Development Spaces, 2023-2024

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Seasons around the globe

Learning goals, project description, and a lesson plan for an educative, interactive, and interdisciplinary robotics project, on the phenomenon of the four seasons on different parts of the globe due to the inclination of the earth.

1. Information about the Project

a. Name of the project

Seasons around the globe

b. Name of the team and team members

We are MAFY. You probably wonder how this group began its journey. So, it was our first day in the course of Development Spaces. Aurora, Jakob, Michael and Saga formed a group together and that was the start of MAFY. We got to know each other better and we were thinking about our group name. To make it quick, everybody of us said a letter that came to our mind and put them together: M-A-F-Y.

2. Digital Stories as Unexplained Phenomenon

One of our team members could not understand, as a child, how the seasons work around the globe. It all started with the confusion about Australia having Christmas during European summertime (July). She could not understand that it can be summer and winter at the same time around the globe. We chose to do our Digital Story about this unexplained phenomenon. In our Digital story there is a child with her father in Christmas Markets.

Script from the Digital Story:

“When I was a little child, I always loved Christmas markets! The treats were so yummy, I always wanted some… and the beautiful ornaments! One day it was extremely cold and I told my dad that I was freezing. I asked him: ‘Christmas is great, but why does it always have to be so cold?!’ Dad answered: ‘Well, it’s winter, darling. If you don’t like it, you have to go to Australia, because they celebrate Christmas in summer.’ I was confused: Why would they celebrate Christmas in July?! - ‘That can’t be!’, I thought, so I looked it up on the internet. For the next few years, I thought Australians were crazy.”

Storyboard from the Digital Story -video.

Check out our Power Point Presentation about this project to watch the video!

(The picture of Santa Claus with a ukulele was created by Bing AI Image Creator. The rest of the audio and video material was made by Aurora, Jakob, Michael and Saga.)

3. The Aim of the Activity

a. Target groups

Our project is designated for a 2. class in middle school. The pupils will be of the age of 11-12 years. The pupils do not have to have perfect language skills in German nor to have a special education in programming.

b. Learning objectives

Competence referring the curriculum:
“The pupils should be able to demonstrate the formation of day and night, seasons and moon phases through motion sequences and lighting conditions in our solar system, either scenically or with models” (translated to german from: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20007850)

The pupils should get a basic understanding of coding and problem solving. Furthermore, we have the aim to motivate pupils for a further professional education in programming, where we take the first steps to it. Another aim is the training of their social skills, which they will have to use in the group work. Everybody has to be included in the work and they have to achieve the goal together with united forces. Nobody has to do the project alone and if we as a teacher see signs to it, we have to interfere.

The subject specific goal is for students to get an understanding on how the inclination of the earth affects the seasons and its difference between the northern and southern hemisphere.

4. Designing the Context

a. Explanation of the context

Understanding how the seasons work might be hard for children to understand. Seasons changing not only by month but by the location of the country and the sun can be difficult to

comprehend. When Europe is celebrating Christmas during wintertime, Australians are embraced by the warmness of summer. We wanted to create a project where students get to create their own model of the Earth and program it to rotate around its axis. We wanted to add a light to demonstrate the sunlight so that students can see that when the other side has sun and the other is in the shadows. For this to work students should test this in a dark space.

b. The tools used

We filmed the explanation video with a Smartphone and then we added the sounds at Jakob's place, where he has a studio for cutting the video. For the part of the video, where Santa Claus was shown in a summer landscape, we used AI for the photo and Jakob played the Ukulele and some synthesizers for the musical accompaniment.

We used the LEGO Set to build the robot. To program the movements and inclination we used the LEGO mindstorms program on the tablet. In our project we built the globe out of simple LEGO bricks, however, you could also use a globe made out of a 3D-Printer. That would be especially useful for pupils who have to learn the instructions of it anyway.

c. Explaining the relation/connection with the unexplained phenomenon

With programming the robot, the pupils should see with the reflection of the light how different parts of the globe receive different amounts of light. Then the pupils should take the reference to the sun and connect the observations not only to the day-and-night phenomenon but also to the changing of the seasons and take the inclination of the earth as the reason for it.

d. How to implement the project/activity with the target group

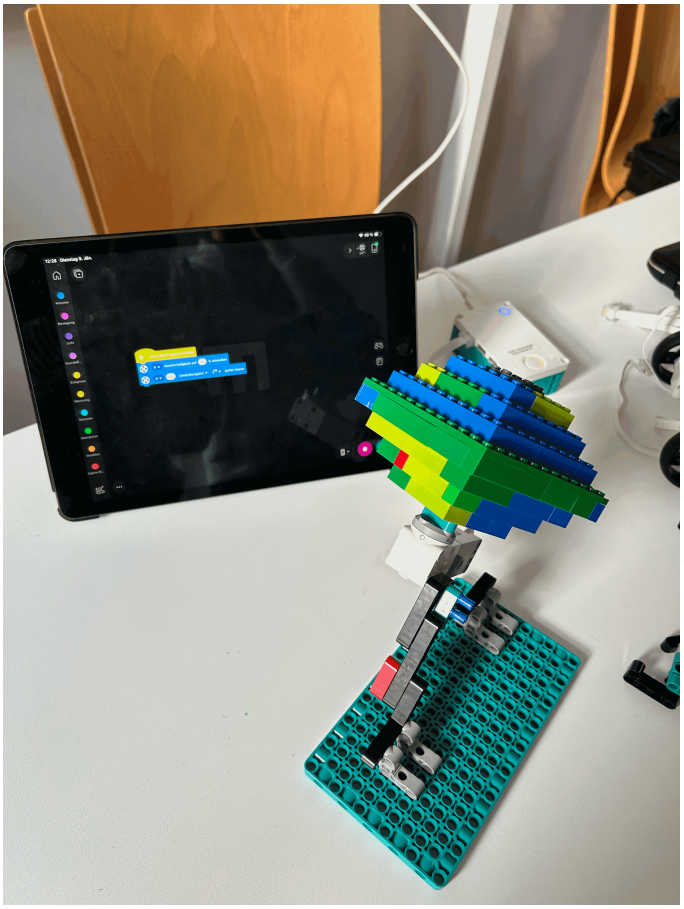
With the instruction video we want to explain in an easy and humorous way the phenomenon (explained at 4a) to the pupils. Then they have to make thoughts of the problem and find an explanation.

Action plan:

Time frame	Procedure	Interaction format	Materials
~ 5 min	Introduction: watching the digital story	Frontal instruction	Video
~ 30 min	Research behind the project. What the earth looks like, where is Europe and Australia on the globe?	Single Work	iPads
~ 60 min	Revisioning LEGO Mindstorm. The class goes through the app, robots and coding together. Students work with their own table groups (max. 4 students)	Group Work	LEGO sets, iPads
~ 30 min	Students start creating their codes with the app and building the Earth -model	Project Work	LEGO sets, iPads

Time frame	Procedure	Interaction format	Materials
~ 60 min	Finishing the codes and the Earth -model	Project Work	LEGO sets, iPads
~ 60 min	Showing the results in class. Having Discussion about the process of making the project	Group Work	LEGO sets
~ 15 min	Students answer three questions regarding the topic	Single Work	Papers withQuestions on it
~ 30 min	Final discussion in class	Project Work	

5. Implementing the Activity



a. Pictures/videos

Script for the solution video:

"To understand the natural phenomenon of the four seasons in different parts of the globe, students will build a model globe. On their globe, they will mark one region on the north and one on the south globe, such as Australia and Europe. The model in the picture is an example of what the students could create.

The model globe must be able to rotate around a slightly inclined axis. After building it, students will light the globe from one side with a flashlight in a dark room, and have it rotate. Just like in our example model, students should be able to see that during their respective daytime the south globe receives more light than the north. With light coming from this side (representing the relative position of sun and earth), it is summer in Australia, but winter in Europe.

If the light comes from the other side, the north globe receives more light instead, which means, it is now summer in Europe and winter in Australia."

Check out our PowerPoint Presentation to see the full solution video! Note that, in the video, a flashlight was used to represent the sun, coming in from the left side of the screen. This is not always visible due to the automatic lighting of the camera.

6. Evaluation

a. Difficulties encountered during the project

How to create the globe using legos? How to create the LEGO model to demonstrate our issue? How to show the sunlight clear enough because the room was light? Maybe doing the project in a dark room in class would make the results clearer.

b. Limitations

Our project only shows the globe spinning and the light coming to a certain surface of it. It could demonstrate how the sun and Earth rotating affects us creating day and night but also summer and winter. It doesn't show the difference between how seasons and days work. Also, our model globe is not round. There are areas, which are completely shaded during daytime in the region which is supposed to have winter. This is of course not a perfect model of the physical phenomenon of the seasons, but it will explain the relation between the inclination of the earth and the lighting of the north and the south globe. The model does not explain why a region on the model globe, which receives more light, is warmer - this would be the topic for an advanced physics class, which can follow this project.

c. Potential uses for the future

We would really like to use the LEGO mindstorm in the future as well. With its simple structure it is a good way to have an introduction into programming and it could be used in other school lessons as well.