A 3d planetary neocartographic tool in education: a game on virtual moon and mars globes. H. Hargitai[1], E. Simonné-Dombóvári[2] and M. Gede[3], [1]Eötvös Loránd University, Faculty of Sciences, Department of Physical Geography, Pázmány P. st. 1/a, 1117 Budapest, Hungary hhargitai@gmail.com, [2]Vienna University of Technology, Institute of Geoinformation and Cartography, Erzherzog-Johannplatz 1, A 1040 Vienna, Austria, E-mail: eszter@cartography.tuwien.ac.at, [3]Eötvös Loránd University, Department of Cartography and Geoinformatics, Pázmány P. st. 1/a, 1117 Budapest, Hungary, E-mail: saman@map.elte.hu

Introduction: Educational tools in middle and higher education are today expected and are able to provide visual methods that can compete with other visual media that the student use in their daily routine. This is especially true for those subjects which are only marginal parts of the curricula. We have developed an online neocartographic game (Fig 1.) with a twofold goal: to show the basic landform types of the Moon and Mars and also to make planetary toponyms more familiar to students.

Our web application in teaching planetary cartography is founded on a concept of edutainment, the method of attractive teaching and learning with multimedia applications.

The project combines two resources. (a) A *mute map game* called 'Blind mouse' (referring to blind or outline maps used in teaching toponyms) ('Vakegér' in the Hungarian version) and its *new three-dimensional versions on virtual globes whose* goal is to raise the attention of the students to the game and the virtual globes and the same time to this special topics of geography. This game can be used by educators of both cartography and geography. This game has been developed at the Eötvös Loránd University in Budapest. (b) Virtual Planetary globes which use the kmz standards of Google Earth produced under the auspices of the International Cartographic Association (ICA) [8], for outreach in planetary sciences.

'Blind Mouse': The *Blind Mouse is a mute map game* [1]. The aim was to make an online and easily usable application for anyone who likes playing and testing his/her knowledge of maps and geography. It raises the attention to geography knowledge and a more extensive use of maps. On the other hand this game can also be a great tool in education to prepare for the exams at different grade levels. The levels of the game correspond to the Hungarian National Core Curriculum and it is based on the topographic requirements of primary schools, of secondary school final exams and of university geography courses.

The criteria main idea of developing the game was firstly creating a game with which you can check the students' knowledge of position and identifying map features that they have learnt previously. The map areas are the same as in the atlases and in schoolbooks.

Secondly, developing a game that is able to promote its build-up and programming in the future [2].

The currently available detailed geographic themes are Hungary and Turkey, while Austria and several areas with features e.g. settlements, world heritage sites, mounts or rivers are under construction. This program was implemented in Hungarian, English, German and Turkish languages. The positive feedbacks from the students and teachers and the number of more than 10 000 registered user show the real usefulness of the website [3].
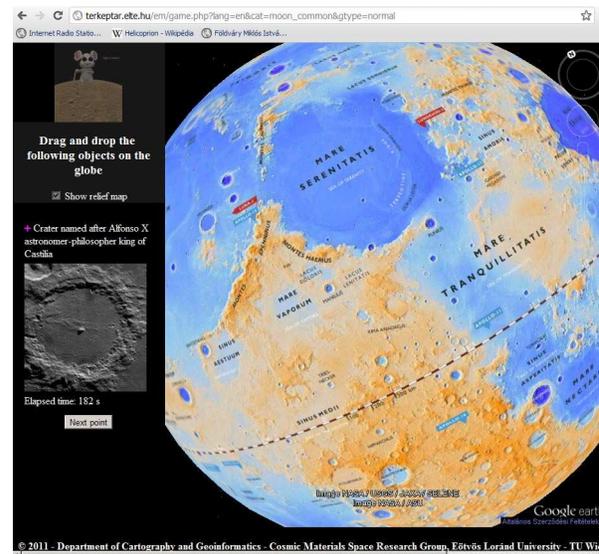

Fig 1. "Question" layout of the 'Blind mouse on the Moon' modul. Source: http://terkeptar.elte.hu/em

3D Blind Mouse: The aim of the developing a new website based on the original concept was to create a complete web application for enriching the topographic knowledge of pupils with the introduction of new functions of web mapping technology. The capacity of WebMapping 2.0 makes it possible to collect and integrate various sources (e.g. Wikipedia, Panoramio) and visualize them on a website via an API. Another choice may be to use three-dimensional, steerable-zoomable virtual globes instead of traditional maps in these educational or entertaining programs.

This new solution is the *three-dimensional version of the Blind Mouse – mute map with the Google Earth*

plug-in which allows us to handle global datasets in addition to national or regional data (such as world heritage, 100 Wonders of the World and Capitals of the World). This is important in the education of geographic content, as it helps to gain basic insight into the global dimension of many geographical issues. The pupils can learn with a virtual version of the traditional classroom globe, and this which fits well in today's expectations [4].
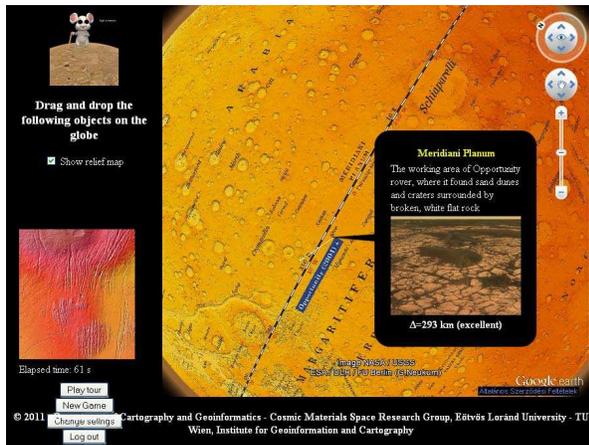

Fig 2. "Tour" layout with answers of the 'Blind mouse on Mars' modul. Source: http://terkeptar.elte.hu/em

Blind Mouse on the Moon and Mars: In this game the students can check their knowledge of positioning and identifying map features in two categories – Mars (fig. 2) and Moon. The three-dimensional, steerable-zoomable virtual globe displays maps with selected, fixed nomenclature in English/Latin or Hungarian/Latin. This nomenclature is raster based, using various font faces and sized as used in paper maps and are 'burned' into the map. The nomenclature includes not only officially adopted names, but also informal names (for example, basin names) used in astrogeology. Some of the questions are also related to these landforms which have no official name. Both maps are color coded topographic maps, using a color scheme developed by ICA commission on Planetary Cartography; the map of Mars uses MOLA data, the map of the Moon uses LRO WAC DTM. Users can also choose default Google Mars and Moon overlays.

The questions are different from those in the terrestrial geographic game. In the original game, toponyms are asked to be positioned on the map. Since knowledge of planetary toponyms are well beyond the requirements even at university level (in geography), the questions are describing specific landforms - their morphology or origin - or are related to eponyms.

At the end of the game the exact location of the objects appears on the globe and the user can also start a virtual trip along these objects. Clicking the placemarks displays short description about the structures.

The game as a tool in education will be gradually implemented with additional modules into the courses on planetary morphology, astrogeology [5] and astrobiology [6] at Eötvös Loránd University and astronomy clubs and can also be used in its present form for testing nomenclature issues [7].

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