like. It is the name given to the process of deliberately modifying the conditions on a planet (atmosphere, temperature, surface topography and ecology) to make it habitable by Earth-like life. The term is a synonym for planetary engineering and it is an idea present both in science fiction and in scientific debates. Terraforming has not yet been put into practice but, as we well know, the environment can be altered on purpose. It can be a slow process, depending on the conditions of the specific planet and the present development of technology and the economy does not allow for such large investments. Scientists have already thought about terraforming Venus, Mars, the Moon, Europa or other bodies in the Solar System. Of course, for us adults the question of how ethical terraforming is may rise. But to children this new concept is appealing and may inspire their imagination.

To start with this lesson, we can use some space music with our students like this sample from YouTube:

<https://www.youtube.com/watch?v=EfZxZmbbWl8>

The length of the video is 7:58 min, but it can be shortened once children are immersed in the topic.

After the video, we will start a role play activity where we explain to the students that they are scientists who have the responsibility to choose various living beings from Earth to introduce them in two new planets where they will be able to survive.

“We are scientists.”

“Our mission is to design a space colony.”

“In order to ensure a better life for the future colonists we have to choose some life forms from Earth adaptable to the newly discovered extraterrestrial worlds.”

“The space explorers send us important data about two promising new planets. The Discovery Spaceship first landed on a small planet covered with ice and salty water. The next planet it visited is also a small one but different, as this one had rich, rainforest-like vegetation, fresh water and plenty of insects.”

“On both planets, breathable air is present and low and high temperatures are comparable to those on the Earth.”

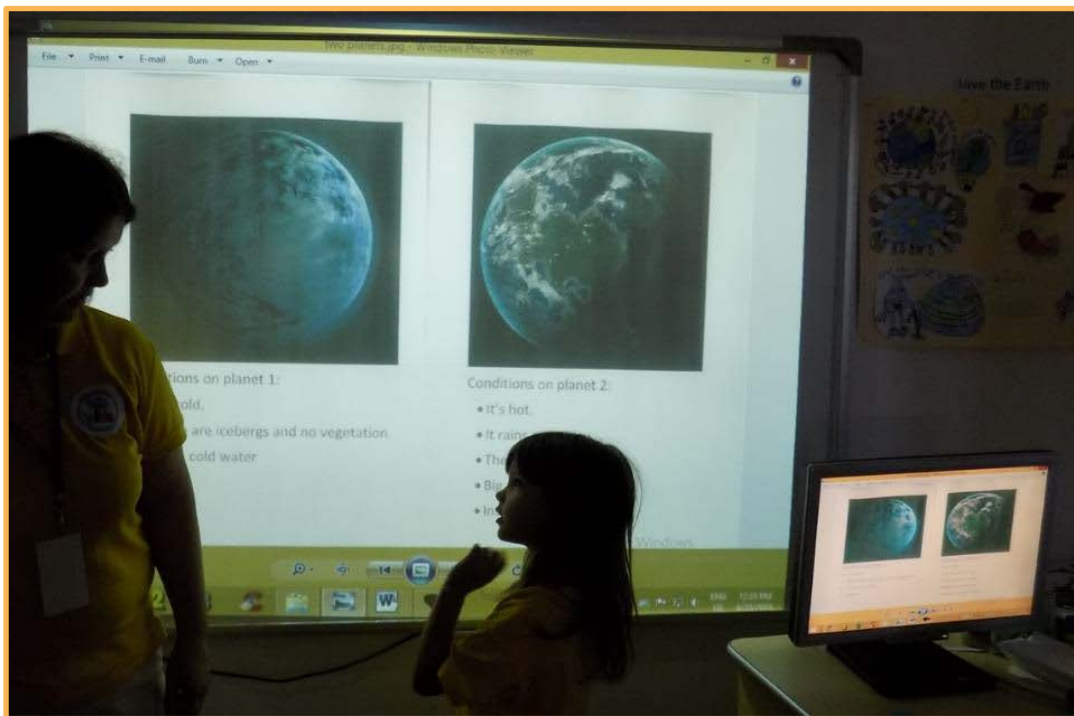
“The first planet is of course cold and the life forms are just algae present in the salty water. The climate on the second planet is warm and wet with daily showers.”

The mission task, terraforming the two planets, is projected on the Interactive White Board. After asking about the possible meaning, explain in simple words what terraforming is.

“What is terraforming?”

“It is the name given to the process of deliberately modifying the conditions on a planet (atmosphere, temperature, surface topography and ecology) to make it habitable by Earth-like life.”

Then project the worksheet included at the end of this teaching sequence. Show the images of the two planets and some brief information about each of them.



EXTRA GUIDELINES

Use of ICT tools and other resources

Other suggestions for the introductory space music are:

<https://www.youtube.com/watch?v=S9pCUEIIDLE>

https://www.youtube.com/watch?v=y73LYL_EiUQ

Use of a projector or Interactive Whiteboard to show the conditions of the planets to students.

CONCEPTUALISATION

Children read and offer feedback on the information to make sure they understand exactly the nature of the two planets.

Then we can put these questions to the students:

“What animals could you as scientists take to the two planets in the process of terraforming?”

After we have listened to their ideas, we can explain to them the hypothesis that:

“On the cold planet we could bring animals that live at the poles, while the warm and wet planet we could populate with animals that live in the rainforest.”

Next, they are presented two models: a plastic container, with ice and white pebbles into which we introduce salty water for the cold planet; and a tray covered with colourful playdough, with vegetation represented by plastic trees. On this tray we earlier covered a small bottle with playdough to get the shape of a volcano. To make sure everything is ready for the final surprise, we have previously filled the bottle with vinegar, red food colouring and a drop of liquid soap.



EXTRA GUIDELINES

Materials needed:

Materials for Planet 1: Plastic container, ice, white pebbles, salt and water.

Materials for Planet 2: Tray, playdough, plastic tree figures, small bottle, vinegar, red food colouring, liquid soap.

INVESTIGATION

In this stage, give children a large number of plastic animals that live in different places on the Earth. Tell them that they are the scientists who will have to decide which animals they will try to adapt to each of the two planets. Divide the class into two and give them 15 minutes to think it over and place the animals.

“Which animal can survive in a cold / warm / wet environment? What would it eat? Which animals would feed on the chosen animal? Are the features of this animal compatible with the environment?”

Let the children make their own choices; they will start discussing and debating on different animals. We try to make ourselves invisible and not interfere in any way. However, we should be attentive to the exchange of ideas.

Interesting topics might be discussed within the two groups: the monkey should be placed in the trees, while the gorilla lives on the ground, you should not place the bird next to the crocodile as the parrot could easily be eaten, we need more animals that feed on insects because there are many creepy-crawlies on this planet.

EXTRA GUIDELINES

Using ICT as an alternative:

You can create two PowerPoint slides, one for each planet.

The background can represent the nature of the planet, so one will be green or trees, and the other can have a background image with ice.

On one side of the slide you can download many different “clip art” images of animals. For example: Go to “insert”, click in “Online Pictures” and search for “clip art monkey”. Once you have your PowerPoint ready, share it with the students and make sure they all collaborate in the activity.

CONCLUSION

The animals that live at the poles are the best suited for the cold planet. Small fish could feed on algae, and bigger fish, whales, seals and penguins could eat the fish while polar bears could feed on seals and fish. Reindeer and other plant-eating animals could not survive even if they are adapted to cold temperatures.

The warm, wet planet inhabited by a large number of insects could accept some insect eaters such as lizards, frogs, snakes, birds and also fruit eaters like monkeys, rodents or toucans. Bigger carnivores could feed on monkeys and other small animals.

Encourage them to add as many animals or plants as they think are suitable to the environment. Guide them to pay attention to the balance: big/small animals,

carnivore/herbivore animals. Provide one copy of the worksheet for each group, where they can write their results.



DISCUSSION

Get all the children in a large circle so that each of them can see the two planet model. The children will present their work and explain their choices. Ask them to give full attention to classmates and to what other teams are presenting. Encourage the children from the other groups to analyse their classmates' choices, make comments and say which animals would not be suited/should be added to that environment. Make sure that all the children are involved in the discussion/presentation. Ask the children to respect different opinions and points of view. Help them to identify alternative explanations and choices.

Dry ice can be a fantastic surprise to end this lesson. A little dry ice made our volcano smoke and the bicarbonate made it erupt. On the other hand, the children who worked on the icy planet could make their own icebergs by combining water and dry ice in cone-shaped glasses.



This resource was developed by volunteer teachers and the Space Awareness team. Space Awareness is funded by the European Commission's Horizon 2020 Programme under grant agreement n° 638653.



WORKSHEET

Data: _____

Crew members: _____

Mission task- the terraforming of the next two planets.

Listen to/read the data carefully:

	
<p>Planet 1</p>	<p>Planet 2</p>
<p>Small Air to breathe (Earth-like atmosphere) Average temperature: -10°C. Cold Large oceans with salty water, covered with ice Small frosty land areas No vegetation Some ocean life forms detected like fish and shell fish</p>	<p>Small Air to breath (Earth-like atmosphere) Average temperature: 30°C. Warm. Lot of fresh water Rich rainforest-like vegetation Plenty of bugs detected</p>

Write a name for each planet.

Choose and write down at least 3 suitable life forms for each planet and explain your choices:

No.	Planet 1	No.	Planet 2



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