

### **e-Learning: The Next Big Thing in Medical Education.**

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**T**he rapid advances in Information and Communication Technology (ICT) and the wide use of the World Wide Web has important implications for education<sup>1</sup>.

This continuous advancement in technology (e.g. Broadband internet connections, Ubiquitous Computing , Open Source Softwares) in conjunction with the recent recommendations in medical education suggesting a move toward problem-based learning (PBL) and use of information and communication technologies<sup>2</sup>. All these factors led to the evolution of the e-learning environment in medical education.

An initiative is underway in Faculty of Medicine and Health Sciences (FMHS), Omdurman Islamic University (OIU), Sudan which aims to introduce a modern web-based learning environment serves undergraduate medical students, supports the newly adopted philosophy of Problem-based Learning, and provides these new generations of doctors (Net generations) with the knowledge and skills they need to be a successful practitioners.

This digest endeavors to give a bird's-eye view of e-learning, its benefits and limitations and explores, with examples, some of the current uses of e-learning technologies in the education of medical students.

**Keywords:** communication, technology, practitioners, undergraduate, medical students.

#### **What is eLearning?**

The electronic learning or e-Learning is an umbrella term, and if you ask five peoples what e-learning is or isn't? You will end up with five different answers.

Usually it's used to describe two different modes:

1. **Distance learning:** is a teaching and learning system designed to be carried out remotely by using electronic communication.

This mode is out the scope of this paper.

2. **Web-based learning:** (also called computer-assisted instruction, Internet-based learning, and online learning): is the use of the internet, or a computer network for the purpose of providing education.

When we mention e-learning in this article we refer to this type.

Ruiz J.G et al. defines e-learning as "the use of Internet technologies to enhance knowledge and performance"<sup>3</sup>. We can adjust this definition to become more consistent with the medical field to:

*"The use of internet technologies or computer networks for the purpose of providing domains of learning (knowledge, skills and attitudes) to the medical students".*

The basic thing that distinguishes between the two modes is the **physical separation** of the student from the instructor and the classroom in the distance learning while the web-based learning is a method that definitely enhances the classroom experience.

Simply, we can say that e-learning is the marriage between education and technology and this marriage leads to emerge of new concepts in medical education such as Blended Learning and e-Problem-based Learning.

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**Blended Learning:**

Is an approach that combines traditional face to face methods with electronic media; this may include combinations of face to face lectures supplemented by an online interactive self assessments with immediate feedbacks and online discussions through chat rooms or forums.

Nowadays, there is a wide agreement among the medical educationalist that blended learning will be the “next big thing” in medical education.

**Why We Need e-Learning in Medical Education?**

One estimate suggested that by 2010 more than 30% of a physician's time will be spent using information technology tools<sup>4</sup>, and there is no doubt this will transform and change the learning and practice environment as a whole. The following factors justify our need for e-learning:

1. Changes in philosophy of health care delivery, from acute care setting to community-based for chronic care, have required adaptations in educational strategies<sup>5</sup> to reduce the shortage in students exposure to chronic cases, e.g. use of Virtual Patients simulations.
2. Medical schools curricula are already crowded, challenged to cover conventional materials<sup>6</sup> and finding time to teach “new” fields in medicine is difficult.
3. Medical students don't see e-learning as replacing traditional instructor-led training but as a complementary to it.
4. Interactive course materials such as self assessments, animations, and simulations can improve learning and are often more enjoyable and meaningful for learners.
5. It has gained popularity in the past decade; however, its use is highly variable among medical schools and appears to be more common in basic science courses than in clinical clerkships.

**Models in Undergraduates Medical Education:**

1. **Rich Media “Interactive” Simulations:**  
The term ‘rich media’ or “interactive multimedia” is defining the combination of texts, static pictures, videos and sounds through the use of modern technology, e.g. the simulation of physiological processes or parasites life cycles. This will help the student's brain to convert heard or read words, and diagrams into moving models thus many difficult concepts in physiology or microbiology are learned and thus helps the *acquisition of knowledge*.



**Fig. 1** Interactive simulation of Plasmodium life cycle contains texts, animations and audio. (Source: McGraw Hill).

**2. Virtual Learning Environments (VLE):**

Also called Learning Management Systems (LMS), Managed Learning Environment (MLA) or Virtual Classrooms. "They are sophisticated tools that facilitate distribution of information,

administration and tracking of students' achievement, creating online assessments and communication between students/students and

students/tutors through discussion boards and chat rooms" e.g. Angel™, Blackboard™.



Fig. 2 Screenshot of Virtual Learning Environment of Royal College of Surgeons (Ireland).

### 3. Virtual Patients Simulations:

The American Association of Medical Colleges describes Virtual Patients (VPs) as: *"Interactive computer programs that simulate real-life clinical scenarios in which the learner acts as a health care professional obtaining a history and physical exam and making diagnostic and therapeutic decisions"* Since every student cannot observe every patient, with the use of VPs we can broaden the students' exposure to a greater variety of patients, they enable students to discuss, manage, and make decisions in a safe environment without risk to the patient and the status of patient may change over time thus VPs bring the dimension of **experience acquisition** to medical education<sup>7</sup>.

There is strong evidence, however, that media-rich VPs are at least as effective as standard teaching methods<sup>8</sup>.

### 4. Videoconference:

They are real-time interactions that take place over the Internet using features such as audio and video, chat tools, and documents sharing between two or more sites at the same time.

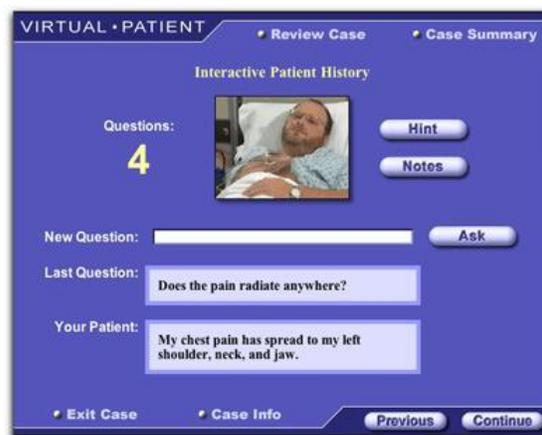


Fig. 4 Screenshot of a Virtual Patient. (Source: MedPORTAL, AAMC).

They can be used for a variety of purposes including personal use, administrative meetings, or in the clinical rotations where the students are distributed in different hospitals . In our faculty we strongly need this model, because the males and females are taught separately and sometimes the teacher gives the same lecture twice a day!!



**Fig. 3** Videoconferencing system connects between five sites. (Source: Wikipedia).

### 5. Virtual Reality (VR):

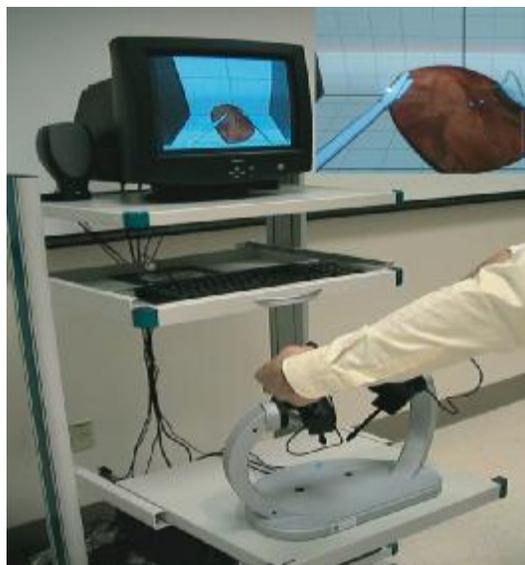
A computer simulation of a real or imaginary system that allow people to interact or perform operations on the simulated system and shows the effects in real time using their *natural* senses and skills<sup>9</sup>.

These systems range from simple stimulator for training medical students and nurses the suturing and cannula insertion skills to more complex simulators for colonoscopic procedures (e.g. MIST System -figure 5-and da Vinci Surgical System), they give the students and Surgeons an opportunity to gain the *skills* and view the outcomes before the patient undergoes surgery.

Computer software can also produce VR effects (e.g. CAVE system, figure 4), Two- and three dimensional objects can be



**Fig. 4** Inside a CAVE (computer assisted virtual environment) to understand the anatomy of Cardiopulmonary system. (Source: British Dental Journal).



**Fig. 5** Using MIST system for minimally invasive surgery training. Source: Laparoscopy Today Blog.

incorporated into the web that can be controlled by the viewer<sup>10</sup>.

### Advantages of e-Learning:

With its many benefits, e-learning is the perfect complement to a traditional teaching methods, particular advantages of e-learning include:

1. Resources can be made available from any location in contrast to traditional libraries.
2. “*Just-in-time*”: as the learning materials are available 24/7 the students can learn when they need it.
3. “*Just-for-you*”: the students can learn at their own paces and they can also pause learning sessions at their convenience.
4. It can encourage more independent and *active learning*.
5. Increase of *accessibility* to information and ability to link resources in many different formats (e.g. hand-out contains links to electronic journal) this function are particularly useful for research, clinical activities and further readings. However, typical web-based courses must contain link to external resources in addition to assessment activities with feedback to learners and channels for communication and interaction between them rather than just displaying and storage of knowledge<sup>11</sup>.

6. There is a possibility of *collaboration* between teachers and students from different universities, which allows exchange of knowledge and experiences (Distributed Synchronous Learning)<sup>12</sup>.
7. Ease in Update: Updating electronic content is easier than updating printed material<sup>13</sup>.
8. Promote the interactions, by means of emails and forums, and remove the psychological barriers between students and teachers.
9. With time, the students and instructors will learn new technologies and technical skills.
10. Numerous research opportunities and ideas exist in the relatively new field of e-Learning<sup>14</sup>.
11. The e-Learning enhances the Problem-based learning with its visual and interactive features; it allows the instructor to introduce photos and videos to the problem and give the students immediate feedbacks<sup>15</sup>.
12. It prevents the lecturers reverting to traditional teaching methods (in institutes adopted PBL) allows them to retain their facilitator role, and encouraged students to explore, analyse and make decisions within the safety environment of a virtual patient simulation.
13. Cost effectiveness: web-based learning can result in significant cost reduction, compared with traditional instructor-led learning<sup>16</sup>. Marked reduction related to travel costs, and labor costs, and the possibility of expanding programs with new educational technologies<sup>16</sup>.
14. Finally, it's a **Green Technology!!** I think this is the best benefit over all, because e-learning reduces the environmental impact (**Eco**-friendly) and allows people to avoid traveling and thus reducing the overall carbon output. Moreover, in the virtual environments there is some reduction of paper usage.

### Disadvantages of e-Learning:

e-Learning like all tools must be used appropriately, although it has few

disadvantages, some of them may act as potential drawbacks, it is considered as neutral. The main barriers to the effective use of web-based teaching materials are:

1. The *technology* (for example, rapid advances in technology, poor access, slow downloading) rather than the design of the learning materials themselves.
2. Inadequate computers and accessing to computer facilities will be a key problem and commercial internet café are too expensive to use on a regular basis, the cost of one hour may range between 1-3 SDG (1 USD  $\approx$  2.26 SDG).
3. Huge and various amount of information that must be added in web-based learning environment may become a daunting task for institute or instructors.
4. Lack of information technology skills between students and instructors<sup>17</sup>, this increase importance of ongoing technical training and support of learners and instructors.
5. Instructors need to learn to be effective online instructors and to convert face-to-face contents online (Instructional Design).
6. Students can feel isolated especially in the lack of interaction (student/teacher – student/student), student-friendly texts and communication tools such as emails, forums and mailing list solve this problem.
7. Studying to inappropriate depth and spending excessive time searching for resources, these recourses can vary in quality and accuracy, so guidance and signposting is needed.
8. Academic honesty of online students is difficult to monitor.

### Future Prospects

Harden RM et al in his article *An international virtual medical school (IVIMEDS) the future for medical education* states "Trying to predict the future of e-learning is like trying to guess which colours and shapes will appear at the other end of the kaleidoscope"<sup>14</sup>

The future of e-learning will determine by two essential issues:

**1. Technology:** The development in technologies is the key driver and has a particular significance in the use of ICT in medical education, the two developments which may play a vital role are:

**§ Ubiquitous Computing:**

This term refers to everywhere, "always-on" nature of internet connectivity. The development of wireless and mobile networks, ability of mobile communication devices to access the internet as well as the spread and wide use of broadbands (i.e DSL lines and mDSL) resulting in availability of internet connections everywhere, and offer new opportunities for the use of ICT in medical education.

**§ Social Softwares (Web 2.0 or e-Learning 2.0):**

These softwares constitute the second generation of websites allowing the internet to be used for creating and building the information and knowledge rather than merely accessing and downloading. They include applications such as:

**I. Blogs:** (shorthand term that means Web Log) are websites that contain dated entries in chronological order about a particular topic; they allow users to add comments and links and are updated by one person or a group of contributors.

They form an excellent way of sharing knowledge, getting feedback from learners and helping them to sharpen their written communication skills<sup>18</sup>.

Medical blog example includes Dermatology Interest Group at the University of Texas Medical Branch. (<http://digutmb.blogspot.com/>) Accessed 23 Feb 2009

**Wikis:** They are collaborative web applications that allow any user who has access to them to edit content; they can be used as a source of information or as a platform for virtual collaboration. The

best examples of wikis are 'Wikipedia' and 'WikiEducator'.

**II. Podcasts & Vodcasts:**

The term podcast is inspired by the Apple<sup>®</sup> portable digital audio player "iPod<sup>®</sup>". They refer to any software and hardware combination that permit automatic downloading of audio/video files providing content for students when they want, where they want, and how they want.

Excellent examples of using Podcasts & Vodcasts in medical education are: For recordings of lectures for those students unable to attend the lecture in person and downloadable libraries of high resolution heart and respiratory sounds for medical students.

Podcasts are being used in many medical schools around the world, e.g. Harvard Medical School. ([http://webweekly.hms.harvard.edu/archive/2006/0130/student\\_scene.html](http://webweekly.hms.harvard.edu/archive/2006/0130/student_scene.html)) Accessed 23 Feb 2009.

The social networks such as Facebook<sup>™</sup>, MySpace<sup>™</sup> and Twitter<sup>™</sup> are also models of Web 2.0.

Web 2.0 technologies characterized by their ease of use and rapidity of deployment, they offer the opportunity for information sharing (Blogs) and ease of collaboration (Wikis). In addition, they narrow the divide between the instructors and students, Students themselves become producers<sup>19</sup>.

**2. Economical changes:** Whatever happens in the global economy will be a major influence over what happens in e-learning. This year as a result of the global economic crisis, the e-learning experts don't expect anything huge to happen in hardware, software or e-learning standards. But at the same time they expect increase in adoption of certain available technologies due to the pressure of recession, for example "quick & dirty" videos, web conferences and social networks.

Also there will be an increase in productivity of available softwares and transformation from desktop to web-hosted applications. All these expected changes are to reduce the cost of development and traveling.

### References

1. J.P Ward, J. Gordon, M.J. Field, H.P. Lehmann, Communication and information technology in medical education. *Lancet*. 2001 Mar; 357 (9258): 792–796. (Erratum in: *Lancet* 357 (9266) (2001 May) 1452).
2. General Medical Council. *Tomorrow's Doctors. Recommendations on Undergraduate Medical Education*. London: GMC; 1993.
3. Jorge G. Ruiz, Michael J. Mintzer, and Rosanne M. Leipzig. The Impact of E-Learning in Medical Education. *Academic Medicine*. (March 2006); Vol. 81(3):207-12.
4. Skinner H, Biscope S, Poland B: Quality of internet access: barrier behind internet use statistics. *Soc Sci Med* 2003, 57:875-80.
5. Nair BR, Finucane PM. Reforming medical education to enhance the management of chronic disease. *Med J Aust*. 2003; 179:257–59.
6. Ozuah PO. Undergraduate medical education: thoughts on future challenges. *BMC Med Educ*. 2002; 2:8–10.
7. P. Le Beux, M. Fieschi. Virtual biomedical universities and e-learning. *International Journal of Medical Informatics*. 2007; 76: 331–35.
8. D'Alessandro, D., Lewis, T. and D'Alessandro, M. A pediatric digital storytelling system for third year medical students: The Virtual Pediatric Patients. *BMC Medical Education*, (2004);4:10.
9. Rory McCloy and Robert Stone. Science, medicine, and the future: Virtual reality in surgery. *BMJ* 2001 (Oct); 323: 912-915
10. Mohler J L. Improving spacial ability with virtual reality: a review of research and applications. *WebNet J* 2001; 3(1): 28-35.
11. Judy McKimm, Carol Jollie, Peter Cantillon. ABC of learning and teaching Web based learning. *BMJ* 2003 (April); 326:870–3.
12. Curran VR, Fleet L., A review of evaluation outcome medical education, *Medical education*, 2005, 39(6):561-7.
13. Chu LF, Chan BK. Evolution of web site design: implications for medical education on the Internet. *Comput Biol Med*. 1998; 28:459–72.
14. Harden RM, Hart IR, An international virtual medical school (IVIMEDS) the future for medical education, *Medical Teacher*, 2002 May;24(3):261-7.
15. Mark Corrigan, Michelle Reardon, Connor Shields, and Henry Redmond. "SURGENT"— Student e-Learning for Reality: The Application of Interactive Visual Images to Problem-Based Learning in Undergraduate Surgery. *Journal of Surgical Education*. 2008; 65(2):120-25.
16. Gibbons A, Fairweather P. Computer-based instruction. In: Tobias S, Fletcher J (eds). *Training & Retraining: A Handbook for Business, Industry, Government, and the Military*. New York: Macmillan Reference USA, 2000:410–42.
17. Ahmed. I. Albarrak. Designing E-learning Systems in Medical Education: A Case Study. Sixth International Internet Education Conference & Exhibition. (Sep 2007); *ICT Learn* 2007:77-86.
18. Maged N Kamel Boulos, Inocencio Maramba1 and Steve Wheeler. Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC Medical Education*. 2006; 6:41.
19. Graham Attwell. Personal Learning Environments - the future of eLearning?. *eLearning Papers*. 2007(Jan); 2:1.