

Merging new Technologies with Health Sciences Education and Practice

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ABSTRACT

The aim of this track is to collect some of the most innovative computer based technological developments applied to both the contexts of biomedical training and clinical practice, as well as in other fields related to Health Sciences training, providing an excellent opportunity for the promotion and exchange of innovative teaching experiences in the health field, especially those based on the use of state-of-the-art technology.

CCS CONCEPTS

• Human-centered computing; • Computing education → information technology education.

KEYWORDS

Technologies; innovations; education; biomedical; training; practice.

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1 Presentation

The transmission of knowledge, independently of space and time, using teaching innovation technologies and computer

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systems is, nowadays, one of the great scientific-technical and cultural revolutions in our society, where the field of biomedical and health sciences, has been able to obtain excellent developments and applications.

The aim of this track is to collect some of the most innovative computer based technological developments applied to both the contexts of biomedical training and clinical practice, as well as in other fields related to Health Sciences training, providing an excellent opportunity for the promotion and exchange of innovative teaching experiences in the health field, especially those based on the use of state-of-the-art technology.

We will review the latest methodological and technological trends along with teaching innovations, ranging from software for three-dimensional visualization to clinical simulators, stereoscopic vision environments or virtual and augmented reality.

Technology, applied to training in health sciences, has undergone great changes over time, always parallel to the technological evolution of society; for this reason, technological advances have modified the teaching and learning methods of university students in the experimental and health sciences. The relationship between the current context of the information society, medicine and health systems is especially important given that information and knowledge are especially relevant in this field of activity. The accelerated increase of different devices that the technological industry develops every year, suppose an incorporation and use, in our society, in a daily basis.

The impact of different information and communication technologies on university education in health sciences, make products that are incorporated into the teaching or academic field in a very common way. The application of computer technologies in training in experimental sciences and health, expands the possibilities of action and intercommunication between teachers and students, also allowing access to new means of exploration and representation of information, along with new ways of access to knowledge, through very diverse resources, such as computer simulations.

A number of papers within this track deal with engineer applications in the field of health science.

The paper entitled "Preliminary Investigating on the Influence of Whitening on Natural Tooth Wear Resistance" is part of the area of dental tribology. It is the first study to experimentally explore the influence of whitening on the wear resistance of natural teeth, suggesting an increasing of the volumetric wear on the teeth subject to whitening procedures.

The papers entitled: "Real time analysis of the filament for FDM 3D printers" and "Analysis of the anisotropy in parts for medical applications created by the superposition of layers of PLA and epoxy resin with the FFF & Robocasting techniques". Both are framed within the additive manufacturing context of research. The first one develops a quality control system for manufacturing processes by melt deposition for medical part. The second paper analyzes the anisotropy of a new additive manufacturing technique that will use thermoplastic material and epoxy resin to create the creation of usable parts for the medical industry.

Next, the papers entitled "A Finite Element Model for the Analysis of Squeaking Hips" and "1D Finite Element model using rod element applied to muscle behavior simulation" aim to explore the influence of main prostheses geometrical parameters on its first ten modes of vibration. A new simplified model of a muscle, based on a 1D element, rod type, instead of a 3D mesh of the muscle geometry is developed. The main advantages of this new method for modeling muscles is that several position of a joint, where the muscle is involved, could be analyzed without any added effort to the original meshing of the model. We only need to locate the bones involved in the joint in their new position, and so the muscles will move to their right position. 3D models allows us to study in a more detailed manner the muscle stress maps, an deformations, but the main issue we must work on is the need of re-meshing the 3D geometry any time the joint changes in position. With this simplified method, only its insertion points, the section and the length, define the muscle, in the FEA. And none of the changes when the joint changes in position.

The papers entitled "Aesthetics in Orthopedic Products: Applications of the Advanced Manufacture (AM) to the Industrial Design of Orthoses", "Design of Thermoplastic Oral Appliance With Mouth Opening Control to Treat Obstructive Sleep Apnea" and "Design and prototype of a control for virtual environment in CHD examination" focus on the design, prototyping and production of medical device. These paper aims to invest qualities that improve the chain value of the obtained orthoses by advanced manufacturing methods compared to traditional methods, in order to consolidate the expected demand. In addition to ensuring these devices the health function that is required, it is proposed to incorporate the design aesthetics as an emotional differentiating element that directly affects the psychology of the injured person to avoid the lack of self-esteem and integration that causes an injury or a morphological alteration. A new thermos-adjustable chair-side oral appliance is presented, in particular, a titratable mandibular advancement appliance. It consists of two independent prefabricated trays adaptable to the shape of adult dental arch and linked to each other by a protrusion mechanism. This study

represents a preliminary step for the complete development of a virtual reality glasses control for the simulation of the practice of the ultrasound examination in the diagnostic test of congenital heart disease in medical training. Finally, thanks to the ergonomic analysis, the relationship between the machine and the doctor could be better understood.

The aim of the paper entitled: "Biomechanical normality model of the Human lumbar spine (Lumbosacral region)" is to present a morphological study of the lumbar spine and the lumbosacral articulation in healthy individuals without regular and demanding physical or supportive physical activity.

The paper entitled: "Study of the influence of e-scooter vibrations on human health and comfort" quantify and analyze the effects of vibrations received by users of two types of electric mini-scooters from the point of view of perception, comfort and health.

In another line, three-dimensional representations remain an attractive and innovative method for the teaching and learning in health sciences. Furthermore, the use of three-dimensional images developed with the help of commercial software for 3D reconstruction, are part of the new visual pedagogical strategies that allow the activation and revision of teaching contents, for the better understanding of anatomical structures.

In recent years there has been an accelerated technological development in all areas of life, including teaching and learning, particularly in health sciences and Human Anatomy. This study offers an interactive system which creates three dimensional anatomic models of the eyeball and visual pathway for educational and clinical purposes. Similarly, other papers deal with the generation of 3D models from radiological images within PDF format. With these techniques, teaching content is simplified, facilitating access to information and enabling communication and understanding between colleagues. Applications in the biomedical field are discussed. They offer solutions to increasingly daily clinical challenges, providing the possibility of interventions and treatments increasingly customized to the growing needs of patients. Other studies focus on the development of 3D representation of different anatomical structures such as the pelvis, from 2D magnetic resonance images, making easy to understand both the bony and muscular elements of pelvis.

Another group of papers analyze the somatotopic arrangement of the nerve tracts in the internal capsule and its anatomical position. Through this structure cross many important nerve tracts, including the pyramidal tract, which conducts information for the voluntary movement of the limbs. These nerve tracts and the specific location of their nerve fibers have been known for several years.

The uses of Virtual Reality (RV) and Augmented Reality (AR) in the health sciences have been very different, being one of the most currently used in the field of medical and surgical simulation, using these systems of three-dimensional vision with glasses or helmets of stereoscopic vision. These technologies provide an opportunity for interaction with 3D models with different devices to traditional workstations are now possible,

being able to visualize anatomical structures on a smartphone or even Augmented or Virtual Reality glasses.

It is evident that technological environments provide very useful tools in university education, incorporating additional and complementary resources to learning, which allow generating training situations, free from the restrictions of time and space imposed by a purely classroom teaching.

Currently, the progressive optimization of computer components has allowed computers to have a smaller volume each time, which facilitates their portability. More and more students are coming to different sources of information through their mobile devices and tablets. The boom that these technological media are having the computer applications for these portable devices, is constituting a role of great relevance, for the efficiency and the improvement of the quality of the training processes.

Technological advances define the basis of modern education and offer us the possibility to use new resources in the teaching of health sciences that offer a more versatile strategy for the representation of knowledge, without losing classical descriptive training. These technological resources suppose excellent materials to support medical training, promoting undoubtedly the process of learning and of acquisition of practical skills. Their use, as additional resources, facilitates and optimizes the teaching and learning of clinical skills in students from health sciences specialties.

This track provides a meeting space to share teaching experiences of a technological nature such as those presented at the International Conference on Technology Ecosystems for Enhancing Multiculturality, (TEEM19), is a good representation of its impact and current dissemination, in training in different areas of health sciences.