# E-Learning in Medical Sciences Education: A Comprehensive Literature Review

| **Negin Ghasemi** | Assistant Professor of Endodontics, Dental Faculty of Tabriz University, Tabriz, Iran. |
| --- | --- |
| **Parisa Falsafi** | Assistant Professor of Oral Medicine, Dental Faculty of Tabriz University, Tabriz, Iran. |
| **Naser Asl Aminabadi** | Department of Pediatric Dentistry, Dental Faculty of Tabriz University, Tabriz University of Medical Sciences, Tabriz, Iran. |
| **Ramin Negahdari** | Department of Prosthodontics, Dental Faculty of Tabriz University, Tabriz University of Medical Science, Tabriz, Iran. |
| **Ayla Bahramian** | Assistant Professor of Oral Medicine, Dental Faculty of Tabriz University, Tabriz, Iran. |
| **Kazem Khodadoust** | Ph.D, Department of History of Medical Science, Tabriz University of Medical Science, Tabriz, Iran. |
| **Reza Khorshidi Khiyavi** | Department of oral and maxillofacial surgery, Dental Faculty of Tabriz University, Tabriz University of Medical Science, Tabriz, Iran |

**ABSTRACT**

**Introduction:** Educators need evidence-based guidance on how to develop effective e-learning in dentistry.The purpose of this literature review is to update previously published information and present a com-prehensive list of articles regarding e-learning.

**Method:** A review of the literature was performed by using electronic and hand searching methods for e-learning from May 2000 to July 2015.

**Results:** The overall perceptions of online learning were positive, and although there were some frustrations, the majority of students reported learned a great deal, found the course valuable, and became familiar with the terminology; but there are concerns and challengesin relation to the value of online learning.

**Conclusions :** Although the experience of developing and using online courses was new in much dental school, the study results revealed that the program was feasible effective. It seems that combination of classroom and online education was the ideal teaching methodology.

| **KEYWORDS** | Advantage; Disadvantage; Challenges; e-learning. |
| --- | --- |

## Introduction

The education systems are undergoing major changes all over the world, witheducational courses and programs being designed in new ways accompanied by new educational contents toincorporate the most updated knowledge to pave the way for making use of new technologicaladvances(1-6). In the higher education area, it was particularly reported that "integrating teaching, learning and technology is a mandate, not an optionand doing any less would border on professional irresponsibility"From a pedagogical viewpoint, electronic education can shift the balance from the passive teacher-centered scheme to active student-centered learning process(5-9). Currently, computers have achieved a crucial and ever-increasing role in dental education. Electronic education has shifted the focus from the hard medium to the online environment, thanks to high internet speed and widespread accessibility (6, 10-13).

Blended learning combines face-to-face learning ande-learning, giving rise to didactic learning and aiming to improve the quality and quantity of educational activities both vertically and horizontally dimensions by usingstate-of-the-art technolo-gies(14-16). In the horizontal dimension, the aim is to expand use of instruments to facilitate learning using a learning strategy in such a way to achieve the highest quality. In the vertical dimension, the aim is to carry out an in-depth analysis of learning in order to better understand educational materials for optimized learning(9, 14).The interactive nature of web- or internet-based e-learning,apart fromfacilitating access to the available learning strategies, over a wide range of time and location, enables researchers to benefit from different education management systems(10-13, 17-21).

The purpose of this literature review is to update previously published information and present a comprehensive list of articles from May 2000 to July 2015 regarding advantages, disadvantage and challenges of e-learning in human health education field; also, the limited literatures regarding that were available regarding to dental education with this new method was mentioned.

## Inclusion and Exclusion Criteria

Peer-reviewed journals were searched for articles related to thee- learning published in English from May 2000 to July

2015. Studies that did not meet these criteria were excluded.

**Search Methodology** Appropriate MeSH headings and key words related to different aspects of e-learning were searched in PubMed and Cochrane databases. Moreover, hand search of the last 2 years of issues of the following endodontic journals was conducted.

**Advantages vs.Disadvantage**
Advantages of online learning have been reported in previous studies and include ease of using the program, learners'working at a pace and time suitable for them, the possibility of the student-student interaction, feedback provided by the program, multiple sensory inputs, improvements made in computer literacy, enhanced self-motivation and finally, self-directed learning(2-5).

Furthermore, learners are able to gain access to the material from multiple locations; it is possible to limit access only to students enrolling in the course; learners are able to use other websites; it is possible to incorporate multimedia material at a relatively low cost;it is possible to decrease linear teaching and promote high levels of interactivity between the student and the instructor and shift from instructor-centered to learner-centered instruction(10, 18, 22-25). With the use of online learning, students are not required to attend classes at times or places dictated by the institution; therefore it is possible for them to meet both employment and family commitments while they are carrying out their educational responsibilities (22, 23, 26, 27).

The concept of convenience might be defined in different ways, from ease of access to the online program to a decrease intravel time. Students are all pleased to be able to actually acquiredegreesby studying in their homes. They believe it is advantageousto completethe course at a time appropriatefor them, their work and their family schedules. One student believedsince his work schedule was not predictable, he was unable to enroll in traditional courses. Furthermore, students enjoy the advantage of having access to the educational program round the clock, being able to work at any pace they choose and to review the materials repeatedly until they master them(28-32). Also, it wasreported that students preferred online learning because it made it possible for them to fulfill their family and occupational commitments while studying (10, 18, 20, 23-25).

In fact, many students are unable to enroll in courses if it involves in commuting to campus. Two dental hygiene students mentioned the decrease in commute times and costs alluded to in previous studies (12,13). The dental hygiene students were delighted that they did not have to attend the class on Mondays and Fridays at 8:00 a.m. All, except for two students, expressed willingness to enroll in online coursesin future. It is interesting to note that these two students were on-campus dental hygiene students. They enjoyed the online program but the instructor–student and student–student interactions were more enjoyable for them(10, 18, 23-25).

Two studies on online learning in nursing and medicineshowed that students were satisfied with this form of distant learning and believed it was an effective learning strategysimilar to other teaching and learning methods. It was reported that technological problems did not interfere with learning, emphasizing that the teleconference- and web-based education can be as effective as traditional classroom-based teaching technique (9, 14).

Apart from the necessity of students'preparedness for learning online, other factors mightaffecttheir preferences for online versusconventional classroom courses, includingpersonality traits, that more extrovertedand sensitive students preferred online presentation ofinformation and enjoyed the way they were evaluated in such courses (18).

Despite its advantages, the chief disadvantages of online learning are technical issues and isolation of students. Some students miss the interaction in a traditional classroom;however, self-directed learners enjoy online education and arte more successful (4),which explain whyit is necessary to integrate electronic and online education with conventional problem-solving sessions or other activities (5-7). Disadvantages attributed to online education in allied health and other higher education courses chiefly concern technological problems. Students might be hampered by the slow downloading of images, high phone bills when a local number for the Internet access is not available, and also by lack of campus computer resources (13,15).A lack of direct contact with the teacher/instructor and other classmates might lead to an unpleasant feeling of isolation and disconnection(11-13, 17).Finally, some students might not accept a new learning method because the conventional lecture format is deeply rooted in educational systems(27). One studyshowed that students believed instruction in a conventional classroom setting covered the subjects more adequately,with more interaction and participation being involved in the classroom setting;they also found faculty preparation and interaction a very important aspect of the learning process, believing that more communication skills were required in a classroom environment(3-5).

**Challenges**
A consistent and paramount challenge is how to adapt educational goals and methods to the new opportunities and technologicalchallenges and how to integrate these technologies most effectively into the educational curriculum (5, 7, 33).

Which technologies are able to help improve and augment education? Which applications are just technological fads? And, more importantly, how should one use technology in innovative ways for better educational results? Such changes require faculty members to use technology more effectively to educate students so that they can think and read critically, express themselves more clearly and persuasively, and solve complex problems more effectively. A greatchallenge for dental schools is how to maintain and balance a complex mix of activities, including clinical care, education, research and administration. This complexity, in itself, gives rise to computational complexity (13, 17, 19).Use of online elements in education results in many benefits compared to traditional classroom teaching (3). Despite their potential, developing critical thinking skills in these virtual text-based environments is still a challenge for educators. It involvesthe useof an inquiry-based environment to encourage students to challenge assumptions andconsider their own experiences (5). The capacity of online discussion panels to support learning in the health fields is a successful educational strategy, especially in supporting collaborative learning in online educational programs(28-31).

The chief advantage of blended learning technique is the integration of the advantages of synchronous (conventional face-to-face) and asynchronous (online and web-based) learning modalitiesby dividing the class time into two parts: a part for distance or web-based learning and a part for classroom or face-to-face activity(7, 8, 34). The length of each mode will depend on the course design (5). Creating a balance between these twoentities is a challenge, depending on factors such as the instructional aims, the characteristics of learners, the condition of online resources and the trainer's experience(15, 16).

**E-learning in Dentistry**
Studies suggest that online learning is a valuable method for teaching dental terminology and is advantageous to students who have difficulty gaining access to the educational courses due to long geographical distances. Online courses can be a greatchoice for distantlearning in dental hygiene programs (2, 4, 22, 25).

Only a limited number of studies are available in relation to e-learning in different fields of dentistry. A literature review showed that the majority of these studies are related to restorative dentistry. A cohort study in relation to the evaluation of the results of teaching using an online technique showed

an increase in the students' motives for learning, an improvement in learning and an increase in students' skills in the field of restorative dentistry. The results of this study are consistent with those of two other studies in which the students' skills significantly increased in the evaluation and diagnosis of dental caries with the use of e-learning model compared to presentation of lectures(2, 31-33). In a study aiming to evaluate the e-learning strategy in restorative dentistry, all the under- and post-graduate students reported that their skills increased significantly in restoring teeth, with post-graduate students exhibiting better performance with this educational model (16).

A study used blended-learning model for education in the prosthetic pre-clinic courses, which showed an increase in students' satisfaction with the educational content and in usefulness of the courses. In addition, the majority of students suggested web-based examinations (18).

In another study the opinions of under- and post-graduate dental students in relation to holding web-based examinations were evaluated. The results showed good reliability and security of such examinations. However, the major problem was access to the internet and the limited band width in some areas, which had a negative effect on exam results (10, 11).

Another study evaluated the skills of dental students in relation to the physical examination of patients using a web-based educational program and the results indicated that the majority of students were satisfied with this learning technique (12). Little attention has been directed toward the different aspects of web-based educational model in Iran. Only one study has shown the positive effect of online teaching and learning model on dental students compared to the lecture technique (26).

## Conclusions

The overall perceptions of online learning were positive, and although there were some frustrations, the majority of students reported learned a great deal, found the course valuable, and became familiar with the terminology. Students enjoyed the convenience of taking the course at a time appropriate for their schedule without having to commute long distances. Technical issues and student isolation were the chief disadvantages of online learning. Some students missed the interaction existing in a regular classroom and strongly believed thatone had to be a self-directed learner to be successful in online learning. Furthermore, visual learners were more successful than audio learners in online learning.

There are concerns in relation to the value of online learning. Some students believeda combination of classroom and online education was the ideal teaching methodology. Combining these two methodologies would maximize the positive attributes of each methodology, withstudents having flexible access to the content, but they would also enjoy the interaction between the students and teacher in the classroom that would allow for discussionsthat are not easily provided by the computer format.

Further support is necessary to train teachers to effectively incorporate online teaching elements in their curriculum to achieve their final educational objectives. The results of this study are the first faltering step toward providing evidence-based research, highlighting specific pedagogies in incorporating effective online components within the dental curriculum. Exploring students' perceptions regarding this new technology might provide a better understanding of the advantagesand disadvantagesof learning online and might be useful for programs in relation to distant education initiatives and/or students planning to enroll in online courses.

## REFERENCES

1. Bridges S, Chang JW, Chu CH, Gardner K. Blended learning in situated contexts: 3-year evaluation of an online peer review project. European journal of dental education : official journal of the Association for Dental Education in Europe 2014;18(3):170-179. 2. Camargo LB, Raggio DP, Bonacina CF, Wen CL, Mendes FM, Bonecker MJ, et al. Proposal of e-learning strategy to teach Atraumatic Restorative Treatment (ART) to undergraduate and graduate students. BMC research notes 2014;7:456. 3. Chen ML, Su ZY, Wu TY, Shieh TY, Chiang CH. Influence of dentistry students' e-Learning satisfaction: a questionnaire survey. Journal of medical systems 2011;35(6):1595-1603. 4. Corum KA, Gadbury-Amyot CC, Johnson K, Strait TM. U.S. dental hygiene faculty perceptions of learner outcomes in distance education courses. Journal of dental education 2014;78(4):530-540. 5. Davids MR, Chikte UM, Halperin ML. Effect of improving the usability of an e-learning resource: a randomized trial. Advances in physiology education 2014;38(2):155-160. 6. El Tantawi MM, Abdelsalam MM, Mourady AM, Elrifae IM. e-Assessment in a Limited-Resources Dental School Using an Open-Source Learning Management System. Journal of dental education 2015;79(5):571-583. 7. Hendricson WD, Anderson E, Andrieu SC, Chadwick DG, Cole JR, George MC, et al. Does faculty development enhance teaching effectiveness? Journal of dental education 2007;71(12):1513-1533. 8. Hendricson WD, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, et al. Educational strategies associated with development of problem-solving, critical thinking, and self-directed learning. Journal of dental education 2006;70(9):925-936. 9. Jotwani P, Srivastav V, Tripathi M, Deo RC, Baby B, Damodaran N, et al. Free-access open-source e-learning in comprehensive neurosurgery skills training. Neurology India 2014;62(4):352-361. 10. Shaffer K, Small JE. Blended learning in medical education: use of an integrated approach with web-based small group modules and didactic instruction for teaching radiologic anatomy. Academic radiology 2004;11(9):1059-1070. 11. Shah R, Cunningham SJ. Implementation of the virtual learning environment into a UK orthodontic training programme: the postgraduate and lecturer perspective. European journal of dental education : official journal of the Association for Dental Education in Europe 2009;13(4):223-232. 12. Shapiro MC, Anderson OR, Lal S. Assessment of a novel module for training dental students in child abuse recognition and reporting. Journal of dental education 2014;78(8):1167-1175. 13. Sheridan C, Gorman T, Claffey N. Dental nursing education and the introduction of technology-assisted learning. European journal of dental education : official journal of the Association for Dental Education in Europe 2008;12(4):225-232. 14. Karamizadeh Z, Zarifsanayei N, Faghihi AA, Mohammadi H, Habibi M. The study of effectiveness of blended learning approach for medical training courses. Iranian Red Crescent medical journal 2012;14(1):41-44. 15. Kavadella A, Tsiklakis K, Vougiouklakis G, Lionarakis A. Evaluation of a blended learning course for teaching oral radiology to undergraduate dental students. European journal of dental education : official journal of the Association for Dental Education in Europe 2012;16(1):e88-95. 16. Kunin M, Julliard KN, Rodriguez TE. Comparing face-to-face, synchronous, and asynchronous learning: postgraduate dental resident preferences. Journal of dental education 2014;78(6):856-866. 17. Tan PL, Hay DB, Whaites E. Implementing e-learning in a radiological science course in dental education: a short-term longitudinal study. Journal of dental education 2009;73(10):1202-1212. 18. Reissmann DR, Sierwald I, Berger F, Heydecke G. A model of blended learning in a preclinical course in prosthetic dentistry. Journal of dental education 2015;79(2):157-165. 19. Walsh K. E-learning: controlling costs and increasing value. Journal of the College of Physicians and Surgeons--Pakistan : JCPSP 2015;25(4):292-293. 20. Wright EF, Hendricson WD. Evaluation of a 3-D interactive tooth atlas by dental students in dental anatomy and endodontics courses. Journal of dental education 2010;74(2):110-122. 21. Ylonen M, Viljamaa J, Isoaho H, Junttila K, Leino-Kilpi H, Suhonen R. Effectiveness of an internet-based learning program on venous leg ulcer nursing care in home health care - study protocol. Journal of advanced nursing 2015. 22. Pahinis K, Stokes CW, Walsh TF, Cannavina G. Evaluating a blended-learning course taught to different groups of learners in a dental school. Journal of dental education 2007;71(2):269-278. 23. Pahinis K, Stokes CW, Walsh TF, Tsitrou E, Cannavina G. A blended learning course taught to different groups of learners in a dental school: follow-up evaluation. Journal of dental education 2008;72(9):1048-1057. 24. Papamichail D, Pantelis E, Papagiannis P, Karaiskos P, Georgiou E. A Web simulation of medical image reconstruction and processing as an educational tool. Journal of digital imaging 2015;28(1):24-31. 25. Pyle M, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, et al. The case for change in dental education. Journal of dental education 2006;70(9):921-924. 26. Moazami F, Bahrampour E, Azar MR, Jahedi F, Moattari M. Comparing two methods of education (virtual versus traditional) on learning of Iranian dental students: a post-test only design study. BMC medical education 2014;14:45. 27. Mojtahedzadeh R, Mohammadi A, Emami AH, Rahmani S. Comparing live lecture, internet-based & computer-based instruction: A randomized controlled trial. Medical journal of the Islamic Republic of Iran 2014;28:136. 28. Lanken PN, Novack DH, Daetwyler C, Gallop R, Landis JR, Lapin J, et al. Efficacy of an internet-based learning module and small-group debriefing on trainees' attitudes and communication skills toward patients with substance use disorders: results of a cluster randomized controlled trial. Academic medicine : journal of the Association of American Medical Colleges 2015;90(3):345-354. 29. Leong C, Louizos C, Currie C, Glassford L, Davies NM, Brothwell D, et al. Student perspectives of an online module for teaching physical assessment skills for dentistry, dental hygiene, and pharmacy students. Journal of interprofessional care 2015;29(4):383-385. 30. Lewis KO, Cidon MJ, Seto TL, Chen H, Mahan JD. Leveraging e-learning in medical education. Current problems in pediatric and adolescent health care 2014;44(6):150-163. 31. Linjawi AI, Walmsley AD, Hill KB. Online discussion boards in dental education: potential and challenges. European journal of dental education : official journal of the Association for Dental Education in Europe 2012;16(1):e3-9. 32. Luz PB, Stringhini CH, Otto BR, Port AL, Zaleski V, Oliveira RS, et al. Performance of undergraduate dental students on ICDAS clinical caries detection after different learning strategies. European journal of dental education : official journal of the Association for Dental Education in Europe 2014. 33. El-Damanhoury HM, Fakhruddin KS, Awad MA. Effectiveness of teaching International Caries Detection and Assessment System II and its e-learning program to freshman dental students on occlusal caries detection. European journal of dentistry 2014;8(4):493-497. 34. Haden NK, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, et al. The dental education environment. Journal of dental education 2006;70(12):1265-1270.