Virtual ICU and E-learning tools: Scope in critical care medicine in India

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Abstract

Critical care medicine is an important tool for decreasing morbidity and mortality of patients. There is a need to develop effective web content for use of intensivists and related disciplinaries. Use of simulators and production of good quality videos and their uploading on national connectivity can add fillip to the "National Mission of Education" started by the Government of India.

Keywords: E-Learning, simulators, virtual ICU

Introduction

Technology has created a new dimension for visual teaching and learning with web-delivered interactive media. With new web technologies, rich online learning media can supply current biomedical information to the students and the faculty of medical sciences and promote their technology proficiencies, contributing to their professional development.

Critical care medicine is becoming more and more popular and important tool for decreasing morbidity and mortality of patients.[1] The understanding and modeling of human physiology and the respective reactions on drug delivery is fundamental for patient care in the intensive care unit (ICU) environment. Although the best way to study these principles is to practice on real patients, not all pathophysiological relationships are found in every patient.[2] To overcome these limitations and to provide realistic teaching environments, full-scale simulators are addressed,[3] which support a mixture of mathematical, mechanical and physiochemical models in a software and hardware combination.

Simulators

Simulation and modeling of human physiology, e.g., medical simulators, is highly complex and always includes the question of model choice due to computational complexity. Using simulation technology to provide healthcare professionals with the opportunity to practice procedures and diagnostic methods on computer-based models, medical simulators give clinicians hands-on experience by replicating realistic clinical scenarios, with the added benefit of eliminating the risk to an actual patient. These interactive tutorials allow students and the faculty of medical sciences to practice, repeat and fine tune procedures in order to identify and correct mistakes and maximize clinical outcomes when presented with real-life scenarios. While small dedicated models are widely used, e.g., simulation of oxygen transport[4] and basic life support models, full-scale descriptions are still rare, especially the combination of different existing models and the correlation of their interactions,[5] causing the increase in the complexity substantially.[6-8]

Initiative by Government of India

The Government of India and the Information Communication Technology (ICT) has made it a national

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mission on education through a centrally sponsored scheme to leverage its potential in teaching and learning process for the benefit of all the learners in higher educational institutions anytime and anywhere (www. sakshat.ac.in). NPTEL (National Program on Technology Enhanced Learning, which is a joint venture of seven IITs (Indian Institute of Technology) and IISc's (Indian Institute of Science), was launched in 2003 with its main aim to enhance the quality of engineering education in the country by developing curriculum-based video and web courses. It was divided into two phases:

Phase I (2003–2009) consisted of five engineering programs at the undergraduate level, which included more than 250 courses, including 130 in broadcast quality video form. All course materials were deployed through television (Eklavya channel – Gyan Darshan, since 2004), Internet (YouTube – since Sept 2006), streaming videos for video-on-demand through internet, DVD-ROMs for individual users and mobile-accessible files. Course-specific workshops were also conducted for more than 1000 faculty from engineering institutions all over the country, with pre- and post-workshop testing.

Phase II (2009–2012) consists of major engineering, science, management and some social sciences programs at undergraduate/postgraduate level with more than 950 courses, including 500 in broadcast quality video form. Many institutions would be included as associate partner institutions for content development and thousands of faculty are to be trained in teaching/learning processes. Content is for both web and video courses with additional quadrants of learning (Wiki-type supplementary information, slides, animations, simulations, quizzes) and assignments with solutions, and should be universally circulated. Video and web-based material is free of cost to all educational institutions in India under a National Virtual Private Network, set up through National Mission on Education through Information and Communication Technology (NME-ICT), National Knowledge Network (NKN) and Bharat Sanchar Nigam Ltd. It will be a two-way web content,where497 universities have been enrolled out of which 300 universities are already having the two way connectivity .For prepration of web content, if required further Grants are given by NKN and University Grants Commission The web content is reviewed by NPTEL/A-VIEW (Amrita Virtual Interactive E-learning World, AMRITA Institute) before uploading.. A-VIEW software is available free of cost, provided by the Ministry of Human Resource Development). Further details on "technical enhanced education" can be accessed at www. ictee.org.

Weekly discussions using A-VIEW, which is a part of NME-ICT, holds online sessions where further guidance is provided through online "spoken tutorials/virtual classrooms."

The National Mission on Education

The emphasis is on NME through ICT, which includes building connectivity and knowledge network among and within institutions of higher learning in the country with a view of achieving critical mass of researchers in any given field. It also aims at spreading digital literacy for teacher empowerment and would bridge the digital divide. NME aims at development of knowledge modules having the right content to take care of applications of the academic community and to address the personalized needs for learners. Standardization and quality assurance of E-content would be done to make them world class with research in the field of pedagogy for development of efficient learning modules for a disparate group of learners. This content would be made available for E-knowledge free of cost to its stakeholders and would also provide support for the creation of virtual technological university.

Combining approaches to model physiological processes in a real-time software environment leads to a novel model for simulation of human patient physiology especially relevant for ICUs. Using dedicated hardware–software interfaces, simulated patient signals are measurable with standard monitoring systems. Therefore, this system, based on realistic simulations is very well suited for teaching and education. Additionally, the environment is usable for inferring patient-specific model structures and parameters.

Information Technology and Intensivist-Led Care

An infrastructure for providing intensivist-led care from a distance is receiving much attention. Two years ago, a report examined the poor uptake of information technology into medicine and presented a way of incorporating a technological change into the process of intensive care provision.[9] This allows a specialist intensivist located at one hospital to supervise a resuscitation team located at a peripheral hospital and also in situations of clinical degradation during a night shift. It would be attractive and interactive software, which would provide help from a central district hospital to the peripheries. This would look into all the medical needs of those far apart from medical care and enhance the support of critical care, treating them effectively. A possible software is to be designed so that all information

required by the intensivist to make judgments on patient treatment is available in real time, as if he or she were present at the peripheral hospital. This is achieved by transmitting several high-quality digital video channels, high-quality audio, vital signs data, written notes and medical images. Two-way high-bandwidth video permits natural, low-latency "telepresence" interaction with the intensivist. The system would be designed in such a manner that it would be robust, fault-tolerant and easy to use in the highly stressful atmosphere of the emergency department. This would also remove the manpower deficits and has good future prospects as a profession and an important and helpful tool for postgraduate students.

Role of Critical Care Society

The critical care society should come forward in making "web-based content" for uploading on university sites, thus empowering the students and teachers with recent knowledge and creating a virtual "classroom." Interactive E-content so produced on "evidence base" on different aspects of critical care medicine would further support the mobility and accessibility of the intensivists not only in India but will also provide the forum to communicate abroad as well.

In the future, extension of simulation model can be applied as an extension to predict potential risks and to avoid critical situations in the ICU and will be an interesting and exciting research area.

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