The Mário Schenberg Spaceship: Experiencing Science in a Collaborative Learning VR Environment

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Abstract

This paper presents the Mário Schenberg Spaceship, a Virtual Reality (VR) based collaborative learning environment for Astronomy, Science and Physics learning. The installation has a spaceship-like scenario, where a group of learners experiment an adventure in space. Learners interact with six workstations to play a collaborative but not competitive game. The goal of the game is to complete a mission, which consists on rescuing a population from a distant planet threatened by an exploding sun. Tests with students and teachers showed strong engagement and rich learning opportunities for this kind of environment.

1. Introduction

The realism offered by VR allows users to experience the illusion of “going inside” computer-created environments [1]. In learning activities, VR technologies have been used to support greater interaction between learner and learning object [2,3,4,5]. Virtual worlds also allow learners to communicate and construct their knowledge, while stimulating teamwork [3,4].

Electronic games are another new resource in Education, specially in Science. Games have an interesting advantage over simple concepts' presentation since they trigger a “strong sense of engagement” by learners [6]. They are considered valuable when Science concepts (or other scientific subjects) are part of an investigation process [6]. While stimulating students' curiosity they create enriching learning opportunities [7].

This article presents the Mário Schenberg Spaceship, a Virtual Reality collaborative environment. The installation has a spaceship-like scenario where students experiment an adventure in space. We provide some environment details in the section 2 and a preliminary evaluation in section 3. Conclusions are in the 4th section.

2. The Mário Schenberg Spaceship

The environment called the Mário Schenberg Spaceship simulates an adventure in space conducted by a group of up to 22 students. It was designed to trigger the interest of learners from 8 to 14 years old in Science, Astronomy and Physics as well as to emphasize the importance of teamwork [8].

The spaceship is installed at the CienTec Science Park, an informal learning environment. Visitors make appointments to visit the park and are typically a group of 44 students and teachers. When entering the park, they are divided in two groups that visit the park and participate in the park’s activities separately. These activities are related to Astronomy, Science and Technology and allow children to experience and explore these subjects.

Visits to the Spaceship are one of the park’s activities. Two guides, members of the park’s staff, introduce children to the adventure, help them during the mission and stimulate their curiosity. As a VR environment it can make the collaborative learning process more attractive, innovative and motivating. The activity consists of a collaborative but not competitive game. Giving the group of visitors a unique goal stimulates collaboration.

2.1. Scenario

To make the activity more realistic, the scenario was set up to look like the inside of a spaceship as shown in figure 1. Two screens are positioned at the front of the room; they display stereoscopic projections of planets as well as 3D animations. There are six workstations that correspond to different tasks related to the space trip and a frontal panel with lights, LEDs and a siren that indicates an emergency.
The Mário Schenberg Spaceship is located in a building and occupies two floors; each one is used in a different moment of the activity. The first floor is used to introduce learners to the context. The second one is where the adventure actually occurs.

2.2. Playing the game

On the first floor, a film presents the group of visitors with a challenge: they have 30 minutes to go through space, rescue the Tetractys population and conduct the spaceship back home. Tetractys are beings that live in a very far planet threatened by an almost exploding sun. The adventure consists in rescuing as many beings as possible. The film also introduces a short biography of the Brazilian scientist Mário Schenberg after which the spaceship was named. The group is then guided to the second floor so they can accomplish their mission.

The first activity is to choose a name for the team or crew and inform the system. Children are divided in six groups from three to five components, each of which is responsible for one of the six workstations: Route, Radar, Maintenance, Energy, Speed and Command.

In the beginning the two front screens project an animation that simulates the spaceship’s take-off, orbiting Earth and entering space, as shown in figure 2. When showing planets, the system uses a stereoscopic version of Celestia [8], a free astronomy database.

During the mission students play interactive games related to different subjects, such as Astronomy, Physics, Gravitation, Mathematics and Geometry. To activate the spaceship central computer, for example, the participants need to insert a secret password. Clues displayed on their workstation screens and a video clue shown on the front screens, help them discover the password: “gravity”. Each game gives the team points and better performance means higher scores. The crew name, initially inserted in the system, is displayed at the end of the adventure with the ranking of the best previous groups that have accomplished the mission.

The scores obtained in each workstation are summed to evaluate the group's success. This process determines how many of the Tetractys beings are saved. A completely successful mission rescues all of them. The game was implemented in such a way that every mission brings the ship back to Earth. A final movie is shown to inform students how successful they were, but they are also confronted with planet preservation as a lifelong mission: an exploding sun threatened the Tetractys population; human beings threaten Earth.

3. Preliminary evaluation

We have conducted tests during various sessions in 2008. During each test, one or more observers were present during the session observing and taking notes of how students interacted with the system. Additionally to observations, we have performed informal interviews and applied questionnaires both to students and teachers. This process allowed us to improve the activity interaction as we could see how children actually used the system.

Observations revealed children get very excited during the activity and their engagement is very positive. They also show interest even if they have never heard of the addressed issues. Age seemed to be an important factor to how students interact and how they understand the games. Younger kids (8 and 9 years-old) showed more engagement, their immersion showed a strong sense of fantasy. They feel like “going inside” and their user experience is more realistic [1].
Older children (12 to 14 years-old) are also engaged with the activity but not as much the younger ones. Observations reported their interaction with the game was more independent of the park guides, probably because they are more used to reading instructions. They also seemed to better understand the subjects addressed. So for younger children, the spaceship environment may provide a motivating moment for Science learning, as they get more excited with the activity. For higher ages the VR environment may introduce Astronomy issues.

Experiences also showed collaborative working is supported not only by the workstation architecture and interactive games. Even when children are playing games in their own workstations, some of them prefer to walk around and see what is happening in other workstations. Students go to colleagues not only to observe; but also to help since the engagement in the activity makes kids want an overall good performance.

4. Discussion

This article presented a VR environment focused on Science learning. Children visiting the installation play interactive games to accomplish a mission in a space trip simulation. The system is a “game-like virtual learning experience” [6].

Students are stimulated in different ways: workstation interaction, information visualization in the frontal screens (videos, animations and Astronomy objects) and face-to-face interaction. This rich variety of context makes the activity strongly different from classroom activities and other regular school activities because there is no formal division between the addressed subjects. Observation showed that the face-to-face interaction is a key for collaborative work as students are free to walk around the space [8].

The Mário Schenberg Spaceship can be a rich learning environment as children are stimulated to discuss their ideas. Science concepts are presented as a part of an adventure and valuable learning opportunities are created by group discussion and by stimulating student's curiosity [6,7]. For that reason park guides play a very important role in the learning process as they can answer children’s questions as soon as they are formulated.

Learning comes from the interaction of the various agents involved in the process: student with student, student with park guide and student with teacher [8]. By exploring the potential of a participatory narrative [6], the Mário Schenberg spaceship is a rich opportunity for students to understand science concepts in a more contextualized manner as it supports interaction with a simulated world [8].

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5. References


