Exploring the Potential of Undergraduate Radiology Education in the Virtual World Second Life with First-cycle and Second-cycle Medical Students

Rocio Lorenzo-Alvarez, MD, Jose Pavia-Molina, MD, PhD, Francisco Sendra-Portero, MD, PhD

Rationale and Objectives: Virtual worlds have a remarkable potential for effective teaching and learning, providing immersive, realistic, and engaging online events. Previous studies have explored online education of health professionals in Second Life (SL), the most widely used virtual world, but none of the previous learning experiences were related to radiology. The purpose of this study was to explore the potential use of SL for undergraduate radiology education and the involvement of students in SL learning activities.

Materials and Methods: We delivered a 4-week voluntary undergraduate radiology education program in SL, based on synchronous sessions and asynchronous tasks, with two modalities: introduction to basic radiology for first-cycle (first- to third-year) students and case-based clinical radiology for second-cycle (fourth- to sixth-year) students. Participants completed an evaluation questionnaire about the experiences after the learning program.

Results: Forty-six students (20 first-cycle and 26 second-cycle) participated in this study. They found the contents of the course appropriate (mean ≥ 4.53/5), the initiative interesting, and the environment attractive (mean ≥ 4.32/5), and they were willing to participate in future SL experiences (mean ≥ 4.63/5). All students highly rated the organization, the content, the benefit to their medical education, and the professor (mean ≥ 9.05/10).

Conclusion: Online radiology education using SL is feasible and well received by medical students of all year groups. The students participated and engaged in this activity very positively and rated the experience highly. The potential of using SL for radiology education includes promising expectations regarding collaborative learning and gamification.

Key Words: Education; e-Learning; radiology; virtual worlds; undergraduate medical education.

INTRODUCTION

A virtual world is a computer-based simulated environment, as well as an online community (1,2) and a three-dimensional virtual space that simulates reality in which the user interacts with contents and visitors without having to physically move to a common place. In 2003, the company Linden Research Inc. created Second Life (SL), one of the most well-known and widely used virtual worlds, a virtual community developed by its own users (3). To join SL, the user must create an account, choose an avatar, and download the SL viewer or any other SL-compatible viewer to display the virtual world on his or her computer screen. Almost all the objects that are visible in SL are built from primitive three-dimensional geometric shapes called prims. Prims can assume any desirable shape and can look any way desired by applying selected textures to their surfaces. They can do things via internal scripts written in Linden Scripting Language, or share media, for example, displaying a web page on a face (4). The user interacts with the virtual world by means of his or her avatar. Interactions include viewing the world from different perspectives and focuses, touching objects, answering to displayed menus originated from Linden Scripting Language scripts, moving, adopting gestures, and communicating with others.

Virtual worlds have a remarkable potential to be used for effective teaching and learning (5,6), providing the possibility to create immersive, realistic, and engaging online events that can provide high-quality medical education to health-related users in remote locations (7–9). There are a wide range

Acad Radiol 2018; ■:■■–■■

From the Department of Radiology and Physical Medicine, Facultad de Medicina, Universidad de Málaga, Bvd. Luis Pasteur 32, 29071 (R.L.-A., F.S.-P.); Department of Pharmacology, Facultad de Medicina, Universidad de Málaga, Málaga, Spain (J.P.-M.). Received January 24, 2018; revised February 22, 2018; accepted February 28, 2018. Funding: This work was supported by the University of Malaga (Innovative Education Project PIE10-128). **Address correspondence to:** F.S.-P. e-mail: sendra@uma.es

https://doi.org/10.1016/j.acra.2018.02.026

of health-related activities on SL (10), most of them dedicated to patient education or increased awareness about health issues, but there are also training sites that offer education by means of classrooms, discussions, lectures, simulation, and patient interaction. In fact, professional and academic education in health care contains the largest number of papers in a systematic literature review regarding the use of three-dimensional virtual worlds (11).

The relevance of medical imaging to patient care has increased exponentially over the last years, but the role of radiology in undergraduate teaching has not changed accordingly (12). The use of online resources to deliver radiology education to medical students represents an exciting alternative and an effective method for improving radiological knowledge and skills (13). Furthermore, students feel that their knowledge and understanding of radiology improves by using e-learning (14). There are varied online experiences for undergraduate radiology education (15), but they have still not included the use of or specific dedication to virtual worlds such as SL.

This study explored the potential of using virtual worlds as an alternative method for providing online radiology education for medical students considering two different scenarios:

- early exposure of first-cycle (first- to third-year) students to basic radiological content.
- case-based learning of clinical radiology for second-cycle (fourth- to sixth-year) students.

The objectives of this study were to accomplish the following: (1) explore the potential of the virtual world SL for undergraduate radiology education; (2) measure the involvement of the students in the scheduled activities and their perception of the project; and (3) understand the limitations of SL for undergraduate radiology education.

MATERIALS AND METHODS

The Medical Master Island

The SL virtual world consists of interlinked regions that contain land, water, and sky. A region consists of an entire island that is 256 m × 256 m, or 65,536 square meters. This project started on July 11, 2011, by acquiring and developing an island in SL named The Medical Master Island (Fig 1). Eight months before, the study designers made their own avatars and entered SL to train in communication, creation, and construction skills, and to perceive the educational capabilities of the virtual world, visiting places and establishing contact with other avatars. The purchasing and maintenance costs of the island implied an initial payment of $1029 USD plus a $295 monthly fee. Educational institutions or organizations can apply for a 50% discount for private region setup and maintenance costs (3). No dedicated programmers were used, and no additional personnel were needed to build the island. The contents of the island (including presentations for tasks and sessions) were developed until the end of September, as they were during this project, in a self-taught way. The Medical Master Island was designed to resemble a university campus, with several academic buildings connected by walkways and surrounded by trees and plants. We also built media screens with simple webpages consisting of PowerPoint slides saved as jpeg images and navigation forward-backward buttons, giving them the aspect of 4.5 × 4.5 m or 5.5 × 5.5 m wall panels or 1 × 1 m virtual computer screens. The undergraduate building (Fig 1), where this project was held, contained a partial-basement exhibit hall with wall panels explaining the tasks to be done, a repository room where all contents of the project were accessible during the experience, and two classrooms where lectures and radiology workshops occurred (Fig 2).

Recruitment

Between October 3 and 5, 2011, at the beginning of the academic course, we explained this project in a 15-minute speech to each course in our faculty. We requested that students voluntarily participate in an online course in SL, based on synchronous lectures and workshops and asynchronous tasks to be performed in-world. We proposed a maximum of 15 students per course and a period of 7 days to respond. Responders received a PDF tutorial explaining how to enter SL and the Medical Master Island.

The medical curriculum of our faculty comprised two subjects of radiology: a 4-month subject on general radiology held during the third year, which included the principles of medical imaging and practical training on systematic X-rays reading, and a 12-day radiology clerkship held during the sixth year, which included training diagnostic decisions based on X-ray image reading. Students who were repeating the third year radiology material were excluded from participation.

The project was performed under an approved Innovative Education Project of our university (#PIE10-128) and received the corresponding institutional review board approval from the Vice-rectorate of Teaching Staff, Training, and Coordination. All participants were previously informed about the project and voluntarily gave their consent when they were requested to be included in the project by email. No additional ethical permission was needed.

The Course

From October 18 to November 14, 2011, a 20-hour course was held in SL with two modalities: introduction to basic radiology for first-cycle students, who still had not studied radiology, and case-based clinical radiology for second-cycle students, who had studied general radiology in third course. The course consisted of one virtual session per week, each lasting for 2 hours, and four asynchronous individual tasks (estimated to last 3 hours each). Tasks consisted of visualizing the contents of the corresponding wall panels and sending a written answer to the professor's avatar by means of a notecard, assuring that the work was done in-world. These notecards were stored in the inventory of the professor's avatar, to