

VIRTUAL CITIES AS CONTENT ENVIRONMENTS IN A FAMILY HEALTH POST-GRADUATE PROGRAMME

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Abstract

Background and Aim: The aim of this study is to describe the creation of virtual cities targeted at the education of Primary Health Care (PHC) health professionals and to identify how many of these professionals were committed to the courses in which virtual cities were used as a teaching method. **Materials and Methods:** The creation process followed these steps: Designing Cities Workshop, Creating Clinical Cases, Describing the Health System, Describing Socio-demographic Factors and Culture, and 3D Modelling. **Results:** Thus far, the use of this method resulted in the creation of three fictional cities in the South, North, and Northeast Regions of Brazil. Of the 1,015 students who took the course, 624 (61.5%) have graduated. **Conclusions:** The virtual cities designed for this purpose are applicable to the education of PHC health professionals.

Keywords: virtual reality; eHealth; Primary Health Care; education; Brazil.

Introduction

Distance education has been an effective way to educate health professionals working in the public system¹ due to its low cost and widespread aspect.² In a continental country such as Brazil, distance education is necessary to reach professionals working in remote locations of large centres.³

The Federal University of Health Sciences of Porto Alegre (*Universidade Federal de Ciências da Saúde de Porto Alegre - UFCSPA*), which constitutes the Brazilian Open University of the Unified Health System (*Universidade Aberta do Sistema Único de Saúde - UNA-SUS*), offers a Family Health Graduate

Course. This distance course is targeted at physicians, nurses, and dentists working for the Family Health Programme (*Estratégia de Saúde da Família - ESF*), which is Brazil's Primary Health Care (PHC) model.

The creation of this course derives from the need to educate professionals quickly and efficiently. e-Learning allows an increase in the number of students per course as compared to that of students who attend traditional 'classroom' courses.⁴ It also provides a valuable means to update knowledge and contribute to the continued development of health professionals.⁵

Furthermore, it is known that in recent years, new educational media and approaches have been developed with the goal of reducing the number of dropouts in distance courses.⁶ One of these resources is virtual reality, which has shown positive results in the interaction with users.⁷ Thus, the aim of the present study is to describe the creation of virtual cities targeted at the education of PHC health professionals and to identify how many of these professionals were committed to the courses in which virtual cities were used as a teaching method.

Methods

The methods used in this study combine three major areas: literature, health, and Information and Communication Technologies (ICT). They were combined with an eye to technological innovation in the health education field. The methodology involved several steps, especially the ones described below.

Designing cities workshop

The creation of a fictional city in Southern Brazil was based on a focus group whose members were different specialists in the areas of Public Health, PHC, Family

Medicine, Dentistry, Nursing, and ICT. In addition, a subject matter expert (literature professor) worked with the group to provide fictional contextualisation and to explain the development of a narrative discourse and its components. This expert also demonstrated how the narrative would resemble or be different from actual locations, as well as how the conditions of similitude are needed when developing an environment that is to be occupied by a virtual city in the course. Starting from that idea, the city was designed in all of its aspects, namely scenery, history, society, and health system. Reports were recorded in order to gather the required information to combine socio-demographic and health data.

Brazil is a country with a vast territory, and because of that its regions show distinct social, political, and economical features. Considering that the courses offered by UNA-SUS reach every region of the country, different virtual cities are needed for teaching in each culture. Three cities with characteristics that meet the diverse realities of Brazil were designed: Santa Fé, Muiraquitã, and São Luiz Gonzaga.

Describing the health system

The characteristics that determine how healthcare would be managed in each city were presented. Likewise, characters who would be included to represent professionals in the different levels of this setting, from management to healthcare, were introduced. The characterisation of the health system started with the organisational chart of the city's health department and its description. This characterisation includes the financing aspects of the health system, the municipal council of health and all matters related to its administration, and other sectors of the municipality that interact with the health area. Additionally, the Support Centre for Family Health (focusing on improving medical assistance) and the Centre for Psychosocial Care (related to mental health) were established. Health units were created considering their founding date, location, covered area, assisted population, and detailed characterisation of the Family Health Teams. These teams were characterised individually in order to describe the diverse characteristics of each professional: physician, dentist, nurse, nursing technician, dental health technician, and community health agent.

Describing socio-demographic factors and culture

Demographic data was also created for the cities, for instance, geographical location, population size, human development index, gross domestic product, life expectancy, literacy, infant mortality, and population pyramid. It was central that these features were realistic, so that they could be used in the course's Public Health activities. In this sense, real cities provided the basis for the designing of Santa Fé; their data were collected in order to assure that the fictional city would resemble the real world. In addition, communication media were created, for example, a newspaper (Santa Fé Gazette) and a community radio station (Santa Fé Radio). Newspaper reports and radio interviews were used to introduce content for the course. The same guidelines were followed in the designing of Muiraquitã and São Luiz Gonzaga.

Establishing content environments

The Family Health Graduate Course is comprised of two modules: Public Health and Professional Centre (a centre of the three professional areas applied to PHC). The Public Health module took shape in several ways in the city, such as comics, newspaper articles, and radio recordings. It also could be seen in activities based on the city's structure, socio-demographics, health, and healthcare management. In the Professional Centre module, students were grouped together according to their profession - physician, nurse, or dentist. At first, this module involved the use of clinical cases adapted from materials developed by members of the Brazilian Society of Family and Community Medicine (*Sociedade Brasileira de Medicina de Família e Comunidade - SBMFC*). UFCSPA's UNA-SUS staff then asked permission from the authors of the clinical cases to adapt them to the cities, aligning them with content and setting. As a consequence, any discussions that started in the course's first module could continue.

The clinical cases introduced into the virtual cities simulated actual PHC problems, such as common diseases and epidemic diseases in Southern Brazil. Fictional characters were created, and their family context aligned with content. All of the cases followed the same script, but there were different views of medicine, nursing, and dentistry for the clinical situations at hand.

Having established the cases for the cities, the development of educational items took place. To achieve our educational goals some cases were complex, but the characters had features similar to those of actual patients students would encounter in their professional experience. There are more than just disease descriptions, that are also a concern with the illness narratives. In addition to text, presentation of cases used multimedia, including videos, comics, and illustrated stories.

Educational content producers were specialists in their PHC field, and they were given instructions by educators and distance learning developers on how to incorporate the cities and the characters in the content they produced. This helped contextualise several aspects, aiding students to better relate cases to their own professional life.

In total, 30 complex clinical cases that take place in Santa Fé were created; six cases were set in Muiraquitã, and six other cases were set in São Luiz Gonzaga. The cases set in Muiraquitã and São Luiz Gonzaga dealt with the subject of epidemiologic particularities of the tropical climate, since Santa Fé is located in Rio Grande do Sul, where the climate is subtropical. At the end of the course, students completed an assessment questionnaire containing a section in which the use of virtual cities as an educational environment in the graduate courses was put to the test.

3D Modelling

Aiming at transposing the city from a fictional setting to virtual reality, Santa Fé was 3D modelled by using the Sketchup Pro Software (Trimble Navigator Limited). Animations for the city were performed in the 3DS Max Software (Autodesk® 3DS Max®), and the V-Ray^(c) plug-in (Chaos Group) was used to render videos and images. The cities of Santa Fé and Muiraquitã were 3D modelled in accordance with local geographical features. PHC units, and important features such as the city hall, a central square, and schools, were 3D modelled in both of them.

Results

To date three fictional cities have been created, representing the South, North, and Northeast Regions of Brazil, but only two of them have been 3D modelled. The multidisciplinary approach involving professionals from the fields of health, education, art,

design, and literature led to the creation of a city with a realistic and contextualised health system, historical development, and socio-demographic characteristics similar to those of the actual regions. The 3D modelled cities can be found on the following websites: Santa Fé (<http://unasus.ufcspa.edu.br/cidadesvirtuais/NovaStaFe/story.html>) and Muiraquitã (<http://unasus.ufcspa.edu.br/cidadesvirtuais/NovaMqta/story.html>).

Forty-two clinical cases were ascribed to the three cities. The characteristics of each region, such as climate, territory, population and endemic sub-regions, were taken into account in case development. These clinical cases address over 150 management situations met by health professionals working in PHC. The creation of an organised and credible health system containing PHC units, associated with the portrayal of specific characters and the description of health teams for each clinical case, enabled 3D modelling of a fictional city. The production of short videos that illustrate the cases gave the students a realistic view of the “rights” and “wrongs” of healthcare at PHC units and during home visiting. (Figure 1)



Figure 1. Videos and images of the short film produced in clinical cases. A - represents medical assistance at the PHC unit. B - represents a home visiting to a bedridden patient.

Turning each city into a 3D environment took approximately six months. The software made it possible to translate the features of the regions into virtual reality. (Figure 2)



Figure 2. A – aerial view of Santa Fe city; B – illustration of a neighbourhood, showing a traditional Southern Brazilian centre of culture in the middle.

The city of Muiraquitã, located in the Northern Region (Amazon Region), has six neighbourhoods, including Indigenous, Quilombola (Brazilian people of African origin), and riverside communities (families that live on river banks), among others. (Figure 3)

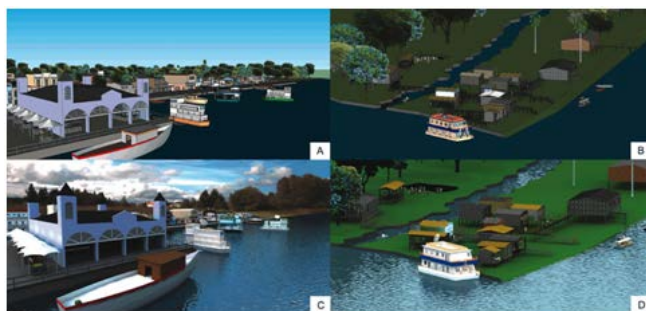


Figure 3. The city of Muiraquitã. A/B - images of different neighbourhoods, Riverside Community and Downtown (both images were rendered in Sketchup Pro Software). C/D - are the same images but rendered in 3DS Max; the software adds a more realistic touch to the environment.

Regarding the health department, over 14 PHC

units were 3D modelled ,including and itinerant river unit. (Figure 4)



Figure 4. 3D model of a Primary Health Care unit located in Santa Fé, where seven clinical cases were set.

A website has been created to display the cities.⁸ These cities were used in UFCSPA’s UNA-SUS courses, which lasted 18 months, from 2010 to 2013. Of the 171 physicians enrolled in the course, 82 (48.0%) graduated; of the 247 dentists enrolled, 158 (64.0%) graduated, and of the 597 nurses, 384 (64.3%) graduated. In total, of the 1,105 students enrolled, 624 (61.5%) have graduated from the course.

The evaluation process has shown the virtual cities method applied to the course has been effective. For all four of the classes, 811 of 996 evaluation questionnaires were answered with 76.4% of students satisfied with the course. Another important index was the messages sent through discussion forums, which demonstrate students’ contributions in the development and maintenance processes of the virtual cities.

Discussion

The present study described the design and 3D modelling processes of virtual cities, and their use in a Family Health graduate course aimed at physicians, dentists, and nurses. Moreover, it has been observed that the course had a low dropout rate.

Some studies have used the Second Life platform in the creation of 3D environments.^{9,10} This platform was not used for the 3D modelling of the cities because some regions in Brazil have poor Internet connectivity.¹¹ While PHC units all over the country have Internet access, broadband Internet access in PHC units far from major urban areas is unavailable. The available service is a result of an agreement between municipalities and the Ministry of Health, as well as a necessary condition for professionals to enter the graduate programme. Designing a fictional city with Sketchup made it possible to characterise every Brazilian region. 3D modelling with this software allowed greater creative freedom and thus greater reliability in the produced material.

Developing a website for the cities allowed us to characterise the physicians, dentists, and nurses of each PHC unit and enabled the multidisciplinary approach needed for professionals/students to work in a health team. The use of virtual reality provided the students with a dynamic approach to content in a lifelike form and also contributed to their motivation and interest, which are important aspects of the learning process.⁷

Overall 61.5% of the students enrolled in the course have graduated, with dentists and nurses showing higher completion rates, 64.0% and 64.3% respectively. Enrolment in the course was open to physicians, dentists, and nurses who worked in PHC units, and no enrolment fees were charged. For a free, open-access course, we had a reasonable number of graduates. However, the Brazilian Association for Distance Education (ABED) census reveals that the dropout rate for both paid and free distance courses in Brazil is around 19%.¹²

The clinical cases are problem-based, and the virtual cities developed increased the potential of creating new educational resources.¹³ A PHC game is currently being developed. This game will simulate virtual patient care in PHC units, and aims at bringing the playful aspect to the learning process of students and professionals.

The UNA-SUS/UFCSPA staff focused mainly on the creation of virtual settings that tackled health care issues that were true to, and suitable for, the situations found in the population of Brazil. From a realistic point of view, this approach also furnished an enticing and intriguing setting for significant learning that gave rise to reflections on the working practice of students in the graduate programme.

Conclusion

Virtual cities that simulate the context of different locations in Brazil were successfully created by using ICT tools. The virtual cities designed for this purpose have been demonstrated to be applicable to the education of PHC health professionals.

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Conflict of Interest. The authors declare no conflicts of interest.

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