OPEN APPLICATIONS DEVELOPED IN BRAZIL FOR DISTANT LEARNING IN DENTISTRY: VALUABLE EDUCATIONAL RESOURCES FOR ACADEMIC AND PROFESSIONAL QUALIFICATION

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Abstract

Technology Enabled Learning, distance learning that leverages Information and Communication Technologies (ICT), has enabled thousands of individuals to access educational content, , and encouraged many educational institutions to adopt this modality. In Brazil, in order to promote Permanent Education in Health or continuing professional development (CPD) of professionals working in the public health sector, the government created the Open University of Brazilian National Health System (UNA-SUS), which offers postgraduate, updating and improvement courses, focusing on public and community health. In addition, to improve quality in Primary Care service inside SUS, Brazil developed the Telehealth Networks Programme; a national program that integrates teaching and service through ICT, offering conditions to promote Telecare and Tele-education. A challenge in consolidating these initiatives is to service professionals working in remote areas, precisely those who need CPD the most. To address this problem, UNA-SUS collaborated with Federal University of Maranhão (UFMA) to develop applications for mobile devices available through the SAITE Store platform. This makes the educational content created by the institution available both online and offline, and using different types of devices. Recognising Dentistry as a primary healthcare component, UNA-SUS/UFMA developed applications for this specific area. The content is multidisciplinary, presenting relevant information to the various professionals who provide primary care services in dental care within the healthcare network. This paper describes the history of the partnership between UNA-SUS/UFMA, the focus on dentistry and alignment with the Faculty of Dentistry of the University of São Paulo (FOUSP) Teledentistry programme, the rationale and production process of mobile applications by UNA-SUS/UFMA, and their relevance for academic and professional qualification of primary healthcare workers throughout Brazil.

Keywords: distance learning; eHealth; mHealth; teledentistry; telehealth; Brazil.

Introduction

Distance Learning and UNA-SUS

Distance Learning (DL) is a teaching modality where self-learning is facilitated between a learner and instructor who are separated by distance. This modality has created new means of teaching, through the incorporation of new content, teaching practices and evaluation procedures. The introduction of Information and Communication Technologies (ICT) in the educational field contributed to the rise and expansion of DL to create Technology Enabled Learning (TEL), allowing thousands of people to have access to educational content in a much quick and more efficient way, through the Internet. As Internet access grows, the difficulties faced by health professionals regarding access to continuing education are minimised or eliminated using TEL as a pedagogical innovation in education.[1]

In Brazil, UNA-SUS (The Open University of Brazilian National Health System**)** is the gateway initiative of the Ministry of Health that provides continuing education to health professionals who work in the Brazilian National Health System (SUS), in

Primary Care. It uses ICT as tools to mediate learning of thousands of health workers around the country, offering post-graduate, updating and training courses, focusing on public health and community health.

Created in 2008, it was established as UNA-SUS in 2010 via Decree No. 7.385/2010, consisting of three structural elements: Arouca Platform (an information system regarding health workers in Brazil), ARES - Archives of Educational Health Resources (a database of educational health resources), and a network of 35 free public universities in all regions of Brazil – the UNA-SUS Network.[2] It is through this network that UNA-SUS produces and supplies free online distance learning courses for the qualification of health workers, which gives the system great flexibility.

The approach adopted by UNA-SUS to grow its capacity and educational opportunities was to set up standards for the construction of educational items, such as: reuse of developed educational resources; interoperability across various computing platforms; and a focus on the workers professional learning needs, allowing greater effectiveness of educational programs.

In the latter context, courses are developed based on the healthcare workers' daily life, considering guidelines regarding continuing health education and care policies recommended for each area. As part of UNA-SUS System guidelines, SUS' principles are embodied within the Health Organic Law and the Law of Directives and Bases for Education.[3]

Difficulties experienced by health professionals, such as lack of time, poor Internet access, and / or the remote location of health professionals are being combated by UNA-SUS, in partnership with the Federal University of Maranhão (UFMA), through creation of applications for mobile devices. This provides educational content developed by the institution for training in key areas of healthcare service that can be accessed online and offline, and through various types of mobile devices.

Brazil Telehealth Networks Programme and UNA-SUS

Seeking to improve quality in primary care service inside SUS, the Brazil Telehealth Networks Programme is a national programme that integrates teaching and service through ICT to promote Telecare and Tele-education.[3] Among the programme's goals and services, two topics can be highlighted that are convergent with the *objectives* and *services* of UNA-SUS, namely: improving quality in Primary Care service/SUS seeking positive results and efficiency in this level (*objective*), and tele-education provided through the use of information and communication technologies (*service*).

In this positive confluence of purposes, a shared project arose between the Brazil Telehealth Networks Programme and UNA-SUS for the supply of educational resources in Dentistry.

FOUSP Teledentistry and UNA-SUS/UFMA

FOUSP (Faculty of Dentistry of the University of São Paulo) Teledentistry and UNA-SUS, in partnership with the Federal University of Maranhão (UFMA), have sought to collaborate and to boost and disseminate educational activity within the field of dentistry. This initiative was extremely important, especially when considering the small amount of free educational material focused on dental care within the primary care area, and also considering Dentistry as a relevant component of the primary healthcare network.

Partnerships like this are extremely important, aligning efforts among different government programmes to optimise continuing education of healthcare professionals. This initiative became even more valuable when considering the different geographical regions and different social realities of the States in which UNA-SUS/UFMA and FOUSP Teledentistry are based (Maranhão and São Paulo), the poorest and the richest states, respectively, of Brazil. The content of the online material, presented as applications, assists dental surgeons in routine activities, and also provides current insight regarding the most recurring questions they have to face when teleconsulting with practitioners in the primary care sphere.

UNA-SUS/UFMA has developed a fast system by which to produce and offer educational resources via mobile devices using 'apps', with special focus on Dentistry. The potential and value of *mobile learning* (m-learning) is highlighted by the research of Abdala and Haddad, which shows that 94% of dentistry Professors make daily use of smartphones but only 25% of dentistry courses in Brazil provide WiFi service in their computer laboratories.[4]

This paper describes the rationale for adopting apps, and presents the technological tools and educational resources developed and made available by UNASUS/UFMA for dental surgeons and dental students.

Why develop 'apps' for dentistry?

According to 2010 data, Brazil has about 11% of the world's dentists, and is the country with the largest number of these professionals.[5] On average Brazilian Dentistry Courses graduate 9,000 new dental surgeons each year. According to the National Registration System of Health Facilities (SCNES), in 2008, there were 219,575 dental surgeons practising in Brazil, and among these about 4,673 dental surgeons practising in the public healthcare system.[5] One also must take into consideration the fact that as it is not mandatory to register on the system there may be a number dental surgeons practising in the public sector who were not accounted for.[5,6]

Aligning with this are data showing 11.3 million smartphones were sold in Brazil during the second quarter of 2015 while only 1.6 million computers were sold in the same period.[7,8] This fast expansion within the smartphone market, combined with development of processing power, indicate smartphones are potentially powerful tools in the educational field. By integrating mobile devices with e-learning the content becomes more accessible and portable, allowing UNA-SUS/UFMA to spread available courses more widely.[9] In UNA-SUS' experience, digital books are the main source of content presentation in their courses. Therefore, UNA-SUS/UFMA started developing apps for mobile devices in digital book form, using graphical animations, audiovisual resources, illustrations, graphics, tutorials and games, to make learning enjoyable and exciting. These apps employ the two major mobile operating systems: Android (Google)[10] and iOS (Apple).[11]

Despite the number of dental professionals, the amount of free educational material on dentistry within primary care is sparse. Because oral health is an important factor for ensuring quality of life, UNA-SUS/UFMA considers dentistry a part of primary healthcare, hence their development of content and apps for Brazilian public healthcare professionals wishing to expand and update their knowledge in this field. As the material is easy to access and presents information prepared by experts, these educational resources are useful to a much larger audience than the students of UNA-SUS; e.g., undergraduate students. These applications are also characterised as free educational resources, being available at no cost for any individual interested in the content and functionality. Once downloaded, the material can be accessed offline, avoiding professionals having to abandon their place of service during training and by allowing flexibility in aligning study and work schedules.[12]

The course content is multidisciplinary, containing relevant information and guidelines for different professionals that make up the primary care services in the healthcare network. The specific content ranges from Dental Radiology, Attention to Maternal and Child Health, Oral Health for the Elderly, Oral Health for Children, and Oral Health for the Adolescent. In this way understanding and promotion of dental care throughout all stages of life is encouraged.[13] In addition applications related to health and society, epidemiology, pharmaceutical care, introduction to DL and so on are also included.

The SAITE Store

Wasserman highlights that development of friendly mobile apps is not a simple task, because there is no standardisation of screen size, hardware, operating system, API (Application Programming Interface), processing power, and so on.[14] In addition, each operating system has peculiarities regarding publication and distribution of applications.[15] For example, before publishing on the IOS platform it is necessary to submit the application to an assessment by the platform's technicians, which can take up to two weeks and directly affects the application development schedule. Another issue is that development on different platforms makes it difficult to reuse code and ease maintenance.

Faced with these problems, the solution was the creation of SAITE Store (Learning System and Information in Technology and Education), a mobile platform base for digital books and related apps.

- Specific goals of SAITE Store are to:
- Mediate communication with mobile operating systems
- Provide a standardised environment for the development of new content
- Simplify digital book searching
- Organise digital books
- Have a simple and intuitive navigation
- Apply the principles of Responsive Web Design
- Ensure accessibility on any type of device available
- Provide offline access to content
- Support for IOS and Android, systems that are market leaders
- Installable on any device (smartphone, tablet)

HTML5, CSS3 and JavaScript were the languages chosen for the new platform as they are popular among web developers, and have simple structure and compatibility with browsers such as Chrome, Firefox, Safari and Internet Explorer. To make content accessible, principles of RWD (Responsive Web Design) were applied, facilitating compatibility with different mobile devices.[16] The platform is in charge of dealing with particularities of each mobile system, simplifying the development and maintenance of digital books. All applications that had been published previously can now be accessed through the SAITE Store platform. Once a book is downloaded, the student can access its content while offline, where and when necessary. SAITE Store also helps students to keep a regular schedule of their studies in places where Internet access is limited and mobile devices are more likely to be used than computers.

The application also helps file management by preventing use of special characters in filenames, image formatting, book digital compression and file integrity checking.

It is possible to obtain and install the app through the specific online store of each mobile system (iOS or Android).There is no need for prior registration in a course, and anyone interested in the material available can access it.

Structure of digital books

Digital books are published through a web service that lists all the books available for download. Each digital book is a course module addressing a specific topic, here focussed on dental health topics.

Books also contain metadata that serve to inform students of their content, size, icon, and course. These metadata also help their management around the platform such as download, storage and management of student library.

The design of a digital book, which is a learning object, is aligned to appropriate pedagogical principles, taking into account content presentation requirements and forms of interaction. The amount of information presented is carefully planned considering, for example, that screens of mobile devices have limited resolution. Thus, an attractive interface with appropriate interaction devices has a positive effect on its usefulness, acceptance and potential to promote learning.[17]

Images can be used for different functions: decorative, representative, organisational and explanatory. Therefore, the use of images to illustrate concepts is essential for educational content.

When it comes to learning process, it is important that text and information are displayed in the interfaces properly. Based on guidelines established by Bailey et al., some questions can be raised in this regard: a) Do the text fonts have an adequate size? b) Is it possible for the font text to be increased/decreased according to each user need? c) Is there visual consistency in the presentation of information (titles, formatting, text layout and graphics)?[18]

Interaction with digital books opens up many possibilities for students. However, to take advantage of such resources, it is essential to design and deliver appropriate interaction mechanisms. For example, interaction of a user on a mobile device is different from the one that is done on a personal computer. With computers, a keyboard and mouse are used, while smartphones and tablets work with touch-screen interface.

Conclusion

The rapid development of ICT has been responsible for a revolution in many fields, including higher education. Since 2010, UNA-SUS has offered courses using TEL to SUS health professionals. Of the professionals taking part in extension and training courses offered by UNA-SUS/UFMA, dentists represent the second largest audience. Until initiation of this programme dental surgeons did not have available learning objects specifically targeted to their health area. A primary lesson has been recognition of the need to develop resources (content and tools) aimed at a specific audience, allowing better clinical input into the public health system. Following SUS principles this ensures health practitioners acquire skills and abilities that develop prevention, health promotion, protection and health rehabilitation. UNA-SUS/UFMA further addressed the need by developing mobile applications for dentists. This is expected to result in increased accessibility of TEL and the exploitation of open audiovisual resources for mobile devices capable of operating both online and offline facilitating utility for those in regions with Internet access problems.

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