GEOQUEST TROPOMAG DIGITAL ADVENTURE PATH:
WHEN SCIENCE IS A GAME

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Abstract

Game is a powerful educational tool able to involve students and keep their attention high, promoting cognitive development, discoveries, reasoning, and thinking. It is also an effective active form of learning which consolidates the acquired knowledge and carries out an authentic assessment through reality tasks and immediate feedback typical of the use of the digital games. Our *gamy-learning* experimentation focuses on new methods and practices of science communication, with the aim to face the challenge of educating about natural risks and climate change. The goal is to facilitate the automatic choice of good practices, by stimulating mind, intuition and logic in the perspective of team building in school-based civic education. The proper application of technological tools is a valuable aid for conscious communication for the next generation. A *Computer Supported Collaborative Learning Education* is experienced, in order to test the efficacy of our *GeoQuest TROPOMAG* digital adventure, and pave the ground for the implementation of the storytelling in an integrated table game. Our climate change role-playing videogame explores phenomena related to the possible effects of changes in the Earth's magnetic field on the atmosphere. The virtual adventure path is played on smartphones and follows alternative paths chosen by the players to develop the storytelling. As a result, students play not only "just for fun", but also to actively participate in their learning process and acquisition of new knowledge, skills and competences in environmental issues.

Keywords: Gamification, digital game based learning, computer supported collaborative learning education, educational competition, climate change.

1. Introduction

The education guidelines by the EU Commission are in line with the world's leading educational instances: innovative teaching, Information and Communication Technology (ICT), hands-on and lab activities. In this frame, gaming should be considered a key element (Maraffi et al., 2017), encouraging students to spend more time studying, be more engaged and, as a result, learn more (Chapman & Rich, 2017). This new way of learning offers new opportunities to use collaborative tools, allowing the students to co-construct knowledge efficiently (González-González et al., 2016). *Digital Game Based Learning (DGBL)* increases student motivation to pursue Geoscience learning (Maraffi & Sacerdoti, 2017). Students are familiar with games and we propose the *GeoQuest TROPOMAG* serious game (Fig. 1) to engage them, in an amusing way, promoting teamwork and the *Content and Language Integrated Learning (CLIL)* approach (Maraffi & Sacerdoti, 2016a, 2016b). *TROPOMAG - Influence of geomagnetic storms on the TROPOsphere dynamics: Can the Earth's MAGnetic field be considered a proxy of climate changes?* is an on-going project investigating the possible effects of changes of the Earth's magnetic field on the atmosphere and weather conditions. The main outreach product at the end of the first year is the virtual adventure game developed from the pre-existing *EvoQuest* educational digital game series (http://www.evoquest.eu/). *EvoQuest* is a specific software engine to realize *Computer Class Digital Role* adventure games. The TV science format SuperQuark described *EvoQuest* as an interesting learning game for students (https://www.raiplay.it/video/2019/12/Superquark-piu-Il-Gioco-ee159d7e-b39f-497a-9911-cb269728425c.html). The main goal of our Earth Science *Class Role Playing Game* is building a sustainable system to educate future citizens to respect the natural environment and Nature in response to an increasing disaster risk caused by rapid urbanization, environmental degradation and climate change (Piangiamore & Maramai, 2022; Piangiamore, 2019).

Figure 1. GeoQuest TROPOMAG digital adventure game.
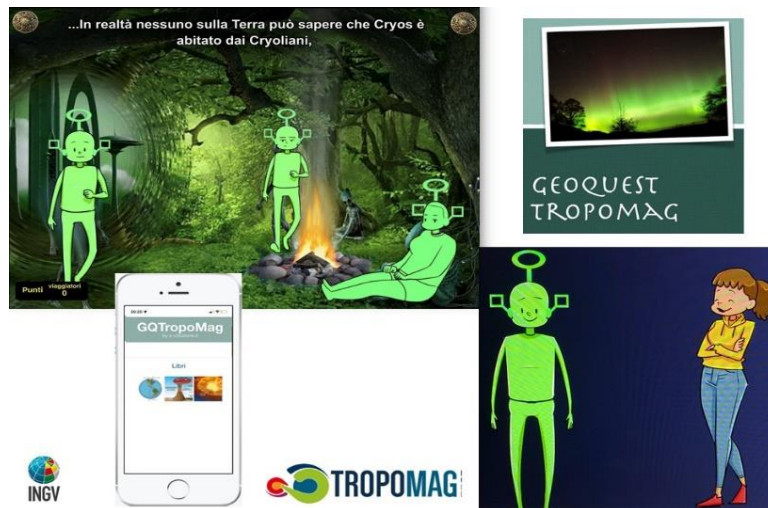
2. Game design and adventure creation

To create an adventure based on *TROPOMAG* project's main scientific topics for students playing with smartphone or tablet, we used a well-tested educational technique based on the *EvoQuest Computer Role Playing Game* (Maraffi & Sacerdoti, 2018a). The new adventure begins with a storytelling that immerses players in an environmental emergency,as well as other topics covered in the project . The overall game ideas have been collected and organized, applying gamification concepts, focusing on the roles of the students in the game. Finally, we defined the characters and the adventure path, writing the text and inserting images video, and GIFs. The *TROPOMAG GeoQuest* adventure, ready to be played, was devoted to test the games in classes of different grades and in special venues, proving to be an user-friendly teaching tool, which also allows students to learn a subject and a second language at the same time (CLIL). It's available in both Italian and in English and it can be translated in other languages.

3. Objectives

TROPOMAG WP3 (Work Package 3 - Scientific Outreach) focuses on the need, for the Society in general and for modern educational system, to embrace a holistic Earth system Science approach, and to provide an effective view on climate change and its consequences. Playing our digital team adventure, teachers discover an innovative *learning-by-playing* tool to spread environmental education at school. *TROPOMAG GeoQuest* is a new way to approach multidisciplinary learning about *TROPOMAG* topics: Artificial satellites, Earth's atmosphere, Geomagnetic storms, Geomagnetism, Global Navigation Satellite System (GNSS), Ionosphere, Polar aurorae, Pollution from volcanoes, Solar radiation, Solar system, Solar wind, Sun, Troposphere and Precipitable Water Vapor. The flow of the adventure computer game engages students from Middle Schools (ISCDE 2) and High Schools (ISCDE 3) through audio, images, and videos on the adventure path they are on.

4. Methods

We developed the implementation of the interactive learning strategies, technology and effectiveness of an already existing successful digital serious game (*EvoQuest* widely tested in several European countries) for schools. *GeoQuest TROPOMAG* is an original scientific outreach product that features a new adventure path based on project's scientific topics using the same game techniques. The structure of the digital game is interactive (players interact with the game through an "automatic responder"), cooperative (players cooperate each other to win, since game is projected on any screen, through a PC), and based on a learning *flipped classroom* approach. Players can select specific topics and choose whether to deepen them by videos and lab activities for effective clarification. Students receive immediate feedback on their responses and benefit from individual insights on their device as compensatory or deepening tools. The game, designed for players aged 12-18, includes some tricks to adapt the target to the age and players' characteristics. These activities have been carried out always with very positive feedback on several occasions at school and in special venues, such as the *Futuro Remoto 2022* science festival in Naples, in collaboration with the Regional School Office USR Molise.

5. Discussion and conclusions

Traditional approaches and engagement in teaching and learning will be replaced by innovative, unconventional forms of knowledge transfer. The Scientific Education Outreach activity we conduct meets the modern school's need of new methods for communicating Science through digital play. We adopt the *gamification* logic such as competition, virtual goods, real-time feedback, storytelling, points, rankings, and levels, to develop *"emotional intelligence"* and *soft skills*. At the end of our ongoing research, a modern and valid *gamy-learning* tool for environmental educational purposes will be realized: the goal is to sensitize players on the issues of natural disasters prevention. The immediate meaningful feedback requires a challenge that is well suited to skill level and it represents an argument in favour of personalised learning (Mayo, 2009). To play the *GeoQuest TROPOMAG* computer game adventure students collaborate and discuss their ideas and possible solutions. This insignificant learning experience in which the *reflective learning* assists students in problem solving and adopting sustainable behavior to win. The next step is to create a new table game that is integrated with the computer game in order to provide a better and more enjoyable game experience while also improving the didactic results. Fun, play, goals, competition make *GeoQuest TROPOMAG* experience at school an involving educational virtual adventure, useful to convey the values of solidarity and commitment to the defense of a common good (our planet Earth).

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