A health promotion web application for virtual teacher training

Una aplicación web de promoción de salud para capacitación virtual de maestros

Um aplicação web de promoção da saúde para formação virtuais de professores

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Abstract

The training of the staff in study centres is scarce around oral health, being the ICT valid tools to improve it. **Objective:** to design a web app for the immediate treatment of traumatic oral injuries in schoolchildren. **Method:** a virtual protocol about the immediate treatment given to children in the event of a traumatic dental injury was designed. The contents follow an instructional design with a logical order of appearance. **Results:** the app was planned together with ICT analysts, following the compatibility demands of browsers and information safety and the PHP-Laravel programming language was applied and the MySQL database engine. **Discussion:** The digital environment or educative spaces are the objects or gadgets of a digital nature in a concrete scenario, social and culturally built, with the purpose of favouring valuable learning experiences. **Conclusions:** a training app was created, promoting de usefulness of open educational resources for the oral health promotion.

Key words: Information and Communication Technologies (ICT), Health promotion, Dental trauma, Ceibal Network.

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Resumen

La capacitación del personal de los centros de estudio es escasa en el área salud bucal, siendo las TIC herramientas válidas para mejorarla. **Objetivo**: Diseñar una aplicación web sobre el tratamiento inmediato de las lesiones traumáticas bucales en escolares. **Método:** Se diseñó un protocolo virtual sobre el tratamiento inmediato a niños frente a una lesión traumática dental. Los contenidos siguen un diseño instruccional con un orden lógico de aparición. **Resultados:** La aplicación se planificó con analistas en TIC con la exigencia de compatibilidad con navegadores y de seguridad informática y lenguaje de programación PHP – Laravel y el motor de base de datos MySQL. **Discusión:** Los entornos educativos digitales son objetos o artefactos de naturaleza digital en una escenografía concreta, construida social y culturalmente que favorecen experiencias de aprendizaje valiosas. **Conclusiones:** Se generó una aplicación web de capacitación fomentando la utilidad de recursos educativos abiertos para la promoción de salud bucal.

Palabras clave. Tecnologías de la Información y la Comunicación (TIC), Promoción de salud, Traumatismos dentarios, Red Ceibal.

Resumo

A formação da equipe dos centros de estudo é escassa na área de saúde bucal, sendo as ferramentas válidas de TIC para melhorá-la. **Objetivo:** Elaborar uma aplicação web sobre o tratamento imediato de lesões bucais traumáticas em escolares. **Método:** Um protocolo virtual foi concebido sobre o tratamento imediato de crianças em face frente a uma lesão dentária traumática. O conteúdo segue um design instrutivo com uma ordem lógica de aparência. **Resultados:** O aplicativo foi planejado com analistas de TIC com a exigência de compatibilidade com navegadores e segurança de computadores e linguagem de programação PHP – Laravel e o mecanismo de banco de dados MySQL. **Discussão:** Ambientes educativos digitais são objetos ou artefatos de natureza digital em uma cenografia concreta, social e culturalmente construída que favorece valiosas experiências de aprendizagem. **Conclusões**: Foi gerado um aplicativo de treinamento web promovendo a utilidade dos recursos educacionais abertos para a promoção da saúde bucal.

Palavras-chave: Tecnologias da Informação e Comunicação (TIC), Promoção da Saúde, Trauma Odontológico, Traumatismo dentário, Rede Ceibal.

Introduction

Dental trauma happens most frequently to school children at school. According to Andreasen et al.,[1] suitable knowledge and a rapid appropriate treatment plan after dental trauma are essential for a good prognosis. Injuries in this age group usually occur on developing permanent teeth. Dental trauma in children at school is a recurrent and concerning global issue. When it occurs, teachers are forced to make quick decisions under stress. Traumatic dental injuries comprise 5% of all injuries. Twenty-five percent of all school children experience dental trauma, and 33% of adults have experienced trauma to permanent dentition, with most injuries occurring before 19.[1] Luxation injuries are the most common traumatic dental injuries to primary teeth, whereas crown fractures are the most commonly reported trau-

ma to permanent teeth. Early diagnosis and an adequate and timely treatment plan ensure the best results in the healing prognosis of dental trauma and its consequences.[1] Currently, there is no data on dental trauma in Uruguay. In 2010, Bernadá et al.[2] found that 1,057 (48%) out of 2,191 children's visits were for fall-related accidents and 22% of cases involved facial injuries. Thirty-seven percent of the accidents outside the home took place at teaching institutions.

Primary dentition considerations

A young child is often challenging to examine and treat due to a lack of cooperation and fear. The situation is distressing for the child, parents, and teachers. Therefore, staying calm and dealing with the emergency efficiently is crucial. It is essential to remember that there is a close relationship between the apex of the root of the traumatized primary tooth and the underlying permanent tooth germ, which may lead to severe consequences in permanent tooth development.

Considerations for immature permanent dentition

The immature permanent tooth has considerable capacity for healing after traumatic injuries—crown fracture, luxation injury, and root fracture. Notably, the prognosis for avulsed permanent teeth is highly dependent on the actions taken at the place of the accident. For those involved, promotion of awareness of and training in first-aid treatment for the avulsed tooth is strongly encouraged.[3] The treatment alternatives and prognosis of a traumatically avulsed young permanent tooth are closely related to the vitality of the periodontal ligament and the degree of root maturation. Replantation is usually the treatment of choice. An appropriate emergency management and treatment plan are essential for a good prognosis.

The International Association of Dental Traumatology (IADT) has developed a guideline for immediate and urgent care of traumatic dental injuries, which is helpful in delivering the best care possible efficiently at the time of the accident.[4] This guide should assist dentists, other health care professionals, teachers, and parents in decision-making and provide relevant information to manage these traumatic injuries and provide the best treatment possible based on specific circumstances. Gugelmeier et al. (2021)[5] report the teachers' experiences with traumatic dental injuries at their schools. Of the 138 respondents, 74 report experiencing one or more situations where children sustained traumatic injuries to both primary and/or permanent teeth (fractures, luxations, etc.) and soft tissues (lacerations or contusions). This study also mentions that the analysis of the teachers' accounts shows that: a) when there is an emergency in the school premises, the principals and other teachers get involved; b) an emergency causes concern, anxiety, and nervousness in the school community. The data analyzed showed that falls were the leading cause of injuries sustained by children, which is consistent with the 2010 results of Bernadá et al.[19]

Progress has been made in training teaching and non-teaching staff in study centers. However, this oral health training remains insufficient and can be improved, and ICT tools have proven valid for this purpose. The evolution of the educational model does not simply entail new resources in the classroom but also requires changes in teaching beliefs and practices. Following Adell and Castañeda,[6] the new professional competencies involve selecting and re-using digital resources, creating and managing online teaching environments and materials, curating and evaluating learning on an ongoing basis, and implementing professional collaboration and exchange with other teachers. The Dictionary of Educational Technology[7] defines educational innovation as "changes applied after certain discovery, invention, or pro-

cess of research and development occurs. It is a continuous process that results in the creation of a new technique or procedure". Educational innovation. The International Dental Federation (IDF, Vision 2020)[8] states that "access to ICT is spreading quickly on a global scale. E-Health is rapidly becoming a reality because of the rapid spread of technology. E-Health means the application of the Internet and other related technologies in the healthcare industry to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, patients, and consumers to improve the health status of patients." E-Health has a huge potential to disseminate and collect targeted and accurate information quickly, and there is a considerable opportunity for oral healthcare professionals to be at the forefront of innovative, rational, and ethical use of new technologies. With appropriate control, we believe that E-Health shall contribute to disseminating disease prevention and health promotion messages electronically; and foster universal access to professional education with online learning tools accessible from anywhere to anyone with an Internet connection. Therefore, E-Health could have a significant positive impact on people's health.

Value and characteristics of ICTs

The omnipresence of information in the current digital culture of the 21st century requires redefining the meaning of literacy as having the skill to master all the codes and expressive forms of each of the current languages of representation (textual, audiovisual, and digital) to select information, analyze it and transform it into knowledge. García-Vera[9] states that literacy n information societies should be redefined as "the functional mastery of the knowledge and skills required to handle technology, moving and still images, information, etc." He indicates that reading texts online requires

skills and competencies that differ from those of traditional literacy. Multimodal digital literacy should teach languages and provide digital tools to analyze and produce messages. Area et al.[10-12] have repeatedly mentioned that diverse literacies are necessary to train educated and democratic citizens in the society of the 21st century. In this regard, Monereo[13] identifies four main types of skills to use the Internet: skills to seek information and learn how to learn; skills to learn to communicate; skills to learn to collaborate; and the ability to participate in public life. The agreement in the field is that current literacy is a much more complex process, which entails not only training people in digital hardware and software but also aims at training citizens in the new codes and communicative forms of digital culture. Gutiérrez points out the above statement.[14] Therefore, digital literacy aims at acquiring and mastering competencies that imply using information and communication rather than skills for using technologies. Digitized information and virtual communication environments are a new ecosystem for the daily life of 21st-century citizens. Individuals or social groups must have the skills to produce, disseminate and consume information rapidly, effectively, and efficiently to survive in this new environment: socially-embedded individuals shall use these skills successfully. So they must know how to turn information into knowledge and have the skills and abilities to use resources and tools efficiently to search for information, produce and disseminate information, and share information on various digital tools and environments. Area et al.[15,16] state that ICTs should not only be defined as tools or artifacts used in different tasks or actions but also as a space for communication and interaction with other individuals and social groups. According to Monereo,[13] the Internet has profoundly changed how the game is played regarding the production, distribution, access, and consumption of cultural products or objects (films, music albums or CDs, photo

images or texts). Today we can replicate a digital file countless times. Files can be distributed on the web instantly or nearly so, and anybody can easily create cultural content and share it online. Also, users can share this content and make it accessible from their own technological devices. All this causes a major crisis in traditional cultural industries (news agencies, audiovisual and music producers, or book publishers). Chacón et al.[17] acknowledge textbook publishers are facing these new challenges by offering online learning platforms and portals. Along this line, public education authorities are also developing web portals specifically for teachers, who use them to have open access to a variety of courseware (mainly online exercises or activities) which may be downloaded and used in class. Kanwar et al.[18] state that teachers, associations and/or foundations develop other websites that offer and exchange self-developed courseware as professional social networks do. They offer an alternative to proprietary educational material, Open Education Resources (OER). So we can see innovation in educational materials and new actors coming into play since, besides traditional companies, new alliances are being made between technology companies and the education sector, as well as a large group of teachers who are starting to develop and share their material online (Dini et al., 2011).[19]

ICTs in Uruguay

According to a report by the Inter-American Development Bank (2012),[20] ICTs have been recently at the forefront in Latin America and the Caribbean and in Uruguay regarding growth rates in the world for the incorporation of technology and connectivity. Nevertheless, there is still a long way to go regarding equity and universal access. The ECLAC report—Social Policies Series No. 171—(2011),[21] states that the design and extent of implementation of ICT policies in different countries of the re-

gion are very heterogeneous: In general, we can ascertain that countries' policy design indexes look better than implementation indexes Mexico, Panama, Uruguay, and Cuba stand out in this respect, with relatively high indexes of ICT policy design and implementation. In contrast, Bolivia, Colombia, Paraguay, and Ecuador have lower ICT policy design and implementation indexes. Finally, Argentina, Chile, Costa Rica, El Salvador, Nicaragua, Peru, and the Dominican Republic have higher design indexes than implementation indexes. This reflects the scenario in many countries with the necessary policy design but that have yet to implement these policies. According to this report, although the most likely explanation for this is the lack of funds to invest in policy implementation, it can be assumed that in some cases, the shortfall is tied in with the very difficulty of implementing initiatives, that is the lack of institutional capacity for policy implementation. López Jordi et al.[22] describe the situation of ICTs in Latin American universities and confirm that Internet access in different countries is very uneven. The report of the Information System on Educational Trends in Latin America (SITEAL 2012)[23] attests to the digital gap existing in Latin America, where Internet access is uneven, although necessary to gain knowledge in today's globalized world. A closer look at the differences between countries shows that access opportunities are very unequal. In Bolivia, El Salvador, Guatemala, Honduras, and Paraguay, less than 5% of the population has Internet access, while in Costa Rica, Chile, Brazil and Uruguay, 19 to 30% have Internet access. Latin American home Internet access for students varies considerably by country. Students in Guatemala, Honduras, Bolivia, and Paraguay have the least home Internet access (2 to 4%). Uruguay has the best relative situation, with approximately 4 out of 10 students having home Internet access. In Brazil, Chile, and Costa Rica, one out of four students has home Internet access (SITEAL 2012).[23] Therefore, according to the

country where they live, some students have a likelihood up to 17 times higher of having Internet access at home than their peers in other countries. (Fig. 1). Public policies at primary and secondary schools vary in the region (Fig. 2).

Fig. 1. School population with Internet access at home, by country (%), Latin America.
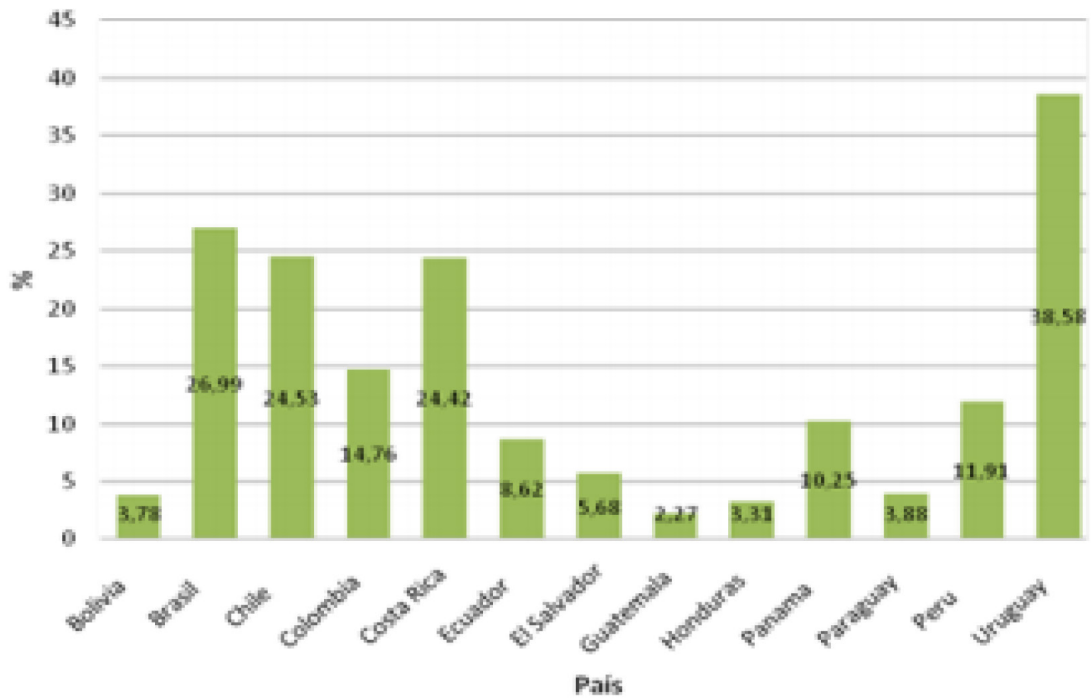
Source: SITEAL Report 2012

Fig. 2. Learner-to-computer ratio in primary and secondary school, 2010.
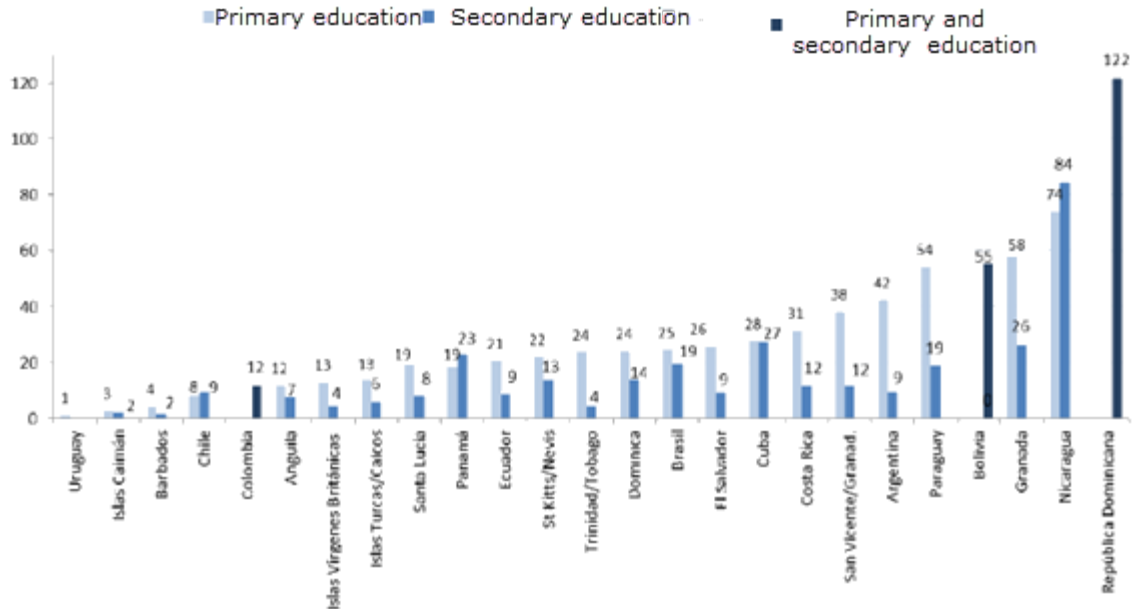
Source: UNESCO Institute for Statistics, 2013

The National Administration of Public Education (ANEP)[24] published a report stating that platform access increased significantly in 2020 compared to previous years in Uruguay: the number of single-day users—learner/teacher who had access and carried out an activity during at least one single day in the analyzed period—increased by 129% compared to these indexes in 2019; while the number of active users—users who enter to the platform and carry out some activity during at least ten days in the analyzed period—increased by 256% compared to 2019. During the pandemic, in-person classes were called off (from 16 March to 30 June). The average number of daily users, including students and teachers from primary and secondary public schools, was 206,000. Once in-person classes were reestablished with blended learning, the average number of daily users was 108,000. The total enrollment of students and teachers at public schools is 719,000.

The report details that 2019 relative use was insignificant during weekends, although some activity is recorded on Sunday afternoons and evenings, presumably from teachers working on their weekly lessons. In contrast, the platform was used on weekends during and after isolation due to the pandemic.

Objectives. - To design a virtual tool for teachers to follow the immediate treatment of traumatic dental injuries in children. - Include ICTs in oral health promotion and prevention activities.

Method. We developed this virtual tool for teachers, which can be accessed quickly and efficiently, and used to learn about the immediate actions required in the event of traumatic dental injuries in children. It also includes a virtual protocol to treat children immediately in this type of event. It is always available to teachers at http://www.dravgv.com/traumadental/ (Fig.3).

Fig. 3. Cover Sheet for "Dental trauma in children" Web Application.

Source http://www.dravgv.com/traumadental/

We designed the virtual training protocol based on the IADT tool (IADT 2012),[4] and modified and adapted it for our target population, with the corresponding selection of theoretical content and new visual tools. The language was adapted, and we designed the specific graphics and drawings. We organized the content and designed instructions in a reasonable order considering possible accidents and traumatic dental injuries. The Directorate of the Program *Uruguay Educa*, Pre-school and Primary Education Council (CEIP), National Administration of Public Education (ANEP) wrote the web application presentation. Both IT analysts from CEIBAL, Uruguay, and Rosario, Argentina worked jointly to develop the virtual training web application. It is compatible with Google Chrome > 48, Firefox > 33 and adapts to different resolutions. So it may be visualized in all electronic devices and has a global reach. This needs to be a practical tool, so we focused on its structure to develop a user-friendly and intuitive web application. We used the HTTPS Protocol to meet the strictest requirements regarding IT security in data transfer. Concerning technology, we used the programming language PHP - Laravel and the storage engine MySQL. Regarding image copyright,

we purchased the photos from es.fotolia.com,© 2018 Adobe Systems Incorporated, Fotolia LLC, a subsidiary corporation of Adobe Systems Incorporated, 345 Park Ave, San Jose, CA 95110, USA. We tested the web application before publishing the tool. The Web Hosting is managed and processed by the author- http://www.dravgv.com/traumadental

Results

The web application was designed for teachers who have it available online. It elaborates on first aid in case of dental trauma and provides instructions to be followed at the event site and at home for children's care.

A) Dental trauma to permanent teeth
What type of injury occurred?, - The tooth has been completely removed from its socket (alveolus), - The tooth is in a different position, - The tooth moves slightly, - A piece of the tooth crown is fractured. - No bleeding at fracture, - Bleeding at fracture, - Home care (Fig. 4).

B) Dental trauma to primary or baby teeth
- Home care, - Check-ups at the dentist's office (Fig. 4).

Fig. 4. Indications according to the type of dental trauma by age group.

Source: http://www.dravgv.com/traumadental

Selwyn et al.[25] state the importance of collective reflection on the role of information and developing new responsibilities and skills to ensure greater transparency, protection, and identification of the information needs of direct users of educational platforms. Therefore, we made an initial nationwide diagnosis to learn about Internet access, needs, and difficulties related to using virtual educational resources and other components for teachers. We also evaluated the quantitative and qualitative aspects of the virtual educational tool. Gugelmeier et al.[4] published the description of this research phase in Odontoestomatología 23[37] 2021. On page 9 of this article, under the title *Satisfaction with the information received through the application*, it reads:

> "A global assessment was obtained on user satisfaction with the technology used and its contribution to solving traumatic dent injuries in schools,... A scale from 1 to 10 was used to rate the procedure. Of 126 responses, 112 teachers (93%) rated the procedure 5 or more (1–10 scale) and within them, 76% rated the procedure 8-10.

Discussion

The digital world is vast and almost unlimited, and guidelines to browse it are lacking. Individuals are being separated culturally based on the skill level required to survive and browse in the vast land of information. Literacy is a basic need for citizens today and, predictably, in the coming decades regarding the new cultural forms associated with the digital society. [12] We believe that the theoretical foundation of these information literacy approaches and practices should grow by including new areas and educational goals such as those mentioned, and that literacy should be considered a continuous lifelong learning process. Therefore, it is relevant to include the use of innovative ICT tools to promote oral health in teacher training courses. Briscoe[26] and Whelan[27] talk about ICTs as part of a digital ecosystem that is taking over the ecosystem of the media and cultural artifacts of the 20th century (the press, books, music albums, videocassettes, photo images, etc.) and the associated social behavior. A book is a tangible, complete, rounded, and stable cultural product, but cyberspace or the

Internet offer fractioned, dispersed, intangible, interconnected, open, audiovisual, multimedia, and ever-changing cultural works. It is the metaphor of the solid culture of books versus the liquid culture of the digital ecosystem.[15] One of the central ideas of this paper is based on the statements of Area et al.[10-12] and Gutiérrez[14]: training cannot just entail the presentation or exposition of knowledge and information as something definite and flawless, transmitted by unquestionable authoritative sources (a teacher or a book). We live in a complex and ever-changing world where successful individuals adapt more favorably to changes and have the knowledge and skills needed to solve problems. Comprehension is a complex intellectual process involving many cognitive skills (discriminating, analyzing, classifying, etc.). In this process, individuals integrate new information into their structure of thoughts, thus creating a new idea or concept. Access to information is the initial, albeit insufficient, condition for comprehension and even for constructing knowledge, since we cannot create meaning without data or prior knowledge. In line with Area (2015),[16] we believe that the prevailing use of didactic materials in the 21st century entails a change in the technological format, a new cultural narrative, and a different pedagogical role for materials. In other words, the author describes digital educational environments or spaces as digital objects, spaces, or artifacts that mean something in a specific social and cultural context and are used to promote valuable learning experiences in cyberspace.

Conclusions

The article describes the development of a web application for the immediate treatment of dental trauma at school. It highlights the importance of digital literacy among teachers to improve resolution and certainty when defining immediate treatment. We should continue developing and promoting different tools to train teachers in open educational resources in their field. In different modalities—formal, informal, virtual, personal, individual, and collective— these tools should improve safety in emergencies.

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4. Discussion of results
5. Drafting of the manuscript
6. Approval of the final version of the manuscript

VG has contributed in 1, 2, 3, 4, 5 y 6.
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