

Interactive Simulation Environment for Interprofessional Education in Critical Care

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ABSTRACT

Interprofessional education is a pedagogical approach which allows health care practitioners to develop a clear understanding and appreciation of the roles, expertise, and unique contributions of their disciplines as well as those of the other participating health care providers. It also helps build effective team relationships which is essential for optimal health care delivery. Interactive virtual simulation environments, such as serious games, offer a feasible alternative to traditional classroom-based interprofessional teaching methods as multiple team members may participate in the simulation simultaneously regardless of their physical location or time of day. Here we describe an ongoing project that seeks the development of an interactive virtual simulation platform using *serious games* technology to augment learning of skills, knowledge, and attitudes requisite in interprofessional education.

Categories and Subject Descriptors

I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—*Virtual reality*

General Terms

Human Factors

Keywords

Interprofessional education, serious games, active learning.

1. INTRODUCTION

The necessity for an increased comprehensive body of knowledge has resulted in specialization of disciplines (e.g., oncol-

ogy, cardiology, and endocrinology). This, in addition to the new inter-disciplinary initiatives to manage diseases such as asthma, diabetes, and heart failure imply that no one healthcare professional can tend to all of the health concerns a patient may experience [3]. In fact, the majority of patients interact with more than one health professional. Therefore, most patient care requires the collaboration of a team of health professionals working together either in the same space or scattered throughout several hospitals or departments. Whether or not the healthcare providers consider themselves as a part of that team, effective team relationship is essential for optimal care delivery. According to the Centre for the Advancement of Interprofessional Education (CAIPE), *interdisciplinary education* or *interprofessional training* is defined as “when healthcare professionals learn together, learn from each other, and/or learn about each others’ roles in order to facilitate collaboration [2].”

Interprofessional education (IPE) is a pedagogical approach which allows health care practitioners to develop a clear understanding and appreciation of the roles, expertise, and unique contributions of other disciplines as well as those of the other participating health care providers. By exposing students early in their educational career to interdisciplinary collaboration, it can alleviate biases before they begin. For post-licensure learners, learners who are licensed to practice with patient IPE is typically in the form of skills maintenance and further professional development. Despite the benefits of interprofessional education, currently it is not a major component of health care education and training. In addition, most healthcare providers and educators have very little formal experience with respect to interprofessional education and any interprofessional learning that does take place is typically not part of “mainstream” clinical learning and thus rarely included in the assessment process [6]. That being said, our current health professional educational system fails to foster interprofessional skills and in fact, it has been argued that the “discipline-specific” educational approach promotes attitudes that hinder interprofessional collaboration [1]. Furthermore, a lack of knowledge and respect for the capabilities of other professionals can lead to

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ineffective and un-safe patient care [5]. Where available, current interprofessional education curriculums include traditional classroom teaching, clinical placements, and practice in simulation laboratories equipped with both high and low fidelity medical manikins. However, such laboratories are expensive to build and maintain [4]. Furthermore, the use of training laboratories present significant challenges in release from clinical responsibilities of team members, and difficult to coordinate amongst multiple team members. Because simulation laboratories are typically not a part of any particular hospital, but rather are centralized within academic settings, bringing the teams together for interprofessional training is often not feasible. In contrast to these three educational approaches, interactive virtual simulation environments, such as *serious games*, offer a feasible alternative as multiple team members may participate in the simulation simultaneously regardless of their physical location or time of day.

This paper introduces an ongoing project whose purpose is to develop an interactive virtual simulation platform using serious games technology to augment learning of skills, knowledge and attitudes requisite in interprofessional care (IPC). The interprofessional skills studied in this work will be those needed by rapid response teams to optimize care delivery in the management of critically ill patients.

2. OVERVIEW

Experts in critical care, education, and game development will construct a number of scenarios with specific learning objectives, feedback and predictors of attainment of the learning outcomes related to a critically ill patient. In each scenario, the critically ill patient requires the immediate attention of a critical care rapid response team which consists of a number of healthcare professionals including doctors, respiratory therapists, and nurses. Each of the response team members has a corresponding avatar within the simulation which is controlled by one trainee/student in a “first-person-shooter” manner (see Figures ??(a) and ??(b)). The simulation supports an “online multi-player” environment allowing trainees to participate from remote locations. The patient will have several clinical concerns which will increase in complexity and severity if not responded to appropriately. The goal of the trainees is to stabilize the patient. This is accomplished through the collaboration of response team members. Response team members are able to communicate and interact amongst each other, the patient, and instruments/equipment within the virtual environment in order to accomplish their task. Virtual decision support systems will be available to enhance information seeking behaviors of the team members. This is analogous to the current *gold standard* in physical simulation using computerized mannequins and portable digital assistant devices. The patient role will be assumed by an instructor; an expert in critical care (in future versions, the expert filling the role of the patient will be replaced by an artificial intelligence system). The instructor is able to control the patient and respond to any actions of the critical health providers. For example, the patient may start to have labored breathing. In this case, one of the nurses may respond by providing the patient with oxygen from an oxygen mask at which point the patient’s breathing stabilizes and the oxygen saturation starts to increase to normal levels as indicated on the monitor. However, an inappropriate response on behalf of the health care member



Figure 1: Sample screenshot of a virtual hospital room with a patient and a doctor and nurse.

could result in the patient’s condition deteriorating further. The simulation is being developed using Panda3D, a freely available 3D engine that allows for 3D rendering and game development [7]. All models are being developed using Maya and/or 3D Studio Max.

3. FUTURE WORK

Future work includes completion of the simulation followed by the testing of the content validity of it using survey and focus groups comprising of interprofessional critical care team members. Future work also includes testing of the content validity of the developed prototype using survey and focus groups comprising of interprofessional critical care team members. The simulation will be modified based on the outcome of user tests.

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4. REFERENCES

- [1] D. C. Baldwin. The case for interdisciplinary education. In E. R. Rubin, editor, *Mission Management: A New Synthesis*. Association of Academic Health Centres, Washington, DC. USA, 1998.
- [2] CAIPE. Interprofessional education: a definition. *CAIPE Bulletin*, 13:19, 1997.
- [3] L. A. Headrick, P. M. Wilcock, and P. B. Batalden. Interprofessional working and continuing medical education. *British Medical Journal*, 316:771–774, 1998.
- [4] W. L. Heinrichs, P. Youngblood, P. M. Harter, and P. Dev. Simulation for team training and assessment: Case studies of online training with virtual worlds. *World Journal of Surgery*, 32(4):161–170, 2007.
- [5] L. Kohn, J. Corrigan, and M. Donaldson. To err is human: Building a safer health system. National Academy Press, Washington, DC. USA, 2000.
- [6] K. McPherson, L. Headrick, and F. Moss. Working and learning together: good quality care depends on it, but how can we achieve it? *Quality Health Care*, 10:46–53, 2001.
- [7] Panda3D. A 3D engine. Carnegie Mellon Entertainment Technology Center. www.panda3d.org.