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### Comparing the effect of e-learning with face-to-face learning in diagnosing oral diseases among dental students during COVID-19 outbreak

**Background:** After the COVID-19 outbreak, most education systems have adopted online learning as alternatives to face-to-face learning. The aim of the present study was to evaluate the effect of e-learning compared with face-to-face learning in diagnosing oral diseases among dental students.

**Method:** The present experimental study was conducted in 2020 at the Faculty of Dentistry, Ahvaz Jundishapur University of Medical Sciences. A total of 54 dental students (11th semester) who have not yet taken or passed the practical diagnostics course 3 participated in the study. The participants were divided into two groups of A (traditional teaching method) and B (e-learning teaching method). In the first week after the completion of training, a test was taken to assess the immediate learning. At the end of one month, the groups were tested again. Finally, the students' scores in both tests were analyzed. Data were analyzed using SPSS version 26.

**Results:** The mean scores of the two groups in the first test were not significantly different. The mean score of traditional and electronic methods in the second exam was higher than the first exam ( $p < 0.001$ ). The mean score of the combination of traditional and e-learning methods was more than e-learning alone. ( $p < 0.01$ ).

**Conclusions:** Traditional or electronic education can support student learning; however, e-learning alone cannot compensate for traditional learning. Successful learning can be achieved through the combination of traditional learning and e-learning (blended model). E-learning can be used as a complementary method to face-to-face learning.

**Keywords:** Electronic learning; Traditional learning; Virtual learning; COVID-19

### مقایسه تأثیر التعلم الإلكتروني مع التعلم وجهاً لوجه في تشخيص أمراض الفم بين طلاب طب الأسنان أثناء تفشي COVID-19

**الخلفية:** بعد تفشي COVID-19، اعتمدت معظم أنظمة التعليم عبر الإنترنت كبديل للتعلم وجهاً لوجه. الهدف من هذه الدراسة هو تقييم تأثير التعلم الإلكتروني مقارنة بالتعلم وجهاً لوجه في تشخيص أمراض الفم لدى طلاب طب الأسنان.

**الطريقة:** أجريت الدراسة التجريبية الحالية في عام ٢٠٢٠ في كلية طب الأسنان، جامعة أهواز جوندشاپور للعلوم الطبية. شارك في الدراسة ما مجموعه ٥٤ من طلاب طب الأسنان (الفصل الحادي عشر) الذين لم يأخذوا أو يجتازوا مقرر التشخيص العملي ٣. تم تقسيم المشاركين إلى مجموعتين من A (طريقة التدريس التقليدية) و B (طريقة التدريس بالتعلم الإلكتروني). في الأسبوع الأول بعد الانتهاء من التدريب، تم إجراء اختبار لتقييم التعلم الفوري. في نهاية شهر واحد، تم اختبار المجموعات مرة أخرى. أخيراً، تم تحليل درجات الطلاب في كلا الاختبارين. تم تحليل البيانات باستخدام الإصدار ٢٦ من SPSS.

**النتائج:** متوسط درجات المجموعتين في الاختبار الأول لم تكن مختلفة بشكل كبير. كان متوسط درجات الطرق التقليدية والإلكترونية في الامتحان الثاني أعلى من الاختبار الأول ( $p < 0.001$ ). كان متوسط الدرجات للجمع بين الأساليب التقليدية والتعلم الإلكتروني أكثر من التعلم الإلكتروني وحده. ( $p < 0.01$ ).

**الاستنتاجات:** يمكن للتعليم التقليدي أو الإلكتروني أن يدعم تعلم الطلاب؛ ومع ذلك، لا يمكن للتعليم الإلكتروني وحده أن يعوض التعلم التقليدي. يمكن تحقيق التعلم الناجح من خلال الجمع بين التعلم التقليدي والتعلم الإلكتروني (النموذج المدمج). يمكن استخدام التعلم الإلكتروني كطريقة تكميلية للتعلم وجهاً لوجه.

**الكلمات المفتاحية:** التعلم الإلكتروني. التعلم التقليدي تعليم افتراضي؛ كوفيد ١٩-

### مقایسه تأثیر آموزش الکترونیکی با آموزش سنتی بر مهارت های تشخیصی بیماری های دهان در دانشجویان دندانپزشکی در دوران اپیدمی کرونا

**زمینه و هدف:** پس از شیوع کووید-١٩، اکثر سیستم های آموزشی، یادگیری آنلاین را به عنوان جایگزینی برای یادگیری حضوری پذیرفته اند. هدف پژوهش حاضر بررسی تأثیر آموزش الکترونیکی در مقایسه با یادگیری حضوری در تشخیص بیماری های دهان و دندان در دانشجویان دندانپزشکی بود.

**روش:** مطالعه تجربی حاضر در سال ١٣٩٩ در دانشکده دندانپزشکی دانشگاه علوم پزشکی جندی شاپور اهواز انجام شد. در مجموع ٥٤ دانشجوی دندانپزشکی (ترم یازدهم) که هنوز درس تشخیص عملی ٣ را نگذرانده بودند، در مطالعه شرکت کردند. شرکت کنندگان به دو گروه الف (روش تدریس سنتی) و ب (روش تدریس الکترونیکی) تقسیم شدند. در هفته اول پس از اتمام آموزش، آزمون برای سنجش میزان یادگیری فوری گرفته شد. در پایان یک ماه، گروه ها مجدداً مورد آزمایش قرار گرفتند. در نهایت نمرات دانشجویان در هر دو آزمون مورد تجزیه و تحلیل قرار گرفت. داده ها با استفاده از نرم افزار SPSS نسخه ٢٦ تجزیه و تحلیل شد.

**یافته ها:** میانگین نمرات دو گروه در آزمون اول تفاوت معنی داری نداشت. میانگین نمره روش های سنتی و الکترونیکی در آزمون دوم بیشتر از آزمون اول بود ( $p < 0.001$ ). میانگین امتیاز ترکیب روش های آموزش سنتی و الکترونیکی بیشتر از آموزش الکترونیکی به تنهایی بود ( $p < 0.01$ ).

**نتیجه گیری:** آموزش سنتی یا الکترونیکی می تواند از یادگیری دانشجویان حمایت کند. با این حال، آموزش الکترونیکی به تنهایی نمی تواند یادگیری سنتی را جبران کند. یادگیری موفقیت آمیز را می توان از طریق ترکیب یادگیری سنتی و آموزش الکترونیکی به دست آورد. آموزش الکترونیکی می تواند به عنوان یک روش مکمل برای یادگیری حضوری استفاده شود.

**واژه های کلیدی:** یادگیری الکترونیکی، یادگیری سنتی، یادگیری مجازی، کووید-١٩

### COVID-19 پھیلتے کے دوران دانتوں کے طلباء میں منہ کی بیماریوں کی تشخیص میں آئے سامنے سیکھنے کے ساتھ ای لرننگ کے اثر کا موازنہ کرنا

**پس منظر:** COVID-19 کے پھیلنے کے بعد، زیادہ تر تعلیمی نظاموں نے آن لائن سیکھنے کو آئے سامنے سیکھنے کے متبادل کے طور پر اپنایا ہے۔ موجودہ مطالعے کا مقصد دانتوں کے طلباء میں منہ کی بیماریوں کی تشخیص میں آئے سامنے سیکھنے کے مقابلے ای لرننگ کے اثر کا جائزہ لینا تھا۔

**طریقہ:** موجودہ تجرباتی مطالعہ ٢٠٢٠ میں فیکلٹی آف ڈینٹسٹری، ابواز جندیش پور یونیورسٹی آف میڈیکل سائنسز میں کیا گیا تھا۔ مجموعی طور پر ٥٤ ڈینٹل طلباء (١١ ویں سمسٹر) جنہوں نے ابھی تک عملی تشخیصی کورس ٣ نہیں لیا یا پاس نہیں کیا، اس مطالعہ میں حصہ لیا۔ شرکاء کو A (روایتی تدریسی طریقہ) اور B (ای لرننگ تدریسی طریقہ) کے دو گروپوں میں تقسیم کیا گیا۔ تربیت کی تکمیل کے بعد پہلے ہفتے میں، فوری سیکھنے کا اندازہ لگانے کے لیے ایک ٹیسٹ لیا گیا۔ ایک ماہ کے اختتام پر، گروپوں کا دوبارہ تجربہ کیا گیا۔ آخر میں، دونوں ٹیسٹوں میں طلباء کے اسکور کا تجزیہ کیا گیا۔ SPSS ورژن ٢٦ کا استعمال کرتے ہوئے ڈیٹا کا تجزیہ کیا گیا۔

**نتائج:** پہلے ٹیسٹ میں دو گروپوں کے اوسط اسکور نمایاں طور پر مختلف نہیں تھے۔ دوسرے امتحان میں روایتی اور الیکٹرانک طریقوں کا اوسط اسکور پہلے امتحان ( $p < 0.001$ ) سے زیادہ تھا۔ روایتی اور ای لرننگ طریقوں کے امتزاج کا اوسط اسکور صرف ای لرننگ سے زیادہ تھا۔ ( $p < 0.01$ )۔

**نتیجہ:** روایتی یا الیکٹرانک تعلیم طلباء کے سیکھنے میں مدد کر سکتی ہے۔ تاہم، اکیلے ای لرننگ روایتی سیکھنے کی تلافی نہیں کر سکتی۔ کامیاب سیکھنے کو روایتی سیکھنے اور ای لرننگ (ملاوٹ شدہ ماڈل) کے امتزاج سے حاصل کیا جا سکتا ہے۔ ای لرننگ کو آئے سامنے سیکھنے کے لیے ایک تکمیلی طریقہ کے طور پر استعمال کیا جا سکتا ہے۔

**مطلوبہ الفاظ:** الیکٹرانک سیکھنے؛ روایتی تعلیم؛ مجازی سیکھنے؛ COVID-19

## INTRODUCTION

Education is a fundamental human right and necessary for the development and growth of the public sector. Nowadays, there is an obvious tendency towards continuous and lifelong learning (1, 2).

With the absolute increase of the population per year, the governments cannot meet all the educational needs of society. Therefore, more affordable and accessible learning platforms are needed for the public sector (3, 4). The current age is the age of continuing professional development. So, organizing new tools and technology should be carefully considered for the educational system (5, 6).

After the COVID-19 outbreak, most education systems have adopted online learning (E-learning) as alternatives to face-to-face learning (7).

E-learning, e-teaching, and e-assessment-based programs are the appropriate responses to the human needs for continuing education and meeting the standard of learning needs of all learners (2, 8).

Any virtual course occurs in the virtual environment by corresponding signs and virtual objects that exist in virtual settings. Therefore, the virtual educational process requires virtual subject and object interaction such as virtual learners and teachers' relations (9).

Effective learning must be independent and self-directed, i.e., students interact with the material more in depth, and interaction between students and the subject should continue for a long time (10).

E-learning is one of the most well-known learning and teaching environments in the digital era. Types of e-learning methods include:

1. Self-learning: One of the most common learning methods in the digital world and can be learned using existing documentation.
2. Video and audio files: Files can be seen or heard online without the possibility of downloading.
3. Computer-based training and web-based training: Educational content on CD or file and program can be run and used on a computer. In Web-based, these files can be used on the Internet. In this method, there is no simultaneous interaction between the learner and the teacher.
4. Combined training or instructor-led learning: It is a combination of simultaneous and asynchronous methods
5. Mobile learning: The most accessible communication tool these days is mobile, education on this platform can be very useful and effective
6. Social learning: is the most effective type of learning that learners learn from each other in an interactive environment
7. Simulation
8. Game based training (11, 12).

The main characteristics of e-learning are: flexibility of teaching and learning, reduction of the total costs of education, covering more students, consistent and repeatable learning for multiple learners, faster interaction between student and teacher, increasing retention and learning speed, student-centered e-Learning environment,

and using audiovisual education or multimedia-based education as teaching tools (13).

Improving the quality of medical education has always been considered and has become more important than ever (12). Teachers and faculties play a pivotal role in the quality of education and can significantly affect students' learning. Therefore, an educational system that is not affected by the personal and emotional problems of teachers is required (10).

Recent decades have brought major advances in medical and dental sciences and new topics have been loaded to learn. The traditional model of classroom education cannot cover all new topics due to insufficient time. Therefore, the educational technique has progressively shifted to lecture-based teaching of theoretic subjects, which is not collaborating. Recent studies have suggested that traditional classroom education is boring due to prearranged time restrictions. However, in e-learning environment the contents are available at any time and learners can have access to all educational resources whenever they need to learn (10).

There is a growing tendency to replace traditional teaching with e-learning due to the advantages of e-learning including full digital accessibility, easy use, and the chance of repetition and playback the content (12).

Some studies have suggested that medical students prefer e-learning to traditional education because of its easy access and use, reproducibility, and high quality (10).

Oral medicine is a field of dentistry that acts as a liaison between dentistry and medicine. It mostly focuses on the diagnosis, prevention, and treatment of oral and maxillofacial diseases. The spectrum of diseases involves the face, jaws, and the hard and soft tissues of the oral and maxillofacial region. The lesions of these areas bear a great resemblance to each other, which makes their diagnosis complex and difficult. Oral lesions are generally classified as red-white lesions, pigmentations, exophytic, ulcerations, and malignancies. Diagnosis of oral lesions requires special expertise and training (14).

Since the schools of dentistry are emphasizing on the measures to ensure the protection of the students' health in the clinical setting during COVID-19 pandemic, the present study evaluated the effect of e-learning compared with face-to-face learning in diagnosing oral diseases among dental students.

## METHODS

The present quasi-experimental and practical study was conducted in 2020 at the Faculty of Dentistry, Ahvaz Jundishapur University of Medical Sciences, Department of Oral and Maxillofacial Medicine. A total of 54 dental students in the 11th semester participated in the study. Written informed consent was obtained from all participants.

The inclusion criteria were passing the practical diagnosis courses 1 and 2, and the exclusion criteria were that the students had not yet taken or passed the Diagnosis course 3. One of the important topics in the practical diagnostics course 3 is oral lesions (Ulcerations, red-white lesions, pigmentations, and soft tissue lesions).

The participants were randomly divided into two groups of A and B (n=27). The two groups were equal in terms of age, gender, and average grade point. Group A (n=27) received the traditional teaching method via traditional classroom face-to-face teaching and Group B (n=27) received the e-learning teaching method. E-learning was conducted using the e-learning system recommended by the Ministry of Health during the COVID-19 pandemic.

A total of 10 contents (multiple acute ulcers, acute and chronic single ulcers, recurrent ulcers, multiple chronic ulcers, white lesions, red lesions, smooth tissue lesions, soft tissue lesions with lumpy surface, single pigmented lesions, multiple pigmented lesions) were prepared in 40 min and uploaded for group B.

The duration of the classes for both groups was 11 weeks (10 weeks of subject training plus one explanatory week). In the e-learning group, the educational contents were available to the students as offline and they received the educational contents in the form of a voiced PowerPoint. The related links were also provided to students and it was possible for students to interact with each other and with the professor using chat, podcasts, discussion boards, and file sharing. Immediately, in the first week after the completion of the trainings, a test was taken to assess the immediate learning. The test contained a set of multiple-choice and descriptive items and case presentation questions. Students were asked to include their student card on the exam sheet in order to prevent bias arising from test scoring. The papers were evaluated by an oral and maxillofacial specialist who had no direct role in the training process.

After the first test, the contents were made available to all participants (traditional group and e-learning group). Access to the site was provided for all students, and to ensure access for all students, content was given to students on CD. They were informed about taking the exam in a month later. At the end of one month, the groups were tested again. Finally, the students' scores in both tests were analyzed.

### Data analysis

Data were analyzed using both descriptive and inferential statistics. Descriptive information (mean, standard deviation) was calculated separately for each group. The independent t-test and paired t-test were used to analyze the effect of the type of teaching method (traditional-electronic) on students' learning. Data were analyzed using SPSS Statistics for Windows, Version 26.0 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM).

## RESULTS

### *The effect of teaching method on students' learning*

The results of the t-test for two types of learning methods are presented in Table 1. There was a significant difference between the first and second test scores in both teaching methods. Students' scores were increased in the long run, so the passage of time can be considered as an effective factor in students' learning (Table 2).

The comparison of the two methods of learning in each test is presented in Table 3. The results showed that the mean scores were similar in both groups and there was no

significant difference between the two teaching methods in the first test, which is consistent with the results of Table 1. However, in the second test, a significant difference was observed between the two teaching methods, and the average test score of long-term learning in the traditional method receiving e-learning (blended education) was higher than the electronic method.

**Table 1. The mean  $\pm$  standard deviation (SD) of tests in traditional method and E-learning**

Group	Time	
	Test1	Test2
Traditional learning(A)	11.74 $\pm$ 2.24	15.86 $\pm$ 0.86
E-learning(B)	11.19 $\pm$ 1.46	14.77 $\pm$ 0.64

**Table 2. Comparison of test1 and test2 in each group of learning**

Group	t*	df	p-value
Traditional learning(A)	-9.464	23	<0.001
E-learning(B)	-10.728	23	<0.001

\*Paired T test

**Table 3. Comparison of the two methods of learning in each test**

Time	t*	Df	p-value
Test1	1.008	39.524	0.320
Test2	4.970	46	<0.001

\*Independent t-test

## DISCUSSION

Oral diseases pose a chief health problem for many countries. Dentists play the most important role in the diagnosis and treatment of oral diseases. Dentists can spot early warning signs in the mouth from asymptomatic to visible lesions. Misdiagnosis or delayed diagnosis of some oral and maxillofacial lesions can lead to serious disability and even death of the patient (14). Therefore, dental education should focus on the oral lesions course, especially for senior students. The type of learning method plays a major role in achieving the desired educational results. Some learning methods are obviously more robust than others. The present study evaluated the effect of e-learning compared with face-to-face learning in the diagnosis of oral diseases.

The results of the present study showed no significant difference between the mean test score of students in e-learning and traditional methods. However, after one month from the availability of content in both groups, the scores of both groups were improved which were significantly different from the scores of the pre-test. The reason can be

attributed to the availability of content, the possibility of daily repetition, and review of the content. Furthermore, in the post-test analysis, a significant difference was observed between the two teaching methods and the mean test score of long-term learning in the traditional method, which also received e-learning (blended education) was higher than the electronic method. This finding indicates the effectiveness of blended education compared to traditional education or e-learning alone.

Since no study has been addressed the oral disease course via e-learning education, the other studies that have been focused on other courses via e-learning and traditional learning have been compared with the present study.

Nourian et al. compared the effect of traditional and e-learning methods in dental public health course among dental students and concluded that the e-learning method successfully achieved its educational objectives and could be used as a substitute for the traditional methods in dental education (15).

Browne et al. compared the lecture and e-learning methods for new and experienced professionals in dentistry and concluded that face-to-face interaction was more effective for inexperienced staff, and e-learning due to technical issues including access speed and manageability was more effective for busy and more experienced staff (5).

Soltanimehr et al. compared the effect of virtual learning and traditional lecture-based method on the improvement of knowledge acquisition in the radiographic interpretation of bony lesions of the jaw. The results showed that virtual learning was more effective than the traditional lecture-based method on the enhancement of theoretical knowledge and reporting skills of dental students in the radiographic interpretation of bony lesions of the jaw. However, they suggested that virtual educational programs should be

revised to provide more opportunities for students to engage in reporting skills (10).

Amir et al. studied the student viewpoint of classroom and distance learning during the COVID-19 pandemic in the undergraduate dental study program. The results showed that dental students could adapt to the distance learning method and most of the students agreed with blended learning (learning that combines face-to-face teaching and online instruction) for future instruction (7).

Traditional or electronic education can support student learning; however, e-learning alone cannot compensate for traditional learning. Successful learning can be achieved through the combination of traditional learning and e-learning (blended model). E-learning can be used as a complementary method to face-to-face learning.

#### Ethical considerations

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. The ethics committee of Ahvaz Jundishapur University of Medical Sciences approved this research, ethics code IR.AJUMS.REC.1399.592.

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