

Medical Education – From Traditional Learning Methods to E-Learning Methods

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Abstract

E-learning represents an educational system which provides information in electronic format. Nowadays, doctors and medical students can easily access scientific information by using new e-learning methods, as there are multiple multimedia formats that facilitate their development. From handbooks to the most recent research results, e-learning incorporates the whole content of medical information. The content can be visualized on a computer screen and other electronic devices such as laptops, tablets or mobile phones. Another advantage of the electronic learning method is the fact that hyperlinks can be provided. These connections enable the user to access another site where expressions and medical concepts are defined. With the development of technology, handbooks can be improved by attaching a hyperlink to a video of a patient with a specific pathology (such as flapping tremor), an x-ray that shows a fracture when hovering the mouse over it or a movie of the gastrointestinal absorption. Additionally, the virtual patient appeared as an educational method in medicine, which presents clinical cases through movies of medical consultations, doctor-patient conversations or written notes with images that show characteristic aspects of a case. Moreover, medical students and young doctors often lack rare pathologies in their practice. Thus, e-learning methods play an important role in the studying process, especially when a particular disease cannot be observed during clinical practice. Many authors tried to show the benefits of electronic learning in parallel with conventional methods. However, even if e-learning in medical education grants effectiveness, this method does not surpass conventional learning, which is characterized by doctor-patient interaction as in integral part of developing clinical judgement. The aim of this paper was to summarize the literature data on the development of e-learning methods used in medicine by students and medical doctors.

Keywords: Medical Education; Virtual Patient; E-learning; Hyperlink; Educational Methods

Introduction

The medical field involves the continuous professional development of physicians in terms of both knowledge and skills [1]. Therefore, this subject is a topical one because of its importance for the progress of medical students and doctors. The medical system faces various problems. In every community this system must achieve some targets in order to guarantee efficiency in healthcare [2]. Even if medical doctors are the main actors, they should not be alone in the healthcare system. Unique

disciplinary solutions are frequently much less convincing and long-lasting than multi-disciplinary solutions [3]. Therefore, there is no universal solution for all the problems that arise. For the proper functioning of the medical system, it is also necessary to involve many professionals in fields such as: economics, technology and innovation, bioethics or sociology [4].

The development of medical education was regarded as an absolute priority once complex medical problems were understood. Medical education is the engine behind an efficient medical system. Still, although medical education can contribute to the creation of a healthcare system that is up to date with the highest standards, the main issue is how to create a true environment for this [5].

Quality medical education trains professionals who can generate accurate solutions by bringing the necessary and correct improvements to the medical system. Equally, for medical education to be effective, it needs to be improved in order to keep up with new trends and teaching methods [6]. This can be done through educational reforms. However, while making changes in the educational system, there are a number of risks that can compromise the benefits of innovation and implicitly alter the education [5]. Proper management of the implementation plan is the key to the success of the reform. In addition, change management should always be focused both on detailed preparations and all financial implications [7]. Main targets of e-learning are represented by guaranteeing unlimited access to updated scientific information worldwide, speeding-up the learning process and optimizing the learning methods.

In medical education, it is not only necessary to transfer a quality information, but also to faithfully pass on clinical experience from one generation to another using methods that are as accurate as possible for the learning processes [8]. Accordingly, medical education involves the acquisition of theoretical information and clinical skills, as well as the ability to empathize with the patients' needs and the art of communicating with them [9, 10, 11]. Moreover, this field is subject to continuous change. Traditional learning concepts describe various methods in learning process such as monolog lecture, studying from handbooks or taking personal notes. [12] In 2006 a group of 46 graduates were interviewed by Watmough S. et al. analyzing satisfaction of traditional learning methods in medical school. [13] Most of them were generally happy with these methods, but they mentioned that preclinic years of medical school are often too theoretical describing lack of interactivity and practical methods.

More and more traditional learning concepts are replaced by new ones as e-learning, telemedicine or virtual patient. The newest concepts will transform the medical education as a fundamental science as well as in terms of clinical practice. On the other hand, not all of the changes of the educational methods are for the benefit of the learning process [1]. This is because modern concepts of learning often present minimum doctor-patient interaction that leads to decreased empathy. On the other hand, e-learning should not be regarded as a radical alternative to traditional means of learning. It is not meant to change, but to help the learning process become more efficient. New is not always better [14]. We aimed to highlight the advantages brought by new learning methods in comparison to conventional ones when it comes to educating young medical professionals.

E-Learning: New Horizons in Medical Education

During the last decades technology has greatly developed, from computers that have become more and more efficient (higher storage capacity and faster operating systems) to smart devices (such as tablets, laptops and smart phones) that have incorporated more and more functions.

The main advantage that comes with these technology advances involves permanent accessibility. This refers not only to the fact that modern gadgets can almost always grant connection to the internet, but also the fact that they are small in size, therefore can be taken anywhere. Furthermore, the internet has also developed over time. Combining these two forms of technology has created numerous advantages for the healthcare system [15]. These advantages benefit patients as well as medical education [1, 16]. Nowadays, the use of technology, computers and the internet must become essential tools for all professionals in the medical field.

Another element to consider is that, while conventional learning has served many generations of physicians and is well known, the e-learning concept offers new aspects of learning. E-learning refers to a learning method that involves using the internet on a computer or electronic device. This method

is also known as online learning or online education [17]. In 2019 Jarrett-Thelell FD et al. concluded that computer-aided learning offers knowledge acquisition, but also more satisfaction for students who used electronic educational methods [18].

Additionally, several kinds of electronic learning (e-learning) techniques are available. There are multiple multimedia formats of information that facilitate the development of medical students and physicians. From handbooks to the most recent research results, e-learning incorporates the whole content of medical information. The content can be visualized on a computer screen and other electronic devices [19]. Moreover, the electronic learning method can also provide hyperlinks. These connections enable the user to access another site where expressions and medical concepts are defined [20, 21]. With the development of technology, handbooks can be improved by attaching a hyperlink to a video of a patient with a specific pathology (such as flapping tremor), an x-ray that shows a fracture when hovering mouse over it, a movie of the gastrointestinal absorption or an audio of heart sounds in cardiac disease.

However, despite all the progress, medical education is confronted with new problems worldwide such as the pronounced tendency to diminish the number of hospitalization days, the new regulations on working time and the focused attention on patient safety all lead to a decrease in the time that young medical professionals and students spend with patients [22-]. Thus, conventional education is more limited. As a potential solution, "the virtual patient" appeared in order to support medical education.

The concept of "virtual patient" was mentioned for the first time in a physiology class around 1990 when a computerized simulation of a hemodynamic system was described [25]. The virtual patient represents a computer simulator, which can be used in medical education, skills acquisitions and training [24]. This educational method presents clinical cases through movies of medical consultations, doctor-patient conversations or written notes with images that show characteristic aspects of a case. Medical students and young doctors often lack rare pathologies in their practice. By using virtual patient in medical schools, the process of developing clinical judgement can be supported [26, 27]. The learner involved in the learning process has to order the signs and symptoms, place them in a context so as to obtain a clinical diagnosis. Then, the student can check the necessary investigations and think about differential diagnoses. In the end, the user can establish a treatment plan [28, 29].

One of the advantages of medical case simulators is represented by the data that the programs can generate: the percentage of correct answers, the time spent for solving a case, the progress registered by the user over a period of time [30]. Besides these benefits, a favorable aspect that virtual patients bring is also the wide range of pathologies with which they are equipped. Thus, medical professionals can train their clinical judgment to diagnose rare diseases. The chances of meeting a patient with a rare pathology during a training period are very small, so the virtual patient can help the physician acquire up-to-date information on such a disease: signs, symptoms, investigations and therapeutic plan. Moreover, the software of virtual patients can be continually improved by adding new scenarios and keeping up to date with all treatment protocols [31]. The virtual patient offers the opportunity of fast forwarding the evolution of a disease. Thereby, the long-term evolution of a pathology could be observed very quickly during a training session [32]. However, the disadvantage of the simulators is that the interaction of the user with the patient is minimal, thus leading to decreased empathy [33]. In this case, young doctors may not fully understand the patient's suffering.

Furthermore, a new way of collaboration between physicians is represented by online brainstorming networks [34]. This method of communication breaks down the physical distance between two or more medical centers, thus proving beneficial since doctors can always ask 'a second opinion' and receive answers from other specialists. More importantly, the call for a second opinion can be focused on a particular symptom, a differential diagnosis, the recommended treatment or the required follow-up. Online brainstorming networks can be conveniently used for sessions with other doctors and operate on the principle that a higher number of network members leads to better solutions. [35]. There are many scenarios that could be discussed for particular situations (e.g. how to manage quarantine). Still, online brainstorming networks can be used for didactic purposes only.

Telemedicine is another e-learning method in medical science. Telemedicine has been in use since the 1960s in the military field [36]. Nowadays, telemedicine can be used directly on a mobile phone.

Generally, telemedicine provides two types of information: audio or video [37]. This method can be used in several areas, its contribution being significant especially when used in conflict regions. One of the major advantages of telemedicine is that it can counterbalance the lack of specialist doctors in some hospitals from small towns [38, 39]. Furthermore, it has four widely used subtypes: teleconsulting, medical emergency assistance, tele-surgery and tele-education [37]. Literature data described situations when physicians received training or assistance when performing different maneuvers. Telemedicine can be used in rural medicine too. In other words, this concept can be compared to practicing medicine from a distance. The medical field in which telemedicine is widely used is emergency medicine. Starting from a video consultation to assisting new procedures in robotic surgery, telemedicine saves time and resources. In the future, this technology could represent a real innovation in every healthcare system as well as in medical education [40]. Telehealth, for instance, is used in medical education for live streaming surgeries. Therefore, a large number of students can engage in surgeries, without being present in the operating room. This, in turn, can decrease the risk of contamination.

To continue with, since there are a great number of internet users, there needs to be a great use of all of the resources that the internet has to offer for the learning process. For example, YouTube is a video sharing platform, where students and health professionals have access to medicine related information. Benefits of this platform consist in its user-friendly interface and it is free of charge. Moreover, YouTube can also be useful during studying by offering a chance to visualize medical procedures, which are described in textbooks. Still, the platform is not faultless, providing no means of verifying the accuracy of the contained information and even more, since it is no search engine, it sometimes does not display the most appropriate results for the introduced keywords [41].

Similarly, to YouTube, AMBOSS is another example of an online platform, which is used by medical students worldwide. It is an interactive platform with one of the main assets being the fact that it provides information both in English and in German, surpassing language barriers. A recent study shows that 95% of all German medical students utilize this website. Nevertheless, AMBOSS does require a monthly subscription, which might not be affordable for everyone [42].

Recent research results in the medical field are widely published in online journals and on internet platforms. Subsequently, the internet became a major means of sharing medical information worldwide [43]. At present, any information published online is disseminated in real time all over the world. In the past, to keep abreast of the new trends, both students and physicians mainly relied on attending regular congresses or subscribing to scientific journals. Moreover, if doctors wanted to research more deeply into a particular topic, they would have to spend valuable time in a library, as opposed to now when any information is just a click away. This leads us to the concept of just-in-time learning.

Just-in-time learning guarantees access to exactly when clinicians needs it [44]. This concept speeds-up the learning process, gives learners access to accurate knowledge and optimizes the learning process [45].

To sum up, with all the benefits offered by today's e-learning methods, we find there is a lack of necessity to depend to a traditional lecture at a specific hour and place, since information can be accessed anytime anywhere.

The Next Steps

E-learning development opens a new era for medical professionals by showing the benefits of using digital technology in medical education.

Since doctors must improve their knowledge and skills on a daily basis, learning methods should also be improved, given the value of e-learning for medical students, resident trainees, physicians and academic professionals.

There are numerous medical platforms for students or clinicians [46, 47]. By creating large databases that can be accessed at any time, medical education has erased geographic barriers. This fact guarantees access to updated scientific information worldwide. Electronic learning provides various multimedia formats that are useful in medical education [48-50]. Moreover, medical students

and young doctors often lack rare pathologies in their practice. Thus, e-learning methods play an important role in the studying process, especially when a particular disease cannot be observed during clinical practice [51]. Many authors tried to show the benefits of electronic learning in parallel with conventional methods. However, even if e-learning in medical education generates productivity, this method does not surpass conventional learning [52]. Living in a fast-paced world forces us to use new technologies in education [53, 54]. Through e-learning we can be trained to recognize the rarest diseases. Telemedicine will help us to treat rare pathologies that were previously treated only in specialized centers [55, 56]. Nowadays, videoconferences allow doctors to be guided in real time while performing new medical procedures. On the other hand, the clinical judgment can only be developed through academic learning in medical universities and teaching hospitals. Nonetheless, even if e-learning in medical education grants effectiveness, it does not guarantee a doctor-patient interaction, which is a crucial element in developing clinical judgement [14, 57]. Practitioners use electronic devices increasingly frequently because they provide information rapidly and allow for the application of evidence-based medical knowledge. The addition of almost instant information to already known practice guides can be very helpful for physicians and patients as it reduces the time needed to make a correct diagnosis and treatment decisions. Resident trainees can also improve their clinical activity by using e-learning methods in order to manage patients more efficiently. However, progress is still required in this field since although practitioners have a positive attitude towards using e-medical resources such as mobile medical apps, they are yet uncertain about selecting the best source of evidence-based medical information [58].

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