

Using Astronomy and Space Science as a gateway to STEM Education

“Colonization of Mars - Challenges and Solutions” A game-based activity

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The way

Schools and universities are mainly responsible for educating the youth. Non-formal sector also plays a critical role integrating science learning and developing 21st century skills.

The need

STEM has transformed our lives dramatically and continues to evolve and determine our world building the sustainable society of the future. In such a society, computational, social and cultural skills as well as creativity, critical thinking and problem solving are essential for the citizens.

Using Astronomy and Space Science as a gateway to STEM Education

The opportunity

Educating people on Astronomy and Space science can act as a "gateway" that opens a world of possibilities by nurturing inquisitiveness and the pursuit of knowledge using the scientific method. Moreover, as astronomical research is technology driven, astronomy and space education provide excellent opportunities to enhance different aspects of STEM education.

The context

While most European countries lack stand-alone educational curriculums on Astronomy and Space Science for secondary students, these topics are strongly represented in non-formal organizations. During the "Future Space" Erasmus+ project teachers and science centers worked together. They developed an Astronomy and Space Program containing lesson scenarios for teaching at school and learning activities for school visits in a science center.

<https://futurespaceproject.eu/en/o-projekcie/>

The concept

Being inspired by the human's plan to colonize Mars NOESIS developed the **game-based activity** "Colonization of Mars - Challenges and Solutions".

Using tablets and a dedicated android app, the students take part in **special missions** and deal with challenges and situations faced by scientists, experts and astronauts in the colonization project of Mars.

The learning approach

Developing the activity, a variety of **educational approaches** (Inquiry based learning, gamification, collaborative learning) and **tools** (boards, cards, 3D objects, lab equipment, tablets) have been combined together to practice different students' skills.



«Colonization of Mars-
Challenges and Solutions»

A game-based activity by



The description

Starting with an **introduction**, a short-guided discussion reveals students' ideas about human efforts to visit and colonize Mars.






During the **experimentation phase**, the students are moving around working stations and perform different tasks. Each task is a mission that transfers them to a specific place and time, assigns them to a specific role and sets a unique goal.

At the **reflection phase**, the students discuss in plenary their group's work and outcomes. Scientific information and up to date data from current research are provided.

The ICT tools

The **Android app** is the guiding tool for the groups, during the experimentation phase. An **admin page** is the summarizing tool for the facilitator during the reflection phase.

Missions overview

	Mission	Date	Place	Group's role	Challenge	Task format / Skills	Means/ Materials	
1	Choose the Astronauts	3 years before Mission-1 launching	Earth	The Astronaut Corps Committee that chooses the astronauts for Mission-1	Human resourcing	- Critical thinking	Printed cards	
2	Load the Supplies	1 month before Mission-1 launching	Earth	A member of Mission-1 crew	Mission preparation	- Critical thinking - Communication and collaboration	Android application	
3	Transfer the Data	4 years before Mission-1 launching	Earth	The scientists of the Space Communications and Navigation Department	Technical competence	- hands on - problem solving	3D objects	
4	Place the Colony	8 months after Mission-1 landing	Mars	The crew of Mission-1	Decision making	- Information literacy - Critical thinking	Android application	
5	Manage the Crisis	3 years after Mission-1 landing	Mars	The crew of Mission-1	Crisis management	- Hands on experiment - Problem solving	3D objects	

Task 4. ID: 1894



Place the Colony

Place: Mars

Time: 8 months after Mission - 1 landing

“Campus Martius” is the base that hosts the first humans on Mars.

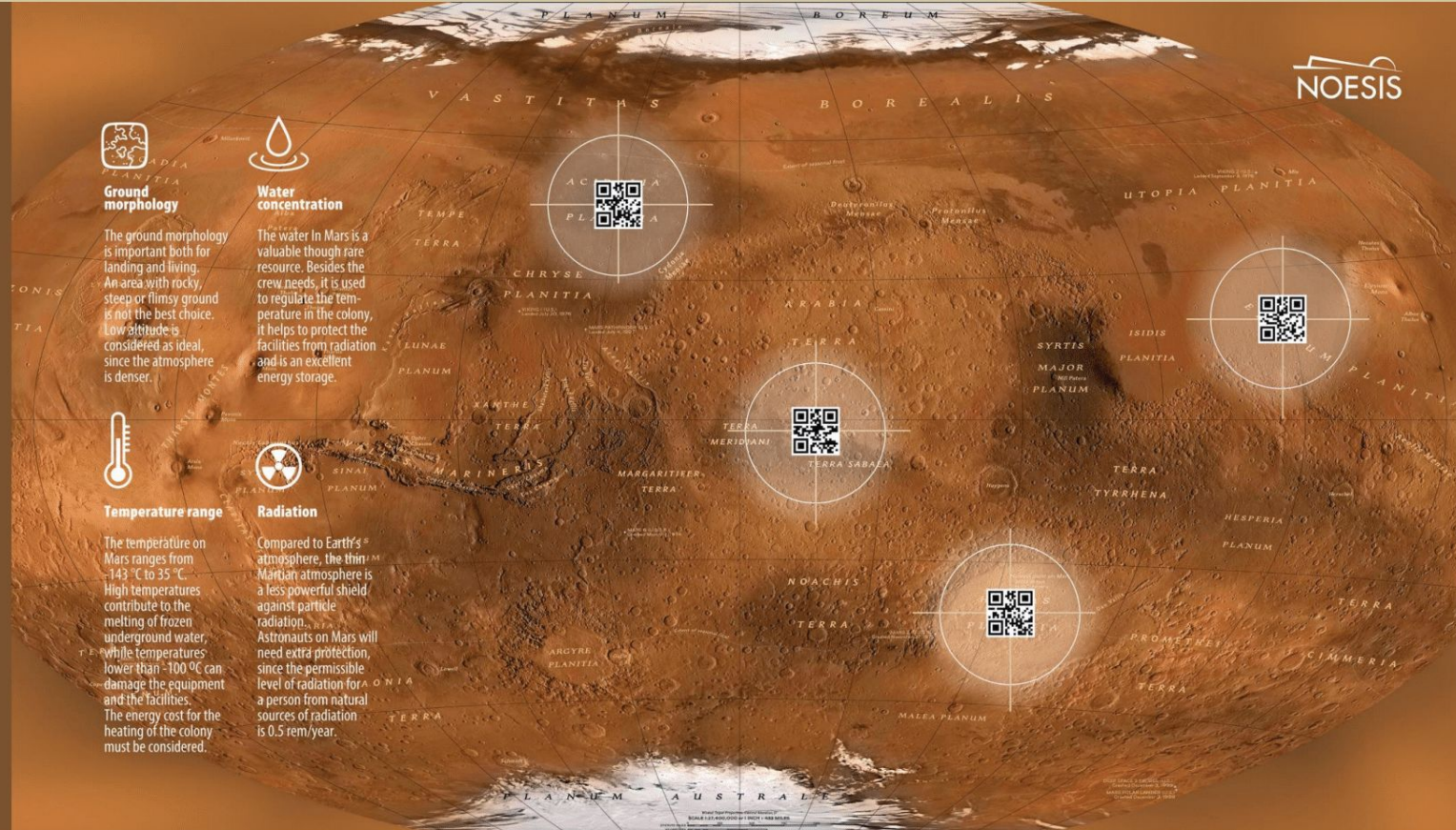
When the optimal place for the colony settlement is to be decided, essential parameters, that ensure both high scientific value and a high security level, have to be considered.

You are the crew of Mars Mission - 1.

One of your main objectives is to inspect the 4 suggested locations for Campus Martius and decide which is the most appropriate.

Study the effect of each parameter, visit the locations to confirm the data and make your choice.

Scan the suggested locations with the tablet and pick the most suitable one.



Ground morphology

The ground morphology is important both for landing and living. An area with rocky, steep or flimsy ground is not the best choice. Low altitude is considered as ideal, since the atmosphere is denser.



Water concentration

The water in Mars is a valuable though rare resource. Besides the crew needs, it is used to regulate the temperature in the colony, it helps to protect the facilities from radiation and is an excellent energy storage.



Temperature range

The temperature on Mars ranges from -143 °C to 35 °C. High temperatures contribute to the melting of frozen underground water, while temperatures lower than -100 °C can damage the equipment and the facilities. The energy cost for the heating of the colony must be considered.



Radiation

Compared to Earth's atmosphere, the thin Martian atmosphere is a less powerful shield against particle radiation. Astronauts on Mars will need extra protection, since the permissible level of radiation for a person from natural sources of radiation is 0.5 rem/year.

