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. Currently interprofessional education includes classroom teaching, clinical placements, and practice in simulated environments using both high and low fidelity simulated patients. These strategies are resource intensive and present significant challenges including the release of team members from clinical responsibilities. Interactive virtual simulation environments, such as serious games, offer a feasible alternative to traditional 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

An aging population, changes in lifestyles and behaviors have contributed to a significant rise in the number of complex and chronic illnesses. The necessity for an increased comprehensive body of knowledge has resulted in specialization of disciplines (e.g., oncology, 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 [4]. In fact, the majority of patients interact with more than one health professional. Furthermore, the number of health professionals involved and the importance of their ability to work together increases as the patients needs become more complex [4]. 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, patient outcome depends on the effective and efficient functioning of the team as a whole [7]. In other words, effective team relationship is essential for optimal care delivery. Salas et al. [13, 14] have suggested an underlying set of principles specific to teamwork training and fundamental to these principles is that teamwork training should include “hands-on practice” with appropriate feedback from the instructor(s). 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].” According to McPherson et al., teams that function well exhibit the following principles and when interactive collaborations incorporate these principles, it leads to improved patient care [7]:

1. Clear aim: a shared understanding of the goals.

2. Clear processes: knowledge of (and respect for) the contribution of others, good communication, conflict
management, matching of roles, and training to the task.

3. Flexible structures that support such processes: skilled staff, appropriate staffing mix, responsive and proactive leadership that emphasizes excellence, effective team meetings, documentation that facilitates sharing of knowledge, access to needed resources, and appropriate rewards.

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. For example, evidence suggests that when dealing with rapidly deteriorating patients in a hospital setting interventions delivered by well trained rapid response teams (RRT’s) lead to a reduction in patient mortality. For pre-licensure students, or students who have not graduated with their professional degree and are not licensed to practice on patients, interprofessional education can assist in the development of skills necessary to interact and interpret the language of other disciplines treating the patient and therefore contributes to positive patient outcomes. Trainees are able to develop an understanding of the other professions in the team with respect to their role, expertise, and contributions thus eliminating any preconceived biases which result from a knowledge deficit regarding other disciplines. 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.

In order for interdisciplinary collaboration to be successful, a level of trust and respect must be established between health professionals. When discussing a patient’s case, it is imperative that the language used is familiar to all professions. The knowledge base of some disciplines may be of a higher caliber in some instances than that of other disciplines. Without interpersonal communication the potential for misunderstandings, and therefore error is far greater.

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 [7]. 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, 11]. Furthermore, a lack of knowledge and respect for the capabilities of other professionals can lead to ineffective and un-safe patient care [6]. 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 [5]. Furthermore, traditional classroom teaching environments present a teacher-centered approach to learning whereby the teacher controls what is being learned and when. This is in contrast to the fact that such approaches have been proven to be ineffective for today’s generation of millennial students (the generation raised in the sensory-flooded environment of digital technology and mass media e.g., the “internet generation” [12]) who prefer a learner-centered teaching approach whereby the student controls the learning through interactivity and allow the player to learn via active, critical learning [16]. The fact that the millennial generation has always been digitally connected has led to a mindset unlike any that medical faculty have ever seen. Understanding this mindset is an important aspect of educational planning and course development. Specifically, according to Villeneuve [18], this generation does not remember a time without e-mail, internet, cell-phones or lap-top computers. Their unique way of being and knowing has largely influenced the learning needs of this generation of students. It is not surprising that this generation highly regards “doing rather than knowing”, making interactive, experiential learning a necessity for their educational success. This generation prefers, expects and appreciates the use of technology in learning.

Clinical placements and practise in simulation laboratories offer learner-centered, experiential educational models. However, they are resource intensive, present significant challenges in release from clinical responsibilities of team members, and difficult to coordinate amongst multiple team members. In particular, rapid response teams are composed of several members that include medical doctors, a respiratory therapist, and a nurse where all of them are engaged in patient care elsewhere. During a patient crisis the team is called and the members leave their more stable patients, focus their efforts on the new critical patient and after go back to their previous duties. 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. Although no particularly clear definition of the term is currently available, serious games usually refer to games that are used for training, advertising, simulation, or education and are designed to run on personal computers or video game consoles [17]. Serious games refer to “games that do not have entertainment, enjoyment, or fun as their primary purpose” [8]. They “leverage the power of computer games to captivate and engage players for a specific purpose such as to develop new knowledge or skills” [3]. In addition to promoting learning via interaction, there are various other benefits to serious games. More specifically, they allow users to experience situations that are difficult (even impossible) to achieve in reality due to a number of factors including cost, time, and safety concerns [15]. Serious games support the development of various skills including analytical and spatial, strategic, recollection, and psychomotor skills as well as visual selective attention [9]. Further benefits of serious games include improved self-monitoring, problem recognition and solving, improved short- and long-term memory, and increased social skills [9].

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). This platform will utilize the recently formulated interprofessional care competencies for setting learning objectives. The specific 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.

The remainder of the paper is organized as follows. Section 2 provides an overview of the simulation presented here, and finally, a summary and plans for future work are presented in Section 4.

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 1(a) and 1(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 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 [10]. All models are being developed using Maya and/or 3D Studio Max.

2.1 Conclusions

This paper has described an ongoing project that seeks the development of an interactive simulation environment for to promote interprofessional education for critical care providers. The proposed interactive virtual simulation platform will enable health professionals to develop clinical, communication and team relationship skills needed to manage rapidly deteriorating, critically ill patients. Additionally the simulation will enable team members to practice and apply skills in a safe learning environment leading to increased competence and self-efficacy. Furthermore, it will limit the use of “physical” clinical laboratories which are expensive to establish and maintain. It is anticipated that the simulation platform will be applicable to other clinical settings where interprofessional skills are required. 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 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. Future work also includes replacing the instructor, expert filling the role of the patient as currently implemented, by an artificial intelligence system.
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3. REFERENCES