Serious Play in the Virtual World: Can We Use Games to Train Young Doctors?

Cor J. Kalkman, MD, PhD

Introduction

Doctors are by tradition not the most forward-thinking group, nor can they generally be classified as early adopters of new technology. On average, it takes more than 10 years before an evidenced-based intervention makes it into mainstream clinical practice. Ironically, in medical education, we are now faced with a new generation of students who can be rightfully called *digital natives*, whereas we, their tutors and instructors, are at best *digital immigrants*.

The term *digital native* was first coined by the educator Marc Prensky[1]; it refers to a person who was born during or after the general introduction of digital technology. Through interacting with digital technology from an early age, a digital native has a greater understanding of its concepts. In contrast, the *digital immigrant* was born long before the meteoric rise of affordable personal computing and instant "everywhere" connectivity via wireless Internet. Although we may have mastered basic computer skills and use e-mail and Microsoft Word every day, computer games, social networks, and online role playing in virtual worlds (such as Second Life or World of Warcraft) remain alien to most of us. It requires considerable cognitive effort for a digital immigrant to adapt to these new modes of learning, communication, and play. There is now some evidence that the brains of the new generation who grew up with computers, games, social networks, and instant messaging are wired fundamentally differently from their predecessors.[2]

It is clear that medical education is firmly rooted in centuries of history, with such cornerstones as learning from text books, classroom-style lectures, attending patient demonstrations—even live surgery in a "theatre" full of students—and diligently taking notes to capture the wisdom of the lecturer. As we slowly try to make the transition to new forms of medical education, we struggle to find the most appropriate formats. Ideally, such new modes of teaching should appeal to the new generation of students and, at the same time, be equally (or more) effective as the more traditional modes of transferring medical knowledge and attitudes.

New Formats for Teaching Medical Knowledge and Skills

The easiest format to grasp for digital immigrants is the *e-learning module* because it is closest to the traditional lecture format. In its basic form, it is a multimedia document that can be studied either in a computer laboratory or be delivered via the Internet to the student's home. In addition to text and pictures, e-learning modules can add animations and live video of real or simulated patients. Most newer modules will have some basic interactivity. Adding online evaluation of the student's progress is fairly simple, and the modules can be tailored to allow for electronic examination.

Simulation is a truly different teaching mode because it allows the student to acquire new knowledge and skills in an environment that more or less resembles the future work situation. Here, the student can freely make errors without interrupting complex care processes or harming a patient. The patient safety movement that started with the Institute of Medicine's 1999 report *To Err is Human*[3] firmly adopted Hippocrates' "First do no harm." The availability of simulators makes it an ethical imperative that we no longer use patients to teach basic technical skills to young doctors, if simulators improve trainees' skills.[4]

Simulators can be categorized by their degree of real-life experience, as perceived by the student. The simplest form of simulation is the partial-task simulator. These simulators range from simple devices, such as a mannequin to practice drawing blood from a vein, perform a vaginal delivery, or practice numerous types of fiberoptic endoscopy. Other skills can be acquired with dedicated simulation software, for example, a computer simulation showing distribution and pharmacodynamic effects of anesthetic drugs.[5] A new generation of dedicated laparoscopy simulators teaches surgeons the required skills and eye-hand coordination for laparoscopic surgery[6] and are now being actively incorporated in surgical training programs.[7] These devices can be obtained with various degrees of simulated virtual reality, such as a simulated, highly detailed 3-dimensional visualization of the body cavity or organ.

In contrast, with full-scale simulation, we attempt to recreate the complete experience of performing complex patient care, which includes the interaction with the patient

Cor J. Kalkman, MD, PhD, is Professor of Anesthesiology, Division of Anesthesiology, Intensive Care and Emergency Medicine, University Medical Center Utrecht, the Netherlands.

Corresponding author: Cor J. Kalkman, MD, PhD, Division of Anesthesiology, Intensive Care and Emergency Medicine, University Medical Center Utrecht, Postbus 85500 3058 GA Utrecht the Netherlands, c.j.kalkman@umcutrecht.nl

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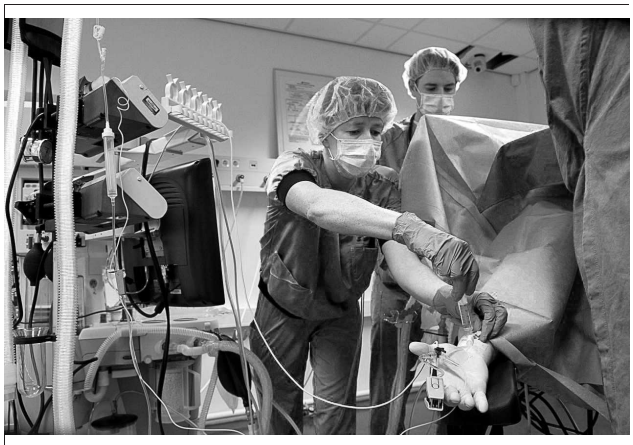

FIGURE **"Hurry, call for help!" (Anesthesia residents in a full-scale operating room simulator.)**

and with other members of the care team.[8] Often, the scenarios will simulate various frequent or rare crisis situations in which it is critical to correctly diagnose the problem in time and institute appropriate remedial action. Many countries now have several locations where teams can practice in a full-scale simulation of an entire operating room. This type of simulation can include all team members (surgeon, anesthesiologist, and nurses) with a patient simulator to provide physiologic feedback of the status of the patient. In those simulations, both technical and teamwork skills can be taught simultaneously. The debriefing after the simulated incidents is considered the most important part of the learning experience. These full-scale simulations are increasingly used in anesthesiology and obstetrics, but their high cost (in terms of hardware, personnel, and time) is currently prohibitive for routine inclusion in most medical curricula.

Serious Games

A well-designed computer game has the potential to teach much of the knowledge and many of the teamwork skills that can be acquired in full-scale simulators but at a fraction of the cost. In addition, a game can incorporate an element of competition by sharing "high scores" over the Internet. Currently, serious games are rare in medical curricula. However, in recent years, some promising developments have emerged, such as *Pulse!!*, a virtual emergency department to teach acute medical skills, developed by Texas A&M University, Corpus Christi, and funded by the Navy's Office of Naval Research (http://www.breakawaygames.com). *ABCDE: Virtual Emergency Room*, a game to teach basic resuscitation skills, including recognition of a compromised airway, is currently under development by Erasmus Medical Center, Rotterdam, the Netherlands. *Air Medic Sky One*, by University Medical Center Utrecht, the Netherlands, teaches residents the basics of patient safety, teamwork, and personal stress management, the latter via a simple biofeedback device connected via a USB (universal serial bus) port (www.airmedicsky1.org).

In serious games, virtual patients and team members may be real (videotaped actors) or simulated and rendered in 3-dimensional computer graphics. The latter technology is in rapid flux, and major improvements in realistic, life-like patients or team members can be expected in coming years. Voice control is still in its infancy. Computers still have huge difficulties understanding natural language with all its ambiguities. For now, most games, therefore, let the player select from several on-screen options to alter the course of events in the game.

There are various obstacles to the rapid development and deployment of serious games in medical curricula. Medical educators and game developers are worlds apart and will need to physically meet and work together to get developments started. Although a well-designed serious game can potentially teach many thousands of students at a very low cost per student, the development of a serious game requires considerable resources in the form of talent, creativity, time, and money.

The next generation of students is extremely sophisticated and will expect both high quality visuals as well as immersive game play. The costs of game development are high and may be well beyond the typical budgets available to medical schools. In addition, sales and marketing of educational games are not skills widely available within the community of medical educators. Even medical publishers are still reluctant to invest in game development and appear to be waiting for the direction that serious games will take. One strategy that was recently proposed at the 2011 European Games4Health conference in Amsterdam, the Netherlands, is to develop serious games that also appeal to a wider audience. Because this strategy will multiply the potential number of customers, the revenues from such games can then be reinvested to create more and better medical education content as well as to increase production values.

Summary

In summary, serious games and virtual reality offer great promise to radically alter the way we teach and acquire medical knowledge. However, before we see widespread use of games in medical curricula, several hurdles need to be overcome. The most important of these is to ensure that game developers and medical educators meet and interact to start exploring the possibilities for developing high-quality, serious games.

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