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Effect of e-learning methods on Dental education: An observational study

Mohan Kumar P, Sruthima N. V. S Gottumukkala, K. S. V. Ramesh, T. Sreenivasa Bharath[1], Gautami S. Penmetsa, C. Naresh Kumar

Abstract:

BACKGROUND: The progress in the usage of technology in hardware, software, and cost-effective Internet connectivity enable the availability of science-related information and its usage in all the developing countries. Hence, in this practical world, there should be a need to implement effective and affordable dental education strategies to attain oral health for all in the coming years.

OBJECTIVE: The aim of this study is to reduce the need to teach theory-based, on-site classes, e-learning came into existence. E-learning for dental education may alleviate the burden of severe health worker shortages and deliver affordable access to high-quality dental education.

METHODOLOGY: Evaluation and assessment methods were done to know the effectiveness of e-learning in dental education by conducting continuing dental education on newer materials and methods, assignments/formative assessments and by open discussions of case descriptions and their treatment modalities through Edmodo app in our dental institute. Effect on knowledge, skills, attitudes, and satisfaction levels of dental students compared to other traditional methods.

RESULTS: Dental e-learning has the capacity to develop into a leading-edge to strengthen clinical training skills among dental students by conducting continuing dental education, assignments, formative assessments, case descriptions, and their treatment modalities through e-learning are the best ways to improve quantity and quality in dental education.

CONCLUSION: The probable prospective of e-learning could be innovative or revolutionary because this helps in both theoretical-related and clinical-related advancements, and it is possible only with e-learning in developing countries to meet the quality in education.

Keywords:

Assessment tool, dental education, Edmodo, e-learning

Introduction

Traditional learning methods are just teacher-centered, which transmits information or knowledge to the student but results in a lack of collaboration, communication skills, and analytical skills, which finally results in a lack of soft skills that are needed in every work environment.[1]

In today's world, as technology is changing continuously at a faster rate, it is important to dental professionals to cope up with this advanced technology by shifting the traditional education system to advanced e-learning techniques. Hence, there is a need for e-learning methodology of learning for all the professional students in order to acquire and retain knowledge and skills to face the global advancement in every profession.[1,2]

When there is integration between education and technology, it results in ease of communication between students and also the staff. E-learning system, along with the traditional methods, has equally become important because the new system of learning will provide to manage sharing of the material, conducting assignments and

Departments of Periodontics and [1]Oral Pathology, Vishnu Dental College, Bhimavaram, Andhra Pradesh, India

Address for correspondence:
Dr. Mohan Kumar P, Flat No: 204, Surya Teja Enclave, Rayalam Bypass Road, Bhimavaram, West Godavari District - 534 208, Andhra Pradesh, India
E-mail: mosups@gmail.com

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discussing special cases to attain correct diagnosis with all possible treatment modalities.[2,3]

E-Learning can be defined as the use of computer and internet technologies to deliver a broad array of solutions to enable learning and improve performance.

E-learning is mainly divided into knowing and integrating the components of it into professional organization, designing an e-learning course, creating interactive content, and evaluating the learning activities.[4]

Methodology

In general, the e-Learning technique or course is broadly divided into introducing the e-learning methodology, designing the course, preparing the interactive content, and managing or evaluating learning activities (Chart 1). These steps are adopted or designed according to the need in the dental education system to achieve better results.

In the first step of e-learning that is introducing the technique, include: knowing the different approaches, various components, and quality of e-learning. These stages are followed by forming a team who are familiar with the computer, Internet, and technology. Once the team is formed, different activities are planned, and content is prepared by the subject experts.

The second step is designing the e-learning course, and it should include identifying, analyzing, and organizing the content, followed by identifying the target audience or students. Before commencing this step, the subject experts should know what course or content should deliver through e-learning methodology so that there will be an improvement in students' knowledge and soft skills.

Once the content is uploaded, the e-learning team should define the instructional methods to be followed by the students and the subject experts should inform the importance of e-learning content and its significance in retaining the student knowledge forever. Furthermore, the participants are informed about the good practices while participating in the assignments/case discussions during online tests, which help in the true assessment of their knowledge.

The third step in e-learning is creating an interactive session by the subject experts and for examples, they develop practice and assessment tests, adding special case descriptions, uploading the standard treatment techniques videos, adding pictures of the instruments and materials used in the dental profession with an emphasis on retaining its identification and their specific usage in dentistry. It provides a platform for discussing the pros and cons of newer and advanced treatment procedures and also helps in planning a correct treatment plan by discussing with the subject experts.

The fourth and final step in e-learning methodology is managing and evaluating the activities provided in the uploaded content. It includes providing instructions to the participants, planning, and documenting the learning activities by the e-learning team, which facilitates reusing the content and discussing it with the expert committee.

Evaluation of the learning activities can be done using the courseware tool. Communication through the authoring tool and discussing among the students and with the subject experts play a vital role in attaining the goals of the e-learning system.

Study design for e-learning in the dental institute

In the dental institute, the importance of e-learning is explained to the target participants. The dental students were divided into three groups based on their performance in their internal examinations. They were divided into slow learners (<50% in examinations), moderate learners (pass class to <65%), and advanced learners (65%).

To improve both theoretical and clinical knowledge in all the groups and to create interest in slow and moderate learners, we designed the course accordingly and divided the content or data into three parts and uploaded it in three phases.

We focused on examination point of view and designed the content into spotter's identification (picture with description), case descriptions (which include clinical features and radiographic pictures), and uploading the standard treatment procedures, including instructional videos.

Results

A total of 170 students participated in the study. Based on the percentages achieved in internal examinations, 170 students were categorized into three groups as slow (46), moderate (56), and advanced (68) learners.

As said previously in the study design, the required data is uploaded in three phases and discussed about the same among the students and between the students and subject experts in each and every phase. After completing the three phases, student's feedback is taken on e-learning technology after the final university clinical examination.

The parameters used to check the outcome of the e-learning methodology in the dental institute were: (1.) Student attendance, (2.) students participation, (3.) Learning experience of students 4. Time spent on online content by the students and 5. Student's knowledge assessment.

The measures used to know the outcome in this study clearly explains the e-learning methodology was effectively followed by both the students and staff which ultimately helped in improving the knowledge of all kind of students taking from slow to advanced learners [Table 1].

Feedback is given by all the students to the following questions. When asked for, does this e-clinical training helped you to improve your knowledge? 58.7%, 58.9%, and 64.7% of slow, moderate, and advanced learners said that e-learning methodology helped very much to improve their knowledge [Table 2].

When they asked about in which areas of Periodontics Clinical point they had seen the improvement with this e-clinical training? 63% of slow learners, 71.4% of moderate learners, and 69.1% of advanced learners said that they have noticed an overall improvement in clinical due to e-learning technique and especially in identifying clinical features, diagnosis, and treatment planning [Table 3].

When e-learning methodology compared with traditional methods of learning: 34.8% said e-learning is better and 47.8% said e-learning is very much useful among slow learners [Table 4].

Most of the students reported that (69% of slow and moderate learners, 60% of advanced learners) e-learning methodology has overall improvement in theoretical and clinical training [Table 5].

e-learning methods improved the overall performance of students appearing university examinations by 97.8% in slow learners, 98.2% in moderate learners, and 97.1% among advanced learners [Table 6].

Discussion

In contrast to the traditional classroom learning methods, the e-learning learning approach follows with no face-to-face component with the learners and totally relies on the use of eLearning technology and methods for the delivery of learning.[2,4]

The e-learning activities can be categorized based on their level of integrity by Paulsen into: Many-to-many, one-to-many, one-to-one, and one-alone. Based on the type of delivery method e-learning approaches are divided into synchronous and asynchronous activities.[2]

There are only a few studies on e-learning for medical and dental education. Most of them are from Asia, South America, and Africa, and very few were seen in developing countries. In these studies, the authors used computers, mobiles, and social media for e-learning education systems.[2,3,5]

A systematic review by the World Health Organization by Al-Shorbaji *et al*., in 2015 examined global e-learning and blended learning methods and their effect on knowledge, skills, attitudes, and satisfaction in comparison to other methods.[5]

Table 1: Explains the parameters used and methods to assess the efficiency of e-learning technology

Parameters	Methods to assess the efficiency
Students attendance	100% attendance was observed in all the three steps of e-learning methodologies followed in this study
Students participation	All the students participated in all the assignments, activities and three steps of e-learning methodologies followed in this study
Learning experience	Students learning experience through this method is better compared to the traditional methods. This was assessed by using the feedback forms for every step in e-learning methodology
Time spent on online content by the students	Time spent by the students in e-learning methodology was more compared to the traditional methods. This was appreciated by their presence in all the activities both online and offline focusing on learning more actively. As the time spent is more in e-learning it is obvious that students are interested in learning through this methodology
Assessment of students knowledge	Students knowledge was assessed by using checklist after each activity, wherein we allotted scores according to the performance of the students

Table 2: Students feedback on e-learning methodology. Question: 1

Students categorized based on their scores in Examination	Does this e-clinical training helped you to improve your knowledge				Total, *n* (%)	χ^2
	Very much, *n* (%)	Better, *n* (%)	Some extent, *n* (%)	No change, *n* (%)		
Slow learners	27 (58.7)	16 (34.8)	3 (6.5)	0 (0.0)	46 (100.0)	0.944
Moderate learners	33 (58.9)	18 (32.1)	4 (7.1)	1 (1.8)	56 (100.0)	
Advanced learners	44 (64.7)	18 (26.5)	5 (7.4)	1 (1.5)	68 (100.0)	

Table 3: Feedback on e-learning. Question: 2

Students categorized based on their scores in Examination	In which areas of Periodontics clinical point of view, you saw the improvement with this e-clinical training				Total, *n* (%)	χ^2
	Diagnosis, *n* (%)	Instrument Identification, *n* (%)	ChairsideViva, *n* (%)	All, *n* (%)		
Slow learners	6 (13.0)	10 (21.7)	1 (2.2)	29 (63.0)	46 (100.0)	0.592
Moderate learners	4 (7.1)	11 (19.6)	1 (1.8)	40 (71.4)	56 (100.0)	
Advanced learners	10 (14.7)	8 (11.8)	3 (4.4)	47 (69.1)	68 (100.0)	

Table 4: Feedback on e-learning. Question: 3

Students categorized based on their scores in Examination	Do you find any improvement in preparation for clinical examination with Hybrid clinical training compared to Traditional methods				Total, *n* (%)	χ^2
	Very much, *n* (%)	Better, *n* (%)	Some extent, *n* (%)	No change, *n* (%)		
Slow learners	22 (47.8)	16 (34.8)	8 (17.4)	0 (0.0)	46 (100.0)	0.714
Moderate learners	23 (41.1)	23 (41.1)	9 (16.1)	1 (1.8)	56 (100.0)	
Advanced learners	24 (35.3)	34 (50.0)	9 (13.2)	1 (1.5)	68 (100.0)	

Table 5: Feedback on e-learning. Question: 4

Students categorized based on their scores in Examination	In which of the following aspects you find improvement with this e-training				Total, *n* (%)	χ^2
	Spotter Revision, *n* (%)	Theoretical Training, *n* (%)	Clinical Training, *n* (%)	All, *n* (%)		
Slow learners	10 (21.7)	2 (4.3)	2 (4.3)	32 (69.6)	46 (100.0)	0.476
Moderate learners	16 (28.6)	1 (1.8)	0 (0.0)	39 (69.6)	56 (100.0)	
Advanced learners	24 (35.3)	1 (1.5)	2 (2.9)	41 (60.3)	68 (100.0)	

Table 6: Feedback on e-learning. Question: 5

Students categorized based on their scores in Examination	Does this e-clinical training helped you to improve your knowledge		Total, *n* (%)	χ^2
	Yes, *n* (%)	No, *n* (%)		
Slow learners	45 (97.8)	1 (2.2)	46 (100.0)	0.911
Moderate learners	55 (98.2)	1 (1.8)	56 (100.0)	
Advanced learners	66 (97.1)	2 (2.9)	68 (100.0)	

The effectiveness of e-learning was evaluated and compared with other learning approaches, such as traditional teaching methods, among the students and teachers' by Frehywot *et al*., in 2013.[6]

A more recent systematic review by Nicoll *et al*. in 2018 used evaluation and assessment tools as well as frameworks of technology-enhanced learning approaches for continuing education of healthcare professionals.[7]

All the above studies lack advanced technical tools to evaluate and assess the e-learning education system. In most of the studies, the content was uploaded in the form of digital textbooks, lecture notes, PowerPoint presentations, keynotes, video content visualizing dental procedures, oral examinations, and links to relevant websites.

E-learning delivery method is by the use of mobile devices and computers, simple audiotape or a DVD to sophisticated multipoint video conferencing facilities in the educational institutes. To provide access to the learner who is geographically located far from the instructor, the e-learning delivery platform has changed to either proprietary eLearning software or open-source eLearning software.[8]

Facebook, Google, Wikipedia, WikiProject Medicine, and MOOCs have been recognized as potentially powerful tools in developing countries like the United Kingdom and still playing a key role in the development and support of world health education.[9]

One of the social learning tools called the Edmodo app founded by Nick Borg, Jeff O Hara, and Crystal Hutter in 2008 is widely used as an educational technology platform for communication, collaboration, and coaching for e-learners and teachers.[10]

With the help of the Edmodo app, we shared the subject content in the form of quizzes, assignments, pictures, videos, which helped the students to retain the knowledge because of the availability of the content and the availability of subject experts to communicate with the students when in doubt.[11,12]

Due to the adaptability, diversity, and economic benefit of e-learning technology, most of the studies concluded that e-learning methodology is effective and has the potential to increase knowledge and skills among students in professional educational institutions. It is also helpful in providing a 1 month elective posting on e-learning technology for final year exam going dental students to improve on the difficult topics and techniques in theoretical and clinical training in the dental institute.[11,12]

Limitations of e-learning methodology

1. Initially, the attitude and awareness of students to learn through online education was challenging
2. Education and motivation of all the teachers toward the online education system.

Suggested functions to overcome limitations

The shift from traditional teaching approach to e-learning methodology to combat with the global knowledge will be achieved by:

1. Conducting awareness programs and providing elective postings for all the students right from the beginning of the course
2. Conducting faculty development programs for the teachers to learn innovative skills in e-learning methodology.

Conclusion

Designing the e-learning methodology in dental education system by using education technology social learning app provided by the organizations improved the overall knowledge and retention capacity of the examination going students and also helped in keeping the up-to-date knowledge on dental health-related updates.

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Conflicts of interest

There are no conflicts of interest.

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