

**COMPETITION-BASED TEACHING METHOD IN THE PLANETARY SCIENCE: IMPLICATION FOR DISCOVERY OF MARS.** Sz. Kárpáti<sup>1, 2</sup>, H. Hargitai<sup>3</sup>, Sz. Bérczi<sup>4</sup>, A. Gucsik<sup>1,5</sup>, <sup>1</sup>Eszterházy Károly Catholic University, Eger, H-3300, Eszterházy tér 1, Hungary, <sup>2</sup>Petőfi Sándor Roman Catholic Elementary and High School of Vecsés, H-2220, Vecsés, Petőfi tér 1, Hungary (e-mail: nyuliszilvia@gmail.com), <sup>3</sup>Eötvös Loránd University, Budapest, 1088 Múzeum krt 6-8, (e-mail: hargitai.henrik@btk.elte.hu), <sup>4</sup>Eötvös Loránd University, Budapest, 1117 Pázmány P st 1/a. (e-mail: bercziszani@staff.elte.hu) <sup>5</sup>Institute of Low Temperature Science, Hokkaido University; Kita-19, Nishi-8, Kita-ku Sapporo 060-0819, Japan; (e-mail: sopronianglicus@gmail.com)

**Introduction:** The Council of the European Union - New Skills Agenda for Europe [1] - makes recommendations on competence in lifelong learning. In the United States, Andrew J. Rotherham and Daniel T. Willingham [2] see the novelty in how the possession of known abilities, the ability to apply them significantly affects collective and individual success. They draw attention to the importance of the interdependence and interweaving of knowledge and skills [2].

In line with the challenges of the modern age, it is essential that students possess skills, abilities, attitudes and key competences that strengthen literacy, numeracy and digital competences. At the same time, creativity, participation in teamwork and the ability to innovate are also key to building a career [3].

The purpose of this abstract is to show how student competencies can be developed purposefully with the help of HyperDocs. It is a specialized lesson designed to provide students with a blended learning experience. During the processing of the curriculum, students communicate, collaborate, think critically, create (4C) in both real and virtual space. The new method helps to constantly maintain the interest and curiosity of students. Through exploratory learning, they receive answers to their questions, expand their knowledge, apply new knowledge [4].

The advantage of this method is that the available internet content provides a lot of opportunities to process a particular topic. And in creating form and content, teachers' creativity can soar. Such a HyperDocs worksheet is also excellent for developing competence. The nature of the teacher or the lesson determines what competencies we want to develop. In the course of applying in teacher training, in connection with the compilation of such a worksheet, prospective teachers learn the "dry" curriculum much faster and easier, and colleagues who are already practicing learn to consciously use and apply it in their daily teaching practice.

The worksheet created in the genial.ly interface further expands the possibilities of applying HyperDocs and its visual appearance, with the additional advantage that it can be shared in both Google Classroom and Microsoft Teams.

**Discussion:** Mars HyperDocs covers 5 main themes (see Figure 1)

1. Characteristics
2. Survey
3. Morphology
4. Maps
5. Terraforming

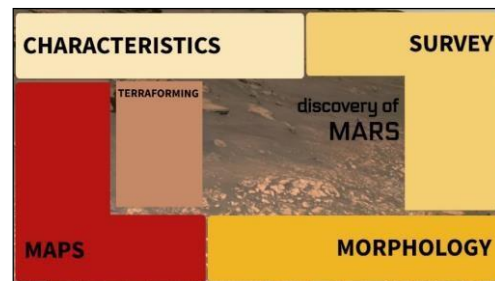


Fig. 1. Main themes of the HyperDocs.

The 5 HyperDocs worksheets process the different units based on the - Explore - Explain - Apply [5] activities. (Figure 2)



Fig. 2. The structure of the HyperDocs.

#### 1. topic tasks:

- Compare the most important properties and characteristics of the planets Earth and Mars (size, structure, motion, moons..) make a graphic organizer about it (lapbook, infographic)!
- Create narration for the Mars transition video, which shows the evolution of the planet.
- Based on the videos, the recognition of Martian atmospheric phenomena, the explanation of their formation, their consequences. Listing similar ex-

amples on Earth, highlighting and explaining differences.

## 2. topic tasks:

- Create a timeline of space probes landing on the planet Mars. Indicate: (name, year, nation, success-failure).
- The task of Mars explorer, rover finder [8].
- After watching the video, design a landing unit for the future landing Mars probe. Experiment!
- Make a rover out of paper! Print Martian probes in 3D!

## 3. topic tasks:

- Look on Earth and Mars for examples of the following surface forms: volcano, canyon, polar ice, river valleys, meteorite crater. Determine the geographical position of their central part.
- The Mars Explorer book is tasked with: Pair map and photo details with the naming of surface shapes [8].

## 4. topic tasks:

- On the website provided, place a map of the United States and your state in the Valles Marineris. Compare their areas! Take screenshots!
- On the website specified in the previous task, use the application to measure the total length of the Valles Marineris. How long would it take to travel the distance, for an astronaut and a Martian and Lunar vehicle? Convert the given data to Martian day!
- Mars explorer tasked with -Making a planetary map [8]. Put the pictures in the correct order.
- The task of the explorer on Mars - Topography colorist, Pixelizer [8].
- Use papermase technique with your groupmates to create a Mars surface from the Tharsys ridge (Elysium-Amazons, Chryse Basin, Vallies Marineris). Use the models created by the groups to create a Mars field table.
- On Earth, in your country, where do we find an environment similar to Mars?
- Search for photos, videos and create a Google Earth project from the selected locations. Share it!

## 5. topic tasks:

- Based on videos, collect what difficulties the first settlers on the planet Mars will face!
- What technical novelties can help terraforming?
- Make a comic book about Martian life!
- How will humanity affect our lives if humanity becomes a 2-planet species?
- Create a space base model! Mark the components.

**Conclusions:** Mars HyperDocs developed a competition, which is based on the competitions of Makádi [6], as follows (see Figure 2):

*Communication Competation:*

- Effective linguistic communication (Compare it! WHEATHER on Earth and Mars.)
- Use of information skills (Make infographics!)
- Digital communication (Make a timeline! Martian probe.)
- The mass media (Make a narration!)

## *Intellectual Competation:*

- Skills of combination (Link them!) [8]
- Effective learning (Terraforming! Which kind of Problems should be faced to the new settlements on Mars?)

## *Scientific Competations:*

- Skills of how to solve problems (Experiment! Landing of the probes.)
- Skills of the research (Find an example!)
- Mathematics (Measure it!)
- Technology and Natural Sciences (Terraforming! Technological developments on Mars.)

## *Social Competations:*

(Terraforming! Bild a modell! Bild a spaca base!)

- Responsibility and Participation of a Society
- Labor, Innovation as well as Business
- Intercultural
- Social

## *Personal Competations:*

- Individual (Maps Google Earth project making.)
- Identity (Terraforming! How our life would be changed if the Mankind will live in two planets?)
- Creation and Self-Expression (Terraforming! Make a cartoon!)

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## **References:**

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