Knowledge Management & E-Learning
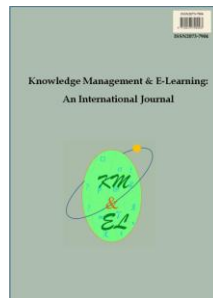
A pilot study on implementation of an e-learning course for clinical education in oral medicine

Vlaho Brailo
University of Zagreb, Croatia
Ivica Richter
Fužine, Croatia
Ana Andabak Rogulj
Vanja Vučićević Boras
University of Zagreb, Croatia
Ivana Škrinjar
Clinical Hospital Center Zagreb, Croatia

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Vlaho Brailo*

School of Dental Medicine
University of Zagreb, Croatia
E-mail: brailo@sfzg.hr

Ivica Richter

Private Dental Practice
Fužine, Croatia
E-mail: ivica.richter@ri.t-com.hr

Ana Andabak Rogulj

School of Dental Medicine
University of Zagreb, Croatia
E-mail: anaandabak@gmail.com

Vanja Vučićević Boras

School of Dental Medicine
University of Zagreb, Croatia
E-mail: borasvanja@yahoo.com

Ivana Škrinjar

Department of Oral Medicine
Clinical Hospital Center Zagreb, Croatia
E-mail: skrinjar.ivana@gmail.com

*Corresponding author

Abstract: This study presents the process of implementing an e-learning course for clinical education in oral medicine and examines its impact on students' knowledge and satisfaction. Thirty six (39.6%) fifth-year undergraduate students participated in the study. Every week before their clinical practice, students studied relevant e-learning materials and completed an assessment test. At the end of the semester, students' knowledge and attitudes towards e-learning were assessed by the knowledge test and anonymous questionnaire. Students who had access to the e-learning course had significantly better knowledge than students who did not have access to the e-learning course. Exposure to the e-learning course contributed to a better understanding of oral medicine curriculum, increased confidence with oral medicine patients and easier participation in oral medicine clinical practice. This study provided evidence that the e-learning can be implemented as a valuable adjunct to

clinical education in oral medicine.

Biographical notes: Vlaho Brailo, DMD, PhD is Assistant Professor at the Department of Oral Medicine, School of Dental Medicine, University of Zagreb, Croatia. He is the chairman of the e-learning committee at his institution. He participates in professional activities related to advancing oral medicine clinical care, research and education through IT.

Ivica Richter is a Ph.D. student at the Department of Oral Medicine, School of Dental Medicine, University of Zagreb, Croatia.

Ana Andabak Rogulj, DMD, PhD is post doctorate fellow at the Department of Oral Medicine, School of Dental Medicine, University of Zagreb, Croatia involved in the development of e-learning curriculum in oral medicine.

Vanja Vučićević Boras, DMD, PhD is the Head of the Department of Oral Medicine, School of Dental Medicine, University of Zagreb, Croatia involved in the development of e-learning curriculum in oral medicine.

Ivana Škrinjar, DMD is oral medicine specialist at the Oral Medicine Unit, Clinic for Dentistry, University Hospital Centre, Zagreb Croatia involved in the development of e-learning curriculum in oral medicine.

1. Introduction

At the School of Dental Medicine, University of Zagreb, oral medicine is taught for four semesters (7th, 8th, 9th and 10th semesters). The first two semesters (7 and 8) consist of lectures, seminars and preclinical exercises. Semesters 9 and 10 consist of clinical practice under the supervision of a tutor. After completing the 10th semester students take the final exam which consists of 45 multiple choice questions. Transition to the clinical portion of the education rarely goes smoothly. Students tend to forget materials taught through lectures and seminars. They usually begin studying only a few weeks before their exams and they often lack theoretical knowledge necessary for active participation in the clinical working with oral medicine patients.

Our primary task was to find a way to motivate students to become more prepared for their clinical work because we do not want to spend precious clinical time on repeating materials that students should already have learned from lectures and seminars. Clinical sessions last 90 minutes and review sessions would take a minimum of 20-30 minutes from this time.

e-Learning came up as a logical solution as it offers flexibility for learning independent of place and time constraints. Students may access teaching materials from anywhere, individualize their learning process and learn at their own pace (Puljak & Sapunar, 2011). Unlike "classical" teaching methods such as lectures and seminars, where the teacher transfers knowledge and students are passive recipients, e-learning promotes active learning where students become creators of their own base knowledge (DeBate et al., 2011; Gadbury-Amyot & Brockman, 2011). Another advantage of e-learning is that students can access learning materials several times as opposed to only having one exposure shared through a lecture or a seminar. Furthermore, e-learning offers

environments free from distractions which often cannot be avoided in lecture halls (Rosenberg, Grad, & Matear, 2003). Studies have shown that e-learning is at least as effective as other learning methods in dental education and that students generally have positive attitudes towards it (Mattheos et al., 2008; Rosenberg, Grad, & Matear, 2003).

The research questions of the study include the following:

- Can e-learning course be implemented in the clinical education in oral medicine?
- What is the impact of the e-learning course on students' knowledge?
- How are students satisfied with the new teaching method in their oral medicine education?

2. Materials and methods

2.1. Description and administration of the e-learning course

A free version of the eFront e-learning platform (Epignosis LLC, USA) was used to create the course. The course was introduced in the 9th semester as a supplement to the clinic and consisted of 15 modules in the 9th and 15 modules in the 10th semester. In the 9th semester, each module consisted of theoretical materials covering examination of the oral medicine patient, laboratory testing in oral medicine, medication prescription, writing referral letters, most common oral lesions etc. Each module also had a quiz to assess students' knowledge. Multiple choice questions, open-ended questions, true/false questions, and matched pairs were used in the quizzes.

Every week before the clinic students were obliged to study the module materials and complete the quiz (10-20 questions). The system automatically calculated the percentage of correct answers giving students immediate feedback on their performance. The threshold was set to 80% correct answers. Students had the opportunity to access materials and take the test as many times as they preferred. Without completing the quiz, a student's attendance in the clinical portion of the class was not registered. In this way, a high level of knowledge about each module and students' preparedness for clinical work was achieved.

In the 10th semester, the e-learning focus was on the application of acquired knowledge in realistic clinical situations. Students were assigned a virtual patient case scenario (Department's clinical photo archive was used) every week, where they had to establish a correct diagnosis, perform corresponding laboratory tests, and prescribe a treatment. Procedural sequencing was similar to the procedures done in real-life. A forum for comments and exchange of ideas related to each case was also made available to students.

Along with the clinical case, every week students had to solve a quiz that included material taught in the 9th semester. These quizzes were more complex and required higher levels of knowledge according to Bloom's taxonomy (such as analysis and synthesis) than the quizzes from the 9th semester (which were based on remembering and understanding) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956).

As this was a pilot project, the e-learning course was available to 36 out of 91(39.6%) of the fifth year undergraduate students. e-Learning course participation was decided by the clinical tutor.

2.2. Outcome measures

The aim of this study was to assess students' knowledge and attitudes towards e-learning. Informal survey was used for that purpose. Knowledge was assessed by 14 open-ended questions at the beginning of the 10th semester. The questions were also distributed to the control group of students who did not have access to the e-learning course. Answers were checked by a single investigator (AAR). Possible score was 0, 0.5 and 1 point for each question.

Attitudes towards the e-learning course were measured at the end of the 10th semester, after the final exam. Five-point Likert scale that determined level of agreement (1- strongly disagree to 5 – strongly agree) with each of the 11 statements was used.

Furthermore, we compared the final exam grades between the students who had access to the e-learning course and the students who did not have access to the e-learning course. The exam grades were numerical (1 to 5).

2.3. Data analysis

Numerical data (i.e. 0, 0.5 or 1 for knowledge assessment and 1-5 for attitudes and exam grades) were organized in MS Excel (Microsoft Excel, Microsoft Inc. USA) spreadsheets and processed using SPSS 20.0 software (IBM Inc., USA). Differences between the two groups were assessed by the chi-square test and student's t-test when applicable. p values lower than 0.05 ($p < 0.05$) were considered statistically significant.

3. Results

3.1. General data

Thirty six fifth year undergraduate students participated in the e learning course. Control group consisted of 55 fifth year undergraduate students who did not have the access to the e learning course. Student characteristics and their use of e-learning software are shown in Table 1.

Table 1
Student characteristics and their use of e-learning software

Sex	N				
Females	30				
Males	6				
Average time spent weekly in the course N (%)	<30 min	30-60 min	60-90 min	90-120 min	>120 min
	3 (8.3%)	19 (52.8%)	6 (16.7%)	6 (16.7%)	2 (5.6%)
With regard to other curricular activities how	It took too much of my time	It took much of my time	It took neither little, nor much of my time	It took little of my time	It took very little of my time

much of your time did this activity take? N (%)				
0	1	6	17	12
(0%)	(2.8%)	(16.7%)	(47.2%)	(33.3%)
On average, how difficult for you, was it to solve the assessment test? N (%)	Very difficult	Difficult	Neither difficult, nor easy	Easy	Very easy
0	1	9	24	2
(0%)	(2.8%)	(25%)	(66.7%)	(5.6%)
On average how many attempts did it take you to solve the assessment test? N (%)	1	1-2	2-3	3-4	4 and more
11	21	4	0	0
(30.6%)	(58.3%)	(11.1%)	(0%)	(0%)
Opinion on the use of the e-learning software N (%)	Very complicated to use	Complicated to use	Neither complicated, nor easy to use	Easy to use	Very easy to use
0	0	3	12	21
(0%)	(0%)	(8.3%)	(33.3%)	(58.3%)
General opinion of the e-learning course N (%)	Very negative	Negative	Neither negative nor positive	Positive	Very positive
0	0	1	11	24
(0%)	(0%)	(2.8%)	(30.6%)	(66.6%)

3.2. Students' knowledge

As shown in Fig. 1, students who had access to the e-learning course had significantly higher number of correct answers than the students who did not have access to the e-learning course (6.6 ± 2 vs. 1.9 ± 1.5; p=0.0003) as assessed by the 14 open ended questions at the beginning of the 10th semester. The bars in Fig. 1 represent average number of correct answers ± one standard deviation. Significant difference between students who had access to the e-learning and students who did not have access to the e-learning course was observed.
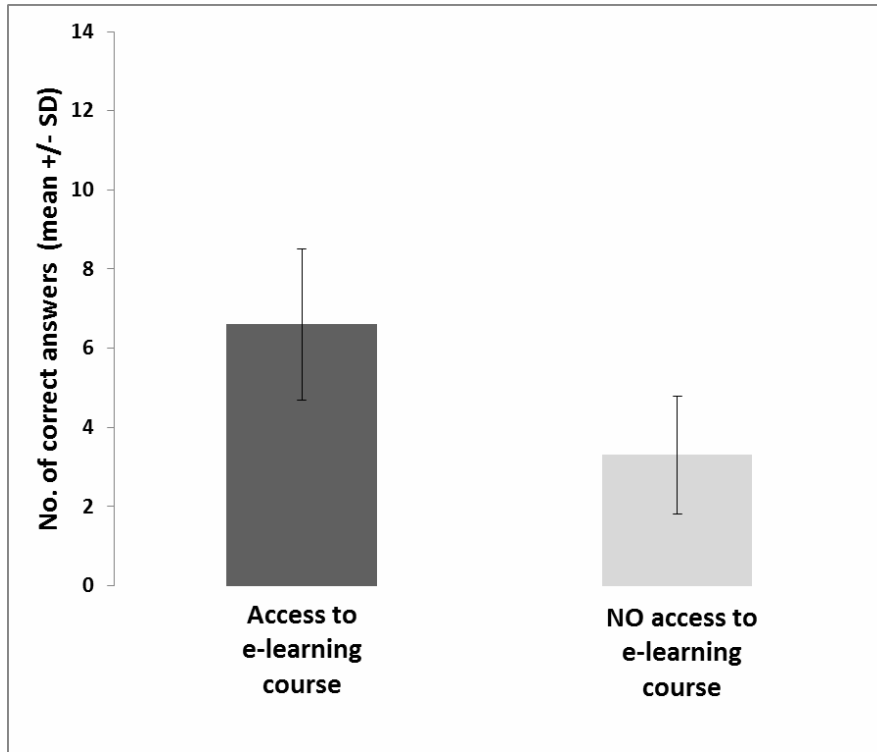
Fig. 1. Results of knowledge testing at the end of the 9th semester

As shown in Fig. 2, no difference in the final exam grades at the end the 10th semester, was observed between the students who had access to the e-learning course and the students who did not have access to the e-learning course (p=0.414). The bars in Fig. 2 represent percentage of students with corresponding final grades. No difference between students who had access to the e-learning and students who did not have access to the e-learning course was observed.
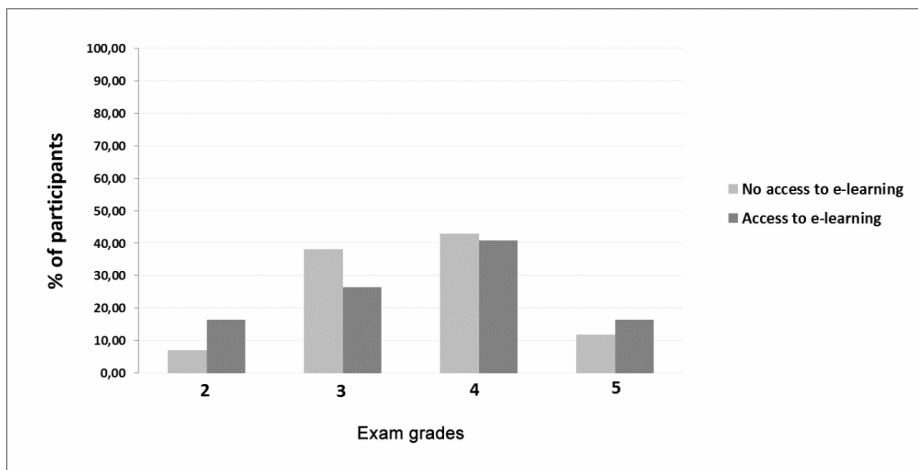

Fig. 2. Distribution of final exam grades among students

3.3. Student satisfaction

Students' attitudes and satisfaction with the e-learning course are displayed in Table 2. A great majority of the students expressed positive attitudes towards the e-learning course.

Table 2
Students' attitudes and satisfaction with e-learning

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
e-Learning course contributed to a better understanding of oral medicine curriculum N(%)	0 (0%)	0 (0%)	0 (0%)	9 (25%)	27 (75%)
e-Learning course made participation in the oral medicine clinic easier N(%)	0 (0%)	0 (0%)	1 (2.8%)	21 (58.3%)	14 (38.9%)
e-Learning course contributed to a better recognition of oral mucosal lesions N(%)	0 (0%)	0 (0%)	0 (0%)	23 (63.9%)	13 (36.1%)
e-Learning course increased my confidence with an oral medicine patients N(%)	0 (0%)	0 (0%)	4 (11.1%)	24 (66.7%)	8 (22.2%)
e-Learning course increased my interest in oral medicine N(%)	0 (0%)	3 (8.3%)	3 (8.3%)	21 (58.3%)	9 (25%)
I would have regularly accessed e-learning materials even if hadn't had the obligation to pass the assessment test before every clinic N(%)	1 (2.8%)	9 (25%)	11 (30.6%)	12 (33.3%)	3 (8.3%)
In my opinion, e-learning should be regular part of oral medicine curriculum N(%)	0 (0%)	1 (2.8%)	2 (5.6%)	12 (33.3%)	21 (58.3%)
In my opinion, e-learning should be important part of the undergraduate dental education N(%)	0 (0%)	1 (2.8%)	4 (11.1%)	13 (36.1%)	18 (50%)

	0	0	1	11	24
e-Learning course made preparation for exam much easier N(%)	0 (0%)	0 (0%)	1 (2.8%)	11 (30.6%)	24 (66.7%)

	1	2	3	4	5
On a scale from 1-5 rate the quality of e-learning materials (1- bad - 5- excellent) N(%)	0 (0%)	0 (0%)	0 (0%)	6 (16.7%)	30 (83.3%)
On a scale from 1-5 rate how much did the e-learning course help you to pass the final exam (1- didn't help at all 5- significantly helped) N(%)	1 (2.8%)	2 (5.6%)	7 (19.4%)	12 (33.3%)	14 (38.9%)
On a scale from 1-5 rate how much did the e-learning course influence your overall satisfaction with the oral medicine curriculum (1- didn't influence at all 5- significantly influenced) N(%)	0 (0%)	1 (2.8%)	3 (8.3%)	10 (27.8%)	22 (61.1%)

4.   Discussion

e-Learning has proven its efficacy as a teaching method in various dental disciplines (Al-Jewair, Azarpazhooh, Suri, & Shah, 2009; Al-Jewair, Qutub, Malkhassian, & Dempster, 2010; Meckfessel et al., 2011; Mitov, Dillschneider, Abed, Hohenberg, & Pospiech, 2010; Rosenberg, Grad, & Matear, 2003; Tan, Hay, & Whaites, 2009). Its use has been described in the field of oral medicine as well (Jontell, Mattsson, & Torgersson, 2005; Porter et al., 1996). Our results are in concordance with the aforementioned studies and indicate that e-learning can be successfully integrated in oral medicine clinical education. Exposure to the e-learning course contributed to a better understanding of the oral medicine curriculum, increased students' confidence with oral medicine patients and made the participation in oral medicine clinic easier.

Exposure to real-life patients and hands-on clinical cases cannot often be achieved in the oral medicine clinic due to time and place constraints as well as the prevalence of certain oral disease in the general population. In a discipline where mucosal lesions can

have a great degree of variability, visual information from the textbooks and lectures is often insufficient and may not reflect real life situations (Jontell, Mattsson, & Torgersson, 2005). As a result of the aforementioned circumstances, students are exposed to a limited number of hands-on cases/oral lesions which will negatively affect their clinical experience. With the use of the e-learning software and the Department's photo/video archive realistic clinical case scenarios can be created (as was done in this study). In this way students can be exposed to a great number of virtual clinical cases and the aforementioned problem can at least partially be alleviated. Furthermore, students can practice clinical skills important for the management of oral medicine patients such as describing oral lesions, ordering lab tests, writing referral letters and prescribing medication. E-learning enables students to undertake these activities numerous times at their own pace opposed to only 90 minutes per week in a real life clinical sessions. We would however, like to emphasize that e-learning can by no means substitute student's encounter with the real patient, but can rather be used as a valuable adjunct to the clinical education.

As the results of this study show, exposure to the e-learning course can positively affect student's knowledge. Students who were exposed to the e-learning course had better knowledge than their colleagues who did not have access to the course. The difference in knowledge was evident during the semester (as assessed by the knowledge test) but not in the final exam grades. Students usually start studying few weeks before the final exam and catch up with the curriculum which can explain the lack of difference in the final exam grades.

Nevertheless, we believe that the e-learning course has fulfilled its purpose, as our primary intention was to motivate the students to learn during the entire academic year and have theoretical knowledge necessary for active participation in the clinic. The element of obligation had to be present in order to assure regular attendance in the course, as nearly one third of the students (27.8%) disagreed or strongly disagreed with the statement "I would have regularly accessed e-learning materials even if hadn't had the obligation to pass the assessment test before every clinic". In spite of the fact that students had to be actively involved in the course for the entire academic year, they felt that the e-learning course did not significantly interfere with their other curricular activities and did not take much of their time.

Students expressed positive attitudes toward the e-learning course and found the e-learning software easy or very easy to use. This is not surprising as the majority of the students are born between 1988 and 1992 and belong to a so called Net generation. This generation grew up surrounded with information technology and is very open to the use of new technologies. Internet is very important part of their daily lives and a computer is a medium that is more familiar for them than a textbook (Oblinger & Oblinger, 2008). In spite of the students' openness to the new technologies, quality of the e-learning materials is more important for students' satisfaction than the variety of media used for the creation of the course (Tan, Hay, & Whaites, 2009). As stated by McNeely, technology should be used "as a learning tool, not just the cool new thing" (McNeely, 2008). We believe that we managed to meet students' expectations as the great majority of the students (83.3%) gave highest grade to the quality of the e-learning materials.

This study has several limitations. First of all, this was not a randomized control trial. Students were not randomly assigned to the e-learning/non-e learning group. The involvement in the e-learning course was based on the decision of the clinical tutor. The study did not prove superiority of e-learning over classic teaching methods, but it confirmed its value as an additional educational tool in oral medicine. Secondly, one

might argue that the sample was relatively small (36 students). However, we feel that the responses from 39.6% of the fifth year students can predict trends in students' learning preferences and adoption of new technologies with a high degree of certainty.

5. Conclusion

e-Learning can provide innovative and interactive ways of presenting learning materials and offers numerous possibilities that can facilitate learning process (Mattheos et al., 2008; Rosenberg, Grad, & Matear, 2003). In a discipline like oral medicine where visual information is essential for knowledge adoption, students can be exposed to a greater number of oral lesions than is possible through classical learning tools such as textbooks and lectures. Integration of various visual information such as clinical photographs and videos enables teacher to create realistic case scenarios that can alleviate the problem of physical constraints and low prevalence of some oral lesions in oral medicine practice. This can increase student's confidence in dealing with real-life clinical situations. In spite of its limitations, this study provided evidence that e-learning can be implemented as a valuable adjunct to clinical education in oral medicine.

References

Al-Jewair, T. S., Azarpazhooh, A., Suri, S., & Shah, P. S. (2009). Computer-assisted learning in orthodontic education: A systematic review and meta-analysis. *Journal of Dental Education, 73*(6), 730–739.

Al-Jewair, T. S., Qutub, A. F., Malkhassian, G., & Dempster, L. J. (2010). A systematic review of computer-assisted learning in endodontics education. *Journal of Dental Education, 74*(6), 601–611.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: Book 1: Cognitive domain*. New York: David McKay Company, Inc.

DeBate, R. D., Cragun, D., Severson, H. H., Shaw, T., Christiansen, S., Koerber, A., Tomar, S., Brown, K. M., Tedesco, L. A., & Hendricson, W. (2011). Factors for increasing adoption of e-courses among dental and dental hygiene faculty members. *Journal of Dental Education, 75*(5), 589–597.

Gadbury-Amyot, C. C., & Brockman, W. G. (2011). Transition of a traditional pharmacology course for dental students to an online delivery format: A pilot project. *Journal of Dental Education, 75*, 633–645.

Jontell, M., Mattsson, U., & Torgersson, O. (2005). MedView: An instrument for clinical research and education in oral medicine. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology, 99*(1), 55–63.

Mattheos, N., Stefanovic, N., Apse, P., Attstrom, R., Buchanan, J., Brown, P., Camilleri, A., Care, R., Fabrikant, E., Gundersen, S., Honkala, S., Johnson, L., Jonas, I., Kavadella, A., Moreira, J., Peroz, I., Perryer, D. G., Seemann, R., Tansy, M., Thomas, H. F., Tsuruta, J., Uribe, S., Urtane, I., Walsh, T. F., Zimmerman, J., & Walmsley, A. D. (2008). Potential of information technology in dental education. *European Journa of Dental Education, 12*(Suppl. 1), 85–92.

McNeely, B. (2005). Using technology as a learning tool, not just a cool new thing. In D. Oblinger & J. Oblinger (Eds), *Educating the net generation* (pp. 4.1–4.10). Boulder, CO: EDUCAUSE.

Meckfessel, S., Stühmer, C., Bormann, K.-H., Kupka, T., Behrends, M., Matthies, H., Vaske, B., Stiesch, M., Gellrich, N.-C., & Rücker, M. (2011). Introduction of e-

learning in dental radiology reveals significantly improved results in final examination. *Journal of Craniomaxillofacial Surgery, 39*(1), 40–48.

Mitov, G., Dillschneider, T., Abed, M. R., Hohenberg, G., & Pospiech, P. (2010). Introducing and evaluating MorphoDent, a web-based learning program in dental morphology. *Journal of Dental Education, 74*(10), 1133–1139.

Oblinger, D., & Oblinger, J. (2008). *Educating the net generation*. Boulder, CO: EDUCAUSE.

Porter, S. R., Telford, A., Chandler, K., Furber, S., Williams, J., Price, S., Scully, C., Triantos, D., & Bain, L. (1996). Computer assisted learning (CAL) of oral manifestations of HIV disease. *British Dental Journal, 181*(5), 173–177.

Puljak, L., & Sapunar, D. (2011). Web-based elective courses for medical students: An example in pain. *Pain Medicine, 12*(6), 854–863.

Rosenberg, H., Grad, H. A., & Matear, D. W. (2003). The effectiveness of computer-aided, self-instructional programs in dental education: A systematic review of the literature. *Journal of Dental Education, 67*(5), 524–532.

Tan, P.-L., Hay, D. B., & Whaites, E. (2009). Implementing e-learning in a radiological science course in dental education: a short-term longitudinal study. *Journal of Dental Education, 73*(10), 1202–1212.