

Using Information and Communication Technologies in Health Teaching and Learning

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1. Introduction

Traditional teaching and learning methods in health have subscribed to the belief that are not engaging enough to motivate students or the general public and, therefore, not fostering their participation and involvement in medical practices.

Online interactive information and communication tools are closing the gaps of traditional teaching [1] by simulating health care training and providing an empathetic learning experience in physician-carer-patients' interactions. Indeed, interactive learning and demonstrations may be particularly important in medical and health sciences education. Not only they foster a hands-on experience of particular topics but also encourage an application-based focus.

Furthermore, teaching activities that include Information and Communication Technologies (ICT) used in basic science education have been recognized to promote interest and engagement, collaboration, while improving knowledge retention and contribute to develop clinical reasoning skills [2].

This Special Issue of the EAI Transactions on Pervasive Health and Technology entitled 'Using Information and Communication Technologies in Health Teaching and Learning' aims to disseminate research using multiple methodologies in teaching and learning with ICTs aimed at Life Sciences, namely Medical and Health.

We expect the topics covered in this Special Issue to be of interest and increasing readership of the research community. It consists of four scientific contributions.

In "Designing a Novel Ensemble Model of a Classification Technique for Gene-Expression Data of Lung Cancer with a Modified Genetic Algorithm", Prem Chandrakar, Shrivastava and Sahu introduce a novel concept of repetition of the Genetic Algorithm with classification algorithms, examining gene expression dataset diagnosing the lung cancer with high classification accuracy. This paper illustrates the way data mining and classification strategies can constitute learning resources to advance knowledge on gene expression and cell functions.

"Virtual Learning Approach Toward Introductory Biological Engineering Course in Uruguay During COVID-19" reports the restructure of the learning curriculum of the biological engineering course in Uruguay to blended learning due to the COVID-19 pandemic.

Parallika, Basha and Shankar propose a Face Mask Detector with OpenCV, PyTorch, and Deep Learning that helps to detect whether or not a person wears a mask. The use of deep learning based on artificial neural networks to guide health behaviours has also been of utmost importance in the syllabus and course modules that combine ICT and health care, paving the way into ICT competences in health teaching and learning.

Finally, the paper "Augmenting Surgery: Medical Students' Assessment and Ergonomics of 3D Holograms vs. CT Scans for Pre-Operative Planning" reports the medical students' attitudes towards traditional Computer Tomography scans or mixed reality (MR) based on a 3D hologram.

Together, these studies highlight the added value of integrating Information and Communication Technologies in health education and preparing the new generations of

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health professionals to the latest advancements in the use of media, virtual reality training and artificial intelligence in bioengineering skills and medical practices.

2. Health Teaching and Learning in times of Pandemics

The COVID-19 pandemic has changed education and medical training. Worldwide, schools were shut down and billions of students were isolated at home.

According to the United Nations Educational, Scientific and Cultural Organization - UNESCO [3], the number of learners who do not have access to schooling or University classes in one hundred and eighty-six countries owing to the COVID-19 outbreak surpass 1 billion.

Consequently, everyone involved, students, teachers and parents had to adapt, and the solution was in to acquire and develop IT skills and literacy. The rise of e-learning skyrocketed and remote teaching via digital platforms was the go-to effective method [4]. In fact, recent research suggests that online learning may be here to stay, maybe in a hybrid format [5], as it has been claimed to increase retention of information with less time invested.

Social confinement have brought learning inequalities to the spotlight with the lack of access to digital equipment and fear of contagion [6].

In Health Teaching, there are many challenges that must be considered and in which information and communication technologies may be an added value. Some of these are summarized as the following:

- Lack of contact with ‘live patients’ [7] and empathic interactions with the patient, having impact on decision-making. Virtual reality (VR) can be crucial to role-playing and train decision-making in stressful scenarios. Teleteaching on hospital sites or access to interview cases and recordings can also help with patient diagnosis and triage [8];
- Information overload, misconceptions about healthcare and confusion [9]. Media communication, digitally mediated campaigns and fake news are some of the topics that need to be addressed in health education curricula;
- Lack of motivation owing to the burnout, illnesses, and deaths of healthcare workers [7, 9]. Social learning is often affected by observation, imitation and modelling [10] and, therefore, digitally mediated networks can be essential to knowledge exchange, emotion regulation, and coping [11];
- Deal with great amounts of data to make healthcare decisions. Data mining and classification strategies can help the professionals

[12] to detect patterns and facilitate these decisions;

- Represent health information [13] and communicate easily the information to the general population, using both the mass media and digital platforms [14].

In sum, the aforementioned challenges lay the foundation for the adoption of information and communication technologies in healthcare and medical education.

3. Trends in the use of ICT in Health Education

Envisaging the future of the adoption of ICT in Health Communication is a difficult task, especially in such uncertain times. However, pinpointing some of the trends in ICT adoption is essential to promote scholarship and lead change in some of the challenges in the field.

Professionalism in medical education [15] is fundamental and given, for example, the advancements in DNA sequencing technology and gene mutation [16] or data protection in health records [17], incorporating ethics in the learning curricula is essential.

Advances in surgery also include computer assisted anatomy mapping [18], 3D geometry, robotics optimization, 3D printing, and imaging datasets [19]. In the same vein, hands-on training workshops may also incorporate, for example, electromyography, electroencephalography and ultrasonography to get the students familiar with such techniques and practices [20].

Extended reality (XR) that combines both physical and digital elements using Augmented Reality (AR) technology, simulators, Virtual Reality headsets and mobile devices help to generate scenario building and assist the students in training and decision-making [21, 22]. Motion capture can be also relevant to the study of muscle function, posture simulation and Human movement [23, 24]. But also, as tools to aid established practices in a sterile and highly regulated and demanding environment.

In terms of healthcare behaviors, behavioral design and eye-tracking may be relevant to assess the effectiveness of social awareness health campaigns [25, 26]. Finally, games are also part of emergent technology that craft the learning experience in healthcare and may enable crowd-detection patterns [27] and data management [28].

In sum, Information and Communication Technologies however promising have a long way not only to facilitate clinical practices but also to develop skilful medical professionals, who have to deal with uncertainty and different types of challenges.

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would like to dedicate this SI to their students to inspire them to these topics of research and to everyone interested in collaborating in projects and curricula reformulation that integrates ICT in healthcare education.

About the Editors



Sónia Oliveira, PhD is member of HMRI (Hunter Medical Research Institute) and HCRA (Hunter Cancer Research Alliance) (Australia) and CICECO – Aveiro Institute of Materials (Portugal). She received her PhD in Human Physiology from the University of Newcastle, Australia, and also holds a Master in Cellular and Molecular Biology from the University of Aveiro, Portugal. During her PhD, she explored the Nerve-Cancer connection in tumors. She also worked in the genetic and molecular control of the mammalian male meiosis and in the anatomical and physiologic effects of compounds present in herbal extracts. She has broad research interests namely in pathology, regenerative medicine and in neurophysiology. She is interested in using biotechnology and biomimetic systems to cure mammalian disorders, namely through the application of stem cells to correct mammalian tissues defects.)



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