REVIEW ARTICLE

Trends on The Use of E-Learning in Continuing Medical Education: A Review

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ABSTRACT

Objective: The objective of this study is to present updated trends, gaps and focus areas of e-learning in the field of Continuing Medical Education (CME) as reported in the literature. A total of 59 journal paper published between 2003 and [June] 2013 were reviewed from selected databases. The results show that there is a growing trend of using e-learning for CME. The e-learning interventions range from using online/web-based training modules to mobile learning using a wide range of tools and technologies, which include learning management systems, smart mobile applications, video imaging, virtual patients and video conferencing. Even though majority of reported studies are from the countries that are generally perceived as *technologically advanced* countries, a few studies from developing countries have also been reported indicating a growing interest in the field.

Keywords: *Continuing Medical Education, e-learning, Review.*

Background

E-Learning is now widely used as an effective source of delivering trainings and instructions. It provides the learners the opportunity to construct and confirm knowledge through electronically mediated asynchronous and synchronous communication.[1] Thus, e-learning not only facilitates the traditional teaching through synchronous mode of communication but also augments learning through asynchronous communication. This flexibility makes the learners both part of the learning community and at the same time give them the opportunity to learn at their own time, space and pace. Studies have shown that expending e-learning through Web 2.0 tools and technologies has contributed positively to the motivation and interaction of students in their learning.[2]

The field of medical education is no exception. There is now wide spread use of learning technologies in almost all the disciplines of health sciences.[3] In particular, there is a significant interest in the use of e-learning for the purpose of Continued Medical Education (CME), where medical professionals are required to advance their knowledge while performing their regular duties.[4] Through the integration of digital technologies and the use of Internet the medical professionals can earn their CME credits in a learning environment that allows them to not only collaborate but learn from distance at their own time and pace. Due to this reasons, a number of e-learning programs have been initiated across the world to facilitate the medical professionals.[5, 6] The efficacy and the efficiency of such programs have been of interest to many medical educationists and practitioners.[7,8,9]

A review of state-of-the-practice and state-of-the-art in the use of e-learning in the field of Continuing Medical Education has been presented in this paper. The aim of the study is to present updated trends, gaps and focus areas of e-learning in the field of CME as reported in the literature. The literature is reviewed with a broader perspective of e-learning, which not only covers online CME but also other e-learning methods including computer-based learning, computer assisted instructions and web-based learning. This widened scope and updated search differentiates this study from other similar studies.[10,11,12] This study is part of an ongoing project to systematically review the efficiency and efficacy of e-learning in the medical education.[13]

Materials and Methods

The literature on medical education is reviewed for use of e-learning in CME. The journal articles related to medical education published between 2003 and (June) 2013 were searched for e-Learning in medical education. The search of the articles was restricted to PubMed Central, BioMed Central, Wiley Online Library and Springer databases to keep the scope of

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the study manageable. The extended time period was selected to clearly identify the trends of use of e-learning in CME. The non-medical databases (Wiley and Springer) were selected to cover articles that may be published in educational and technological journals not related to medical. The keyword 'e-learning' was used to search the medical database, whereas the keyword 'e-learning in Medical Education' was for non-medical databases. The search yielded a total of 249 papers. The papers were classified according to different educational levels in medical education. A total 59 papers were classified in the category of Continuing Medical Education. NVIVO 10 software developed by QSR[14] was used for organizing, classifying and analyzing the studies reported in the papers. The research team for this project compromised of two senior e-learning experts, one medical doctor and two research assistants.

Data Extraction

The full-text of all the 59 papers was downloaded and imported into NVIVO software. The extraction fields included: Health Profession (e.g. Medical, Nursing, Dentistry etc.), Tools and Technologies (e.g., Smart Phones, Podcasting, videoconferencing, CD ROMS, etc.), Study Intervention (e.g. Internet-Based Learning, Computer-Based Instruction, Virtual Schools, etc.), Study Location, Author Country, Year of Publication, Name of Journal. Nodes for all the data extraction fields were created to assist in the organization, classification and analysis of the extracted data.

Results

The review report in this paper covers the analysis of the 59 papers classified in the category of Continued Medical Education. The journal which yielded the most relevant papers was BMC Medical Education (n=8), followed by Journal of Continuing Medical Education in the Health Professions (n=6), BMC Family Practice (n=4) and European Journal of Dental Education (n=4). The journals with less number of publications are Implementation Science (n=3), American Journal of Pharmaceutical Education, ISBT Science Series and Journal of Psychiatric and Mental Health Nursing with two publications each. The list of journal containing one paper each is attached as Appendix A. The year-wise trend (see Figure 1) show gradual start with one to two papers from 2003 to 2006. In the period between 2007 and 2008 the total number of publication rose from 4 papers to 11 papers. However, the number of publications declined from 8 to 6 in 2009 and 2010, respectively. In the following years the publications increased from 7 in 2011 and 8 in 2012. In the first half of 2013 there were a total of 7 studies reported in the selected databases.

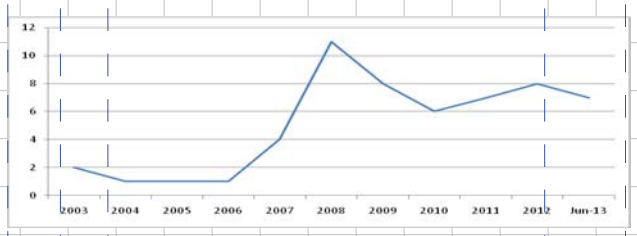

Fig 1: Year-Wise Distribution

To identify the regions active in the research related to e-learning in CME, the data was extracted from two different aspects. The country of the authors was identified in the first category and the study location was identified in the second category. The first category is selected as an indicator of where the research is initiated and the second category is selected as an indicator where the research is carried out. The authors of the selected papers belonged to 18 different countries. The most authors belong to UK (n=16), Canada (n=8), Australia (n=7), USA (n=4) and Germany (n=4). The affiliation of authors to countries with frequency of papers published was three or less is presented in Appendix A. It is noteworthy that in the list attached in Appendix A there are six publications from Asia and two publications from Africa. In the second category 20 different countries are identified where the studies were located. The countries with most studies were UK (n=16), Canada (n=8), Australia (n=6), USA (n=4) and Germany (n=4). The remaining list of countries with three and less publication is provided in Appendix A. Here studies reported from Asia are six and one is from Africa.

The selected papers were also categorized against the health professions to identify those sub-fields that have a keen research focus on e-learning in the domain of CME (see Figure 2). The generic category of 'Medical', which contains all the clinical and basic sciences subject areas, had the most number of studies (n=34). This was followed by Nursing (n=11)

and Dentistry (n=6). There are also some studies (n=5) that did not address any particular field of health profession but reported on CME in general in the health profession. These studies were collated in a field called 'Health Profession in General'. Lastly, there were 3 studies that were categorized for the field of Pharmacy. Within the field of Medical; 18 papers targeted medical field as a whole. Out of the remaining 16 studies, two studies each were for the field of Pediatrics, Surgery and Transfusion Medicine. The rest 10 papers represented the following 10 sub-fields of medical (one paper from each sub-field); Aerospace Medicine, Anatomy, Dermatology, Epilepsy, Genetics, Neurology, Pain Medicine, Physiology, Psychiatrics and Radiology

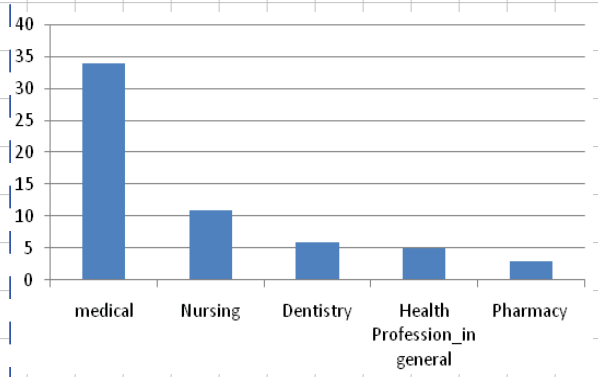

Fig 2: Study Distribution by Health Professional sub-fields

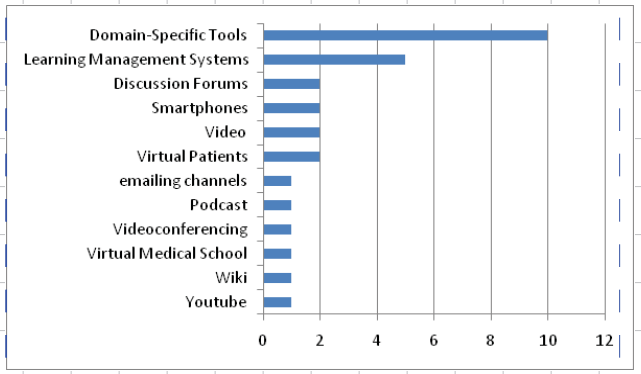

Fig 3: Specific tools and technologies reported in literature

All of the selected studies reported positive impact of e-learning initiatives. The tools and technologies used in the studies are listed in Figure 3. A total of 10 studies reported positively on the use of domain specific tools in addition to the use of Learning Management System (n=5), Discussion Forums (n=2), Smartphones (n=2), Videos (n=2), and Virtual Patients (n=2). The other tools used included Video Conferencing (n=1), Virtual Medical School (n=1), Wiki (n=1) and YouTube (n=1). LMS is a popular tool in Healthcare Education.[17] Raynor and Iggulden [18] reported the usefulness of interactive e-book-VLE hybrid in Anatomy and Physiology and also concluded that institutions and publishers need to resolve issues together to improve its effectiveness. Nurses downloaded podcasts from VLE and reported that these tools have added value to their learning.[19] Use of Learning Management Systems, Discussion Forums, Video imaging,Virtual Patients etc., is present in medical education from many years but use of smartphones[20,21], podcasts and YouTube[22] reveal that CME is not lagging behind in the usage of new technologies. These results shows that Medical (n=14), Nursing (n=5), Dentistry (n=2), Pharmacy (n=2) and Health Profession in general (n=2) are using the e-learning tools and technologies to effectively impart Continuing Medical Education.As for 'Domain Specific Tools', Llambi et al.[15] reported the adaptation of the tool; evidoctor, from Canada to Uruguay. The reason for this adoption was to cut the cost of developing a new system from the scratch by adapting already developed systems. Diabetes Needs Assessment Tool (DNAT)[7] was reported to be useful and easy to be used by the Health Professionals. From nurse-anesthetic perspective, one study[16] reported the successful implementation of Pain Management-Decision Support System.

To identify the specific e-learning initiatives in CME, various e-learning interventions used in the study were extracted from the selected studies. In total there were 11 different types of e-learning interventions reported in the studies (see Figure 4). The major focus of the studies was on online learning (n=23). The online education reported included focused online trainings [17], online tools [8, 23], online resources [24, 25], and efforts to increase the use of online CME [10, 12] among some other online education interventions. The next intervention that was reported the most was use of e-Courses (n=13) that were particularly designed and implemented for CME. The e-Courses covered two evidence-based medicine courses among other e-courses. One was occupational physicians [26] and the other for clinical teaching.[27] Some of the e-courses were particularly designed for a specific field of health profession such as for Epilepsy [28], Dentistry [29] and Nursing.[9]

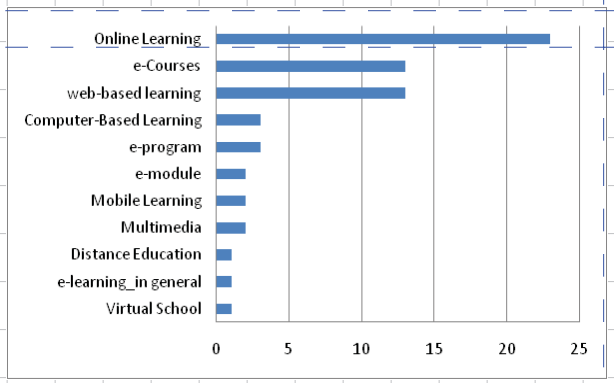

Fig 4: Study Intervention

The focus of studies categorized under Web-based Learning (n=13) ranged from educational websites[30] [31], setting quality standards for web-based CME [32], providing web-based resources [33] to web-based learning systems.[34]Yet another category Computer-based Learning (n=3) covered those papers which made use of software along with practical instructions in classrooms[35], computer-based decision support systems [16] and analyzed the use of simulations for nurses.[36] There were 3 different papers which reported on the use of e-Programs. One was the survey which was conducted to analyze the uptake of e-programs among Danish general practitioners [37], the other paper analyzed the effectiveness of an e-learning program in cardiopulmonary resuscitation [38] and the last one was on transferring evidence-based information through an open-access e-learning program in clinical evidence CME.[39]

There were two studies covering 'Mobile Learning'. In the first study, the effectiveness of mobile technology for the trainee doctors during patient care and work-based learning was evaluated.[20] This paper showed that mobile technology augmented their learning during discussions with their colleagues as dialogue is necessary in clinical-decision making. The other study reviewed the efficacy of smartphone apps in prescribing and pharmacology education. One study explicitly covered 'Distance Education' course conducted with the support of University of Calgary, Canada for Uruguay's physicians.[15]This should be a motivational factor for under-developed countries to improve their CME with the support of those countries which have already excelled in this domain. An international virtual medical school (IVIMEDS) [4] reported how CME could be improved by doing virtual practice with virtual patients, self-assessment instruments etc. Lastly, e-learning for CME was reported in the context of self-assessment.[40] Table I lists the outcomes of few particular studies listed against the top three categories of the 'study interventions' as an example.

Table I: Study Outcomes of some of the studies in the top three categories of the study intervention

No.	Category	Study Outcomes
1.	Online Learning	A design for an online inter-professional health science education has been outlined by Luke et al.[41] Their proposed solution has been justified with some existing best practices. Within the context of Saudi Arabia, online CME has been explored.[11] It summarizes the advantages, barriers and lessons learned while using online CME, thus providing a pathway for others how to implement an effective online CME within the context of Saudi Arabia. An evaluative study for an online rural mental health practice program revealed that the program was successful on small cohort of clinicians who appreciated this prog ram as it added value to their practice.[42]
2.	e-Courses	Badidis et al.[5] provided the procedure of designing a SCORM complainte-course for Aerospace Medicine. E -course in Epilepsy showed a positive result towards the learning of physicians in genetics of Epilepsy.[28] However, results of 9 -month follow -up of ' ePsychNurse.Net ' course demanded an improvement in the course to meet the course objectives.
3.	Web-based Learning	A survey indicated the popularity of web content in Radiology teaching for junior doctors.[43] One study presented a case study on the website 'Orthochina.org.'[30]It not only describes the developmental, technical and administrative issues but also gives details of this project's successful results. On the other hand, a web-resource was well-received by health professional preceptors reporting that it has increased their level of confidence in teaching.[33]

Conclusion

In this paper, a review on the use of e-learning in CME has been reported. A total of 59 studies published in reputed journals between the years 2003 to (June) 2013 were selected from relevant debases. All of the studies reported a positive impact of e-learning for CME. Most the studies reported on the efficiency and efficacy of domain-specific tools for e-learning. The use of Learning Management System and Discussion forums has also been reported as effective e-learning tools. The other technologies now commonly used in the field of e-learning like smart phone applications and podcasting have also been reported along with the use of Web 2.0 technologies like YouTube, Wiki and podcasting. The e-learning study interventions covered a wide range from e-programs, e-courses, e-modules, mobile learning to virtual schools and distance education. Most of the studies were reported out of countries that are generally perceived as technologically advanced. However, there are also a few studies now being reported from the developing countries.

Appendix A

List of Journals having one publication, each

BMC Health Services Research, BMC Medicine, British Journal of Clinical Pharmacology, BMC Medical Informatics and Decision Making, British Journal of Educational Technology, Clinical orthopedics and related research, Epilepsia, GMS German Medical Science, Health information and libraries journal, Hippokratia,

Insights into Imaging, International Journal of Nursing Practice, Journal of Advanced Nursing, Journal of dental education, Journal of Evaluation in Clinical Practice, Journal of Medical Systems, Journal of Occupational Rehabilitation, Journal of Pediatrics and Child Health, Nursing & Health Sciences, Performance Improvement, Respirology (Carlton, Vic.), Safety and health at work, The British journal of dermatology, The Clinical Teacher. The Journal of continuing education in the health professions, The Journal of perinatal education, The open nursing journal and The open rheumatology journal.

List of countries (with either three, two or one publication(s)) affiliated with authors of papers

The countries with three publications each were China and Greece. Italy, Netherland and New Zealand had two publications each whereas Africa, Denmark, Finland, Iran, Norway, Saudi Arabia, Spain and Turkey had one publication each.

List of countries (with either two or one publication(s)) where the studies were located

The countries with three publications each were China and Greece and two publications each were Italy and Netherland. While, Africa, Argentina, Denmark, Finland, Iran, New Zealand, Norway, Saudi Arabia, Spain, Turkey and Uruguay had a one publication, each.

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