

Implementation of an E-Learning System in Dental Education: Intermediate Result

Ilana Gor, I. M. Sechenov First Moscow State Medical University (Sechenov University), Russia

Edita Margaryan, I. M. Sechenov First Moscow State Medical University (Sechenov University), Russia

Zoya Snezhko, I. M. Sechenov First Moscow State Medical University (Sechenov University), Russia

Olesya Dudnik, I. M. Sechenov First Moscow State Medical University (Sechenov University), Russia

ABSTRACT

The purpose of the study is to consider the features of the implementation of an e-learning system at the Institute of Dentistry named after E.V. Borovsky at First Moscow State Medical University (Sechenov University). In order to assess the intermediate effectiveness of the introduction of an e-learning system, an anonymous survey of two independent groups of respondents was conducted. The results of the study of the e-learning system and the intermediate assessment of its effectiveness have confirmed the success of its implementation. Most respondents who acted as experts in the anonymous survey highly assessed the training system. Based on the statistical analysis, the reliability of the assessment of the intermediate effectiveness of the introduction of an e-learning system in dental education was determined. It can be concluded that the values differ in the two groups of respondents.

KEYWORDS

Dental Education, E-Learning, Effectiveness, Integration, Portal

INTRODUCTION

Education systems around the world are undergoing major changes. New training courses and educational programs that are being developed based on e-learning and Internet technologies are aimed at increasing knowledge and the effectiveness of training. However, the challenge is to find the best solution to effectively implement e-learning in educational institutions, and ensure its positive impact on students and teachers (Shenoy & Kuriakose, 2016).

The use of e-learning technologies to improve educational opportunities is rapidly increasing; this requires their integration into the higher education system (Harahap et al., 2019). The major e-learning aspect is the use of information and communication technologies; they offer a variety of tools for online learning and allow students to collaborate through online forums, blogs, and interactive learning websites. E-learning has many benefits, including accessibility, decision support, and the possibility to personalize curriculum and assessment processes to make them more student-centered (Schönwetter et al., 2010).

Digitalization has had a major impact on the development of dental education, including not only such aspects as e-learning and knowledge transfer via the Internet, but also areas related to diagnostics involving the use of three-dimensional imaging and digital radiography, as well as

DOI: 10.4018/IJWLTT.286744

This article published as an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and production in any medium, provided the author of the original work and original publication source are properly credited.

dentistry workshops. Simulation of motor skills, including IOS with 3D printing, prototyping and digital surface mapping, is used in training. Digital applications can provide additional opportunities for assessing and improving dental education by implementing evidence-based surveys related to the penetration and perception of digital education (Zitzmann et al., 2020).

Theoretical And Conceptual Framework Of E-Learning Systems In Dentistry

In recent years, the issue of training specialists in innovative areas of medicine has become particularly relevant and acute. Medical universities and the system of higher dental education should quickly respond to the increasing requirements for knowledge and competencies, as well as offer educational programs of a new format aimed at effective training of modern medical staff taking into account the best domestic and foreign experience in the development of e-learning (Mandra et al., 2019).

The teaching methodology in dental education is changing rapidly; it integrates the latest information technologies (IT) as part of the overall electronic transformation of learning (Baig et al., 2019). The need to improve traditional methods of study taking into account the changes associated with the digitalization of all spheres of education, which is observed in the 21st century, is becoming increasingly important. Lectures, workshops and study groups can be improved through online learning (Reynolds, 2012).

Among the new requirements for the system of innovative education, the need to consider student individuality is prioritized. The use of e-learning technologies allows students to become highly educated intellectual people who are able to flexibly adapt their professional activities in accordance with the requirements and standards of rapidly developing dentistry science (Kuznyak & Gagen, 2017).

Effective learning in the e-learning environment is primarily based on building feedback with students through the use of digital technologies. The development of professional skills and competencies is of great importance here.

The professional skills required in dentistry are acquired during undergraduate studies. The acquisition of knowledge that students need to become competent clinical practitioners occurs in the process of the use of additional e-learning opportunities involving computer-based simulation modules (Seki et al., 2020).

E-learning is an effective complement to clinical experience and lectures. In addition, it allows students to select the location and time of access while some types of resources may be very suitable for the needs of students in terms of learning styles (Bernstein et al., 2020).

E-learning increases educational opportunities for students and dramatically improves the efficiency and effectiveness of teachers. The implementation of e-learning requires institutional readiness to ensure the compliance of new tools with the educational and economic context (Iqbal et al., 2016).

To address the multiple challenges of the efficiency improvement in medical education, e-learning is being integrated into traditional learning based on the 'blended learning' concept that combines digital learning with traditional teaching methods (Bhardwaj et al., 2015). Blended learning is an approach that combines traditional face-to-face learning and e-learning; it has been designed to meet the needs of students with different learning styles. The innovative learning approach allows students to study in an interactive and collaborative environment and motivates them to actively participate in the educational process (Bourzgui et al., 2020).

Interaction and repetitions are the cornerstones of learning any skill. Traditional learning is characterized by deeper human involvement; thus, the possibility of repetition is reduced in order to respect the patient's autonomy and prevent patient and student stress. E-learning includes technologies and simulations that can be repeated any number of times in the same or in a modified scenario in order to increase the level of learning (Dhir et al., 2017).

Performance Assessment Of E-Learning Systems In Dentistry

Effective training is the most important factor in the assimilation of knowledge by students. At the same time, training must become personalized in order to be effective (Soltanimehr et al., 2019).

Advances in e-learning technologies are laying the basis for changes in education; they personalize learning, improve the day-to-day interaction of learners and transform teachers into instructors. In the e-learning environment, adaptive learning can be implemented by identifying the learner, personalizing content, and customizing tracking, monitoring, support and evaluation. Adaptive learning provides a great student-centered experience as it personalizes a unique learning path of each student, who can choose their specific needs and take into account learning trends (Eslamian et al., 2019).

The e-learning effectiveness can be measured based on user experience in terms of their desire to continue e-learning. Thus, an e-learning developer can consider a number of success factors for video design, video content, user support, and user benefits. Video design can include an animated video combined with a narrator voice over and music. Video content can be designed to provide clear step-by-step information, an explanation of each screen change, relevant content, a menu to collect information in a complete and timely manner, and an easy navigation. Support involves a fast response, as well as lecturer and support team guidance when dealing with any issues, and improves e-learning (Natalia, 2020).

Internationally, there are several approaches to the assessment of the effectiveness of the e-learning system implementation. These are expert analysis, surveys and other approaches.

The phased creation of an e-learning system and the assessment of its effectiveness at the Faculty of Dentistry of the University of Alexandria is of interest. It involved renting a server to host on Moodle, an online learning management system, securing a domain name to designate Egyptian academic affiliation (Faculty of Dentistry of the University of Alexandria, 2021), installing Moodle and setting up its functions to include a logo, and creating a Google-powered email address for educators to provide authorized access to Moodle resources and assessment activities (El Tantawi et al., 2015).

Many challenges posed by the rapid development of e-learning in medical education can be overcome through curriculum unification, government support, optimum implementation of electronic resources in the educational process, flexible use of traditional and e-learning methods, improvement of the digital literacy of students and teachers, as well as proper methodological support. It is also important to place emphasis upon the improvement of the teacher salary system in order to stimulate their interest in the development of e-learning technologies in medical education (Eckert et al., 2016).

Foreign and Russian experience in the development of e-learning in the medical education is of both scientific and practical interest in terms of its effective implementation.

The overwhelming majority of studies devoted to assessing the effectiveness of the use of e-learning in dentistry use various scaled forms of assessment and assessment based on objective learning outcomes (knowledge tests, exams and practical application of knowledge) (El Tantawi et al., 2015; Eslamian et al., 2019; Harahap et al., 2019; Iqbal et al., 2016). In our study, a rarely used peer review method is used to assess the expected effectiveness of an e-learning method at an early stage of its implementation. At subsequent stages, it becomes possible to make more subtle assessments based on scaled methods, but preliminary expert assessment makes it possible to make corrections and improve learning in the early stages of the implementation process (Zitzmann et al., 2020). This should significantly increase the overall effectiveness of the application of e-learning in medicine in general and dentistry in particular.

The main question of this study is to assess how the expert assessment of the implemented e-learning model can be adequately assessed using expert judgment. The variability of expert assessment of teaching methods at the [BLINDED] University by a group of experts working at the [BLINDED] University may differ significantly from the assessments of a group of experts from the outside. In order to study the features of the development of the e-learning system in Russia, the experience of its implementation at [BLINDED] University was studied and the assessment of intermediate result was performed. The following research objectives have been set:

- to examine the development status of e-learning at the university;
- to study the features of the implementation of the e-learning system at the Institute of Dentistry;
- to assess the intermediate result of the use of the e-learning system at the Institute of Dentistry.

The introduction section of the study examines current problems of dental training and the possibilities for its improvement through e-learning. The introduction section is followed by the literature review of the theoretical issues of the development of e-learning in dentistry. Next, the approaches to assessing the effectiveness of e-learning systems in dentistry are described. At the end of the section, the purpose and objectives of the study, as well as its structure are given. The research methodology section gives an idea of the research design, data collection methods and the procedure for their analysis. After that, the results of the study followed by the discussion and conclusion are highlighted.

The results obtained in these scientific studies can be used to promote ideas for the development of e-learning in other higher educational institutions in order to improve the system for assessing the effectiveness of its implementation. The practical significance of the research results involves the discussion of a number of issues and problematic aspects of the development of domestic e-learning in dentistry, which will also contribute to broader international cooperation and exchange of experience.

METHODS AND MATERIALS

Research Design

The study relied on the Case Study Research (CSR) method based on the study of the development of e-learning at the [BLINDED]. An empirical research approach was used to study the development of e-learning as a modern phenomenon in the context of its real history and evolution through the example of the Institute of Dentistry based on the generally accepted methodology (Woodside, 2010). A two-sample t-test for comparing the mean values obtained as a result of the expert assessment was conducted based on the methodology (Hanneman et al., 2013; Mukherjee et al., 2018). Two groups of respondents who acted as experts were interviewed remotely by phone. The first group of the employees of the Institute of Dentistry who have at least 5 years of work experience and teaching experience was asked to call and express their opinion on the effectiveness of the introduction of the e-learning system at the Institute of Dentistry. At the next stage, a survey of the second group, which included respondents who are not employees of the Institute of Dentistry, was conducted remotely by phone. The participants of the second group are professional dentists with at least 5 years of work experience and teaching experience, prior to the interview, were invited and deeply and practically familiar with the online learning system presented at the Institute of Dentistry. Thus, they were able to give a comprehensive deep expert assessment. Thus, the data from two independent groups of respondents were obtained. To assess the reliability, a two-sample t-test was used to check the equality of the mean values according to the Student's test.

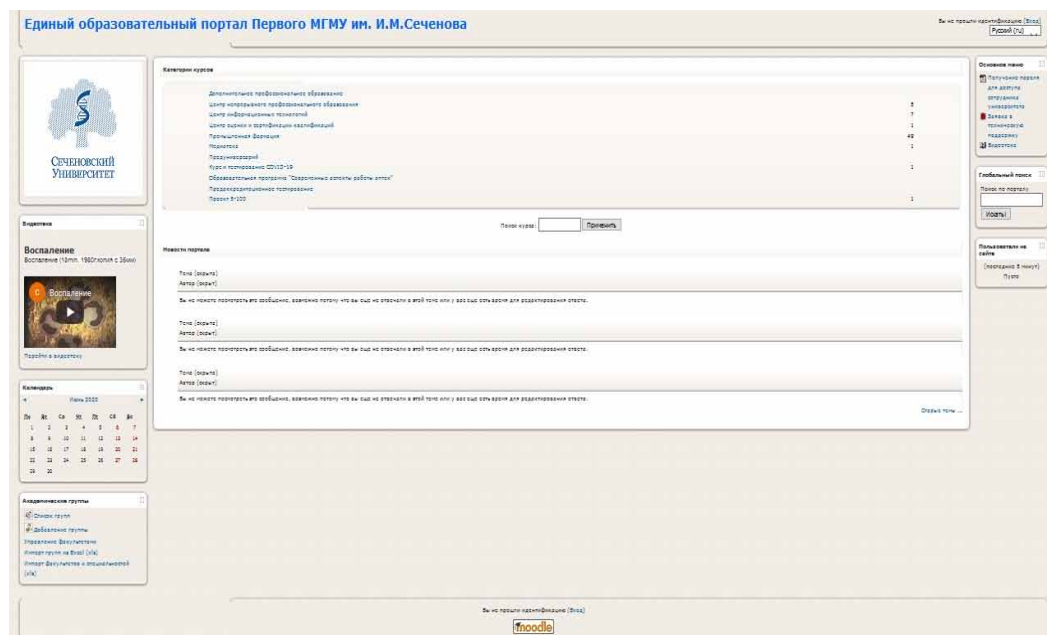
Sample

In total, 24 respondents were interviewed. There were two independent groups of respondents (two samples involving 12 people each). The requirements for the representativeness of the sample are not applied in this case, since this is an expert sample that assumes a qualitative rather than quantitative assessment. The interviews followed the ethical principles, according to which the data obtained were used exclusively for scientific purposes.

Statistical analysis

The data were analyzed in Excel with the help of the Analysis Toolpack add-in.

Figure 1. Unified educational portal of the e-learning and Moodle educational content management system of the [BLINDED] University



Research limitations

The research relied on the experience of the introduction of an e-learning system through the example of [BLINDED] University. The relatively short period of the e-learning system application at the Institute of Dentistry did not allow a more in-depth study of the issue.

Results

The COVID-19 pandemic and the limitations have accelerated the development of e-learning systems in a number of countries, including in Russia, which also opens up new opportunities in the field of medical education. Modern global trends towards the digitalization of education, as well as the dynamics of the development of electronic medical education, have determined the need to create an appropriate infrastructural and institutional framework for the development of this area in domestic education.

Today, there is a trend towards digitalization in many areas, including medicine. Therefore, the education system in medical education is being transformed. In fact, the needs and resource capabilities of healthcare are being synthesized with prospective lines of the development of telemedicine, electronic and digital medicine, as well as tools to support e-learning in the leading medical universities of the country.

One of the leading educational institutions in terms of the implementation of the e-learning system in the field of medical education in the Russian Federation is [BLINDED] University. Since 2011, the university has launched a systematic introduction of e-learning involving the use of distance learning technologies at all faculties of the university. It is based on the Unified Educational Portal. This is an intellectually-oriented Internet portal developed on the basis of the e-learning and educational content management system based on the Moodle platform to create a unified information and educational environment of the university (Figure 1).

Source: Unified educational portal of the [BLINDED] University (2021)

In 2019, the Institute of Medical Electronic Education and the Institute of Digital Medicine were opened at Sechenov University. Several departments of the university are subordinated to the Institute and united into a single system of electronic and simulation training; they develop a unique methodology for the creation, testing and promotion of electronic content, which expands the accessibility of high-quality education.

The activities of the Institute of Electronic Medical Education are based on the development of a strategy for the introduction of modern e-learning technologies and an independent knowledge assessment system, the creation of a domestic accreditation system for medical specialists, the integration of distance educational programs into the system of continuous medical education.

The tasks of the Institute of Digital Medicine are the development, implementation, and maintenance of digital technologies in direct care processes of the university and the practical health care of the country, the creation of a digital ecosystem at the university, and teaching these processes to students.

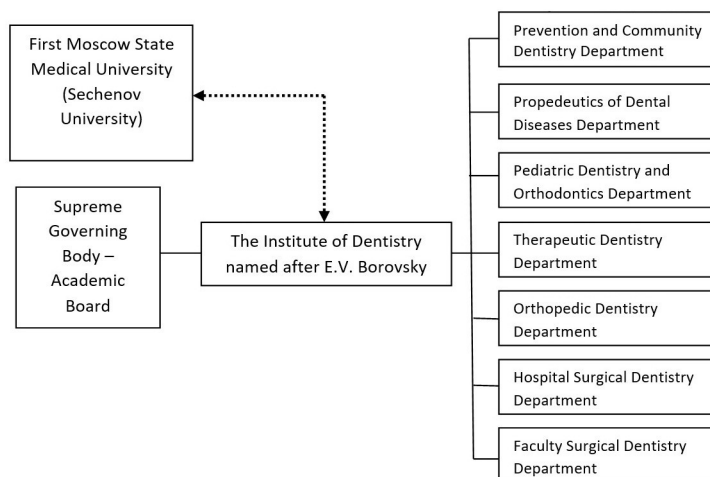
The University is implementing an educational project within the framework of a grant allocated by the Ministry of Science and Higher Education of the Russian Federation to create an institutional framework of the Digital University for the Human Resources for the Digital Economy of the Russian Federation Federal Project. At the end of 2019, it was included in the list of five Russian universities that received a grant for this purpose in a competitive selection process organized by the Ministry of Science and Higher Education. The goal of digital transformation is to create a digital ecosystem to train healthcare professionals who can work in the current digital healthcare environment.

One of the key models of the digital university is the development of information systems in educational activities, which includes a data-based management system, e-learning technologies, individual educational trajectories, and digital economy competencies. This will allow the leading medical university of the state as a provider of high-tech medical services to become a leader in the digital transformation of medical education in Russia, as well as to replicate this experience throughout the country. Since 2014, computerized centralized testing has been operating in the knowledge assessment system; it has replaced the traditional exam and test procedure. An innovative direction of the educational process digitalization is the creation of an information environment that encourages students' independent work and provides access to telemedicine conferences and web-seminars. Progress monitoring in the educational process based on e-learning and (or) distance learning technologies is carried out in accordance with the electronic resources used in line with the class schedule.

Upon the initiative and at the premises of the [BLINDED] University the Association for the Development of Electronic Medical Education was created; it united seven medical universities in Russia: Sechenov University, Kuban, Saratov, Pacific, Bashkir, Siberian, and St. Petersburg State Medical Universities. The Association for the Development of Electronic Medical Education was created at the Institute of Electronic Medical Education (EMEI) of Sechenov University, which was opened in March 2018 as part of the implementation of the 5-100 project roadmap. EMEI is involved in the creation, testing, and promotion of electronic content in various formats, which expand the accessibility of high-quality education. One of the key goals of the institute is the development and promotion of its own unified electronic educational platform to subsequently implement it in other medical universities in order to create a unified electronic environment in the field of medical education. The introduction of an e-learning system at the Institute of Dentistry, which is focused on training dentists (14.01.14 Dentistry), is of considerable interest for research. There are approximately 2000 Russian and foreign students; the university has 40 departments and 7 of them are specialized. These include therapeutic dentistry, orthopedic dentistry, pediatric dentistry and orthodontics, faculty surgical dentistry, hospital surgical dentistry, propedeutics of dental diseases, prevention and community dentistry (Figure 2).

Source: Own development

Figure 2. The structure of dental education at the [BLINDED] University



At the specialized departments, postgraduate training is also carried out, including clinical residency: “Therapeutic dentistry”, “Orthopedic dentistry”, “Pediatric dentistry and Orthodontics”, “Surgical dentistry”, “Maxillofacial surgery”.

Recently the relevance and importance of the introduction of an e-learning system have been confirmed; in order to prevent the spread of coronavirus infection, Sechenov University has switched to distance learning in accordance with the order of the rector of March 14, 2020. Distance learning technologies have made it possible to ensure effective interaction between students and teachers in order to reduce the risks associated with direct contacts during this period. At the same time, students have complete access to knowledge. This became possible due to the formation of a digital ecosystem at the university. All educational materials, video lectures, tests and self-check questions are published on the Unified Educational Portal of the University. Centralized testing is carried out via remote access, the exams are scheduled based on student preferences.

Figure 3. Question: Is the introduction of an e-learning system effective or requires further improvement? (yes / no = needs improvement)

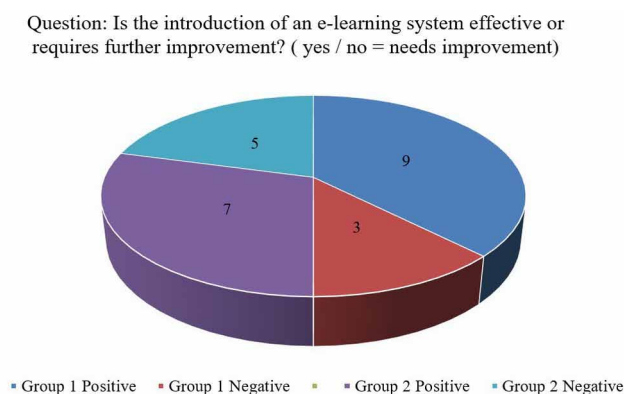


Table 1. Question: What is the average score for the effectiveness of the introduction of an e-learning system? (1 – minimum score, 10 – maximum score)

	group 1 (N=12 respondents)	group 2 (N=12 respondents)
1	10	8
2	10	9
3	6	7
4	10	5
5	10	5
6	6	4
7	10	9
8	10	5
9	10	9
10	10	10
11	7	3
12	9	10
Average	9	7

In order to assess the intermediate effectiveness of the introduction of the e-learning system at the Institute of Dentistry, an anonymous survey of 2 groups of respondents, who acted as independent experts, was conducted (Figure 3 and Table 1-3).

Most respondents agreed that the introduction of the e-learning system is effective. In the first group of respondents, there were 9 people who noted the effectiveness of the e-learning system implementation and 3 people who believed that it should be improved. In the second group, there were 7 positive and 5 negative answers.

In order to find out whether there is a difference between the average score for the effectiveness of the introduction of an e-learning system given by two different groups of experts, it is necessary to confirm or refute hypothesis H_0 . In this case, the assumption that these samples have the same or different variance should be checked based on the Fisher's test. Thus, hypothesis H_0 : the variances of the samples are equal / the variances are not equal. The calculation of the F-test two-sample for variances is carried out with the help of the Analysis Toolpack add-in in Excel (Table 2).

Table 2. Calculation of the F-test two-sample for variances

	group 1 (N=12 respondents)	group 2 (N=12 respondents)
Average	9	7
Variance	2.727272727	6.181818182
Observations	12	12
df	11	11
F	0.441176471	
P(F<=f) one-tail	0.095243081	
F critical one-tail	0.35487036	

Table 3. Calculation of the two-sample t-test to check the equality of the means of the effectiveness score.

	group 1 (N=12 respondents)	group 2 (N=12 respondents)
Average	9	7
Variance	2.727272727	6.181818182
Observations	12	12
Hypothesized difference	0	
df	19	
t-statistics	2.32115383	
P(T<=t) one-tail	0.015776186	
t critical one-tail	1.729132812	
P(T<=t) two-tail	0.031552372	
t critical two-tail	2.093024054	

Based on the fact that $F = 0.441176471$ exceeds the critical F value of 0.35487036 , the hypothesis H_0 is refuted (the variances of the samples are not equal). It follows that a two-sample t -test with different variances should be applied.

Next, a new hypothesis H_0 is tested: the average scores in the two groups of experts are equal/not equal. The Analysis Toolpack add-in and the F-Test Two-Sample for Variances analysis tool are used. The result obtained is described in Table 3.

The calculation of t should be based on its two-tail critical value. T -statistics = 1.30 and the value of t critical = 2.20; thus, the hypothesis H_0 is refuted. It can be concluded that the average values of the effectiveness assessment in the two groups differ. Thus, the reliability of the assessment of the intermediate effectiveness of the introduction of an e-learning system at the Institute of Dentistry obtained by the expert method can be confirmed.

Discussion

The approaches described in the study are mainly in line with those obtained by other researchers. For example, it should be agreed that modern technologies in dentistry require a change in the approaches to training and the development of blended methods involving the use of an e-learning system.

One of the major skills of a dentist is the ability to restore the damaged tooth structure. The skills required to master this ability are based on the development of knowledge about the concepts of operative intervention and the ability to perform it. Teachers can provide guidance on cavity preparation concepts and demonstrate these techniques in large group sessions. However, the achievement component requires students to practise the preparation themselves repeatedly. In recent decades, dental educators have realized that clinical environment cannot be the only learning tool; therefore, e-learning technologies need to be developed. The reasons for this change in the learning paradigm stem from the fact that technical skills, which are becoming more complex due to the advances in knowledge, materials and technology, require the introduction of new educational approaches based on the concept of e-learning (Hollis et al., 2011).

The era of online learning reveals the individual potential of the student by increasing the mobility of teaching and accessibility of learning. Dental educators are faced with the problem of choice: to develop to harness the power of online learning or get stuck at the same level (Schönwetter et al., 2010).

Typical characteristics of the 21-st century students lead to breaks with educators because teachers often feel that Generation Z is devoting too much time to technologies that are not considered to be beneficial for their learning progress while Gen Z learners need technological tools. In fact, Gen Z

students use technology in all spheres of life, including in learning and communication, while many teachers feel uncomfortable allowing students to independently learn based on the use of technology, in particular due to the lack of knowledge. The gap between educators, expectations and student use of technology in the classroom creates incompatibilities between teachers and students while their collaboration is required to ensure the success of the teaching and learning process (Sunarto et al., 2019).

A study conducted at Griffith University School of Medicine found that dental students who tried online integrated learning modules along with traditional methods of study performed better in the General Pathology course and found the course more rewarding and interesting than those who studied based on traditional methods. This difference could be associated with better accessibility, access to self-assessment, higher student engagement, and ease of getting support from the faculty, which were available in online learning modules. The electronic self-study tool consisted of online practice and lecture notes on topics covered by the General Pathology course. This tool included a link to the Blackboard online learning management system for the embedded websites of Griffith University School (Ariana et al., 2016).

The experience of Alexandria Faculty of Dentistry in the implementation of e-learning based on Moodle has shown potential. A very small percentage of respondents reported that e-learning is useless. Moodle facilitates and speeds up some activities; for example, it ensures the availability of learning resources and allows task submission. There are also actions that cannot be performed without Moodle or a Learning Management System, especially in the case of a large number of students, such as access to questions and formative feedback, access to external resources, and review of faculty or course related announcements. Despite the fact that most students were interested in the access to learning resources, they discouraged the replacement of lectures with these resources. The data provided by the system and the course statistics can assist in customizing the system parameters according to the needs and preferences of users. With a large student population, e-learning based on Learning Management Systems, especially open-source ones, such as Moodle, can offer real benefits to higher education institutions at a lower cost. Raising awareness of the faculty about e-learning and Moodle capabilities, student experience and expectations, can help educational institutions respond to student needs. Teacher training, technical support and incentives will help educational institutions popularize e-learning among educators (El Tantawi & Mourady, 2012).

Online learning is a useful tool that complements teaching but not replaces traditional methods of study. It is necessary to consider both subjective and objective criteria for assessing the effectiveness of e-learning outcomes taking into account other factors that should be addressed for the implementation of a successful e-learning model (Asiry, 2017).

E-learning is as effective as traditional classroom methods of study in terms of student performance and clinical procedures in oral radiology. This indicates a positive attitude of students towards e-learning, but also shows that the combination of e-learning with traditional methodologies is more beneficial than e-learning itself (Santos et al., 2016). At the same time, the impact of e-learning on practical skills has not been properly studied. There is a lack of data, especially in the disciplines that require practical studies (Schorn-Borgmann et al., 2015).

Student webinars organized at the King Khalid University College of Dentistry (KKUCOD) Abha, Saudi Arabia received positive feedback from the faculty but had a much poorer student response. The positive feedback from the audience was related to the fact that the webinars were more cost effective compared to regular lectures. Flexibility in time, place and access to learning, especially for people with disabilities, improved digital literacy of the teacher, and diverse and enriching experience are the benefits webinars can provide (Alshahrani, 2019).

Research on Google Docs sharing conducted at Midwestern University College of Dental Medicine-Arizona has confirmed the possibility to more broadly and effectively use e-learning technologies in dental education (Roberts et al., 2019). The virtual method based on e-learning has proven to be more effective compared to the traditional method of learning X-ray interpretation of

jawbone lesions. However, this advantage was mainly related to the theoretical aspect of the topic. Taking into account the superiority of the virtual method of teaching theory and its effectiveness compared to the traditional method of teaching clinical skills, it can be argued that virtual education can be an effective alternative to traditional classroom learning when discussing X-ray interpretation of jaw bone lesions (Soltanimehr et al., 2019).

Conclusions

The results of the study of the e-learning system at the Institute of Dentistry of the [BLINDED] University and the intermediate assessment of its effectiveness have confirmed the success of its implementation. Most respondents who acted as experts in the anonymous survey highly assessed the training system (9 and 7, respectively); there were a total of 12 respondents in each group. Based on the statistical analysis, the reliability of the assessment of the intermediate effectiveness of the introduction of an e-learning system in dental education was determined. Based on the data obtained and the analysis of the two-sample t-test aimed at checking the equality of the means of the effectiveness score, it can be concluded that the values differ in the two groups of respondents. Differences in the assessments of a group of experts employed at the University and outside of it require further factorial research.

The research results can be integrated into the international practice of university exchange of experience in the implementation of e-learning in dentistry. Further studies suggest clarifying the expert assessment regarding e-learning at the studied university using scaled and objectively oriented assessment methods to improve the methodology of early expert assessment.

Recommendations

The findings of the study allow us to recommend using at the early stages of the implementation of e-learning in dentistry and other medical specialties to carry out an expert assessment of the implemented learning systems with the participation of expert groups from the evaluated university and outside it. Based on this double assessment, it is generally possible to quickly assess whether a given training system is worth continuing or needs immediate change.

REFERENCES

- Alshahrani, I. (2019). Orienting faculty and students with online teaching webinar experiences in Saudi Arabia. *Annals of Medical and Health Sciences Research*, 9, 443–447.
- Ariana, A., Amin, M., Pakneshan, S., Dolan-Evans, E., & Lam, A. K. (2016). Integration of traditional and e-learning methods to improve learning outcomes for dental students in histopathology. *Journal of Dental Education*, 80(9), 1140–1148. doi:10.1002/j.0022-0337.2016.80.9.tb06196.x PMID:27587581
- Asiry, M. A. (2017). Dental students' perceptions of an online learning. *The Saudi Dental Journal*, 29(4), 167–170. doi:10.1016/j.sdentj.2017.03.005 PMID:29033527
- Baig, Q. A., Zaidi, S. J., & Alam, B. F. (2019). Perceptions of dental faculty and students of E-learning and its application in a public sector Dental College in Karachi, Pakistan. *JPMA. The Journal of the Pakistan Medical Association*, 69(9), 1319–1324. PMID:31511718
- Bernstein, R., Willsher, H., & Harris, T. (2020). Dental students' perceptions of their use of e-learning to enhance training in oral surgery. *BDJ Student*, 27(1), 18–22. doi:10.1038/s41406-019-0097-y
- Bhardwaj, A., Nagandla, K., Swe, K. M. M., & Abas, A. B. L. (2015). Academic staff perspectives towards adoption of e-learning at melaka manipal medical college: Has e-learning redefined our teaching model? *Kathmandu University Medical Journal*, 13(1), 12–18. doi:10.3126/kumj.v13i1.13746 PMID:26620743
- Bourzgui, F., Alami, S., & Diouny, S. (2020). A comparative study of online and face-to-face learning in dental education. *EC Dental Science*, 19(3), 1–11.
- Dhir, S. K., Verma, D., Batta, M., & Mishra, D. (2017). E-learning in medical education in India. *Indian Pediatrics*, 54(10), 871–877. doi:10.1007/s13312-017-1152-9 PMID:29120336
- Eckert, N. V., Allamyarova, N. V., & Garaeva, A. S. (2016). Problems related to the development of the Russian legal framework and legal regulation in the field of distance learning technologies in the system of higher medical education. *Social Aspects of Population Health*, 1, 1-16. 10.21045/2071-5021-2016-47-1-10
- El Tantawi, M. M., Abdelsalam, M. M., Mourady, A. M., & Elrifae, I. M. (2015). e-assessment in a limited-resources dental school using an open-source learning management system BDS. *Journal of Dental Education*, 79(5), 571–583. doi:10.1002/j.0022-0337.2015.79.5.tb05917.x PMID:25941151
- El Tantawi, M. M., & Mourady, A. (2012). Using Moodle as an e-learning solution in dental education. - A one year experience. In *European, Mediterranean & Middle Eastern Conference on Information Systems 2012 (EMCIS2012) June 7-8, Munich, Germany* (pp. 695-711). Academic Press.
- Eslamian, A., Rajabion, L., Tofighi, B., & Khalili, A. H. (2019). A new model for assessing the impact of new IT-based services on students' productivity. *International Journal of Education and Development Using Information and Communication Technology*, 15(3), 4–21.
- Faculty of Dentistry of the University of Alexandria. (2021). *Official web site*. Retrieved from <https://dent.alexu.edu.eg/index.php/en/>
- Hanneman, R. A., Kposova, A. J., & Riddle, M. (2013). *Research methods for the social sciences: Basic statistics for social research*. Jossey-Bass A Wiley Imprint.
- Harahap, F., Nasution, N. E. A., & Manurung, B. (2019). The effect of blended learning on student's learning achievement and science process skills in plant tissue culture course. *International Journal of Instruction*, 12(1), 521–538. doi:10.29333/iji.2019.12134a

- Hollis, W., Darnell, L. A., & Hottel, T. L. (2011). Computer assisted learning: A new paradigm in dental education. *The Journal of the Tennessee Dental Association*, 91(4), 14–18. PMID:22256700
- Iqbal, S., Shafiq, A., & Iqbal, N. (2016). Perceptions of undergraduate dental students towards e-learning in Lahore Medical and Dental College. *Pakistan Journal of Medical & Health Sciences*, 10(4), 1191–1193.
- Kuznyak, N. B., & Gagen, E. Y. (2017). Modern distance learning. Advantages and disadvantages. *Young Scientist*, 11(145), 466–469.
- Mandra, Y. V., Shkinder, N. L., & Zholudev, S. E. (2019). Dentistry of the future: Innovative educational programs. *Bulletin of the Ural State Medical University*, 2, 22–27.
- Mukherjee, S. P., Sinha, B. K., & Chattopadhyay, A. K. (2018). *Statistical methods in social science research*. Springer. doi:10.1007/978-981-13-2146-7
- Natalia, I. (2020). Accounting students' perceptions of electronic learning in industrial revolution 4.0. In *Advances in Economics, Business and Management Research*, volume 115, 17th International Symposium on Management (INSYMA 2020) (pp. 41–46). Academic Press.
- Reynolds, P. (2012). UDETE (Universal Dental E-Learning) a golden opportunity for dental education. *Bulletin du Groupement International pour la Recherche Scientifique en Stomatologie & Odontologie*, 50(3), 11–19. PMID:22709612
- Roberts, B., Roberts, E., Reynolds, S., & Stein, A. (2019). Dental students' use of student-managed google docs and other technologies in collaborative learning. *Journal of Dental Education*, 83(4), 437–444. doi:10.21815/JDE.019.053 PMID:30745349
- Santos, G. N. M., Leite, A. F., de Figueiredo, P. T. S., Pimentel, N. M., Flores-Mir, C., de Melo, N. S., Guerra, E. N. S., & De Luca Canto, G. (2016). Effectiveness of e-learning in oral radiology education: A systematic review. *Journal of Dental Education*, 80(9), 1126–1139. doi:10.1002/j.0022-0337.2016.80.9.tb06195.x PMID:27587580
- Schönwetter, D. J., Reynolds, P. A., Eaton, K. A., & De Vries, J. (2010). Online learning in dentistry: An overview of the future direction for dental education. *Journal of Oral Rehabilitation*, 37(12), 927–940. doi:10.1111/j.1365-2842.2010.02122.x PMID:20726942
- Schorn-Borgmann, S., Lippold, C., Wiechmann, D., & Stamm, T. (2015). The effect of e-learning on the quality of orthodontic appliances. *Advances in Medical Education and Practice*, 6, 545–552. doi:10.2147/AMEP.S78794 PMID:26346485
- Seki, N., Moross, J., Otsuka, H., Sunaga, M., Naito, M., Kondo, K., Shinada, K., Morio, I., & Kinoshita, A. (2020). Dental hygiene learning outcomes obtained through computer-assisted simulation modules. *Journal of Dental Hygiene*, 94(1), 32–38. PMID:32127427
- Shenoy, S. J., & Kuriakose, C. (2016). Effects of E-learning as a teaching learning method in medical education. *Journal of Evolution of Medical and Dental Sciences*, 5(99), 7272–7275. doi:10.14260/jemds/2016/1645
- Soltanimehr, E., Bahrampour, E., Imani, M. M., Rahimi, F., Almasi, B., & Moattari, M. (2019). Effect of virtual versus traditional education on theoretical knowledge and reporting skills of dental students in radiographic interpretation of bony lesions of the jaw. *BMC Medical Education*, 19(1), 233. doi:10.1186/s12909-019-1649-0 PMID:31238927
- Sunarto, M. J. D., Hariadi, B., Sagirani, T., Amelia, T., & Lemantara, J. (2019). MoLearn, a web-and android-based learning application as an alternative for teaching-learning process in high schools. *International Journal of Instruction*, 13(1), 53–70. doi:10.29333/iji.2020.1314a
- Unified educational portal of the [BLINDED] University. (2021). *Official web site*. Retrieved from http://do.sechenov.ru/index.php?cal_m=6&cal_y=2020
- Woodside, A. G. (2010). *Case Study Research: Theory. Methods. Practice*. Emerald Group Publishing Limited Howard House, Wagon Lane.
- Zitzmann, N. U., Matthiesson, L., Ohla, H., & Joda, T. (2020). Digital undergraduate education in dentistry: A systematic review. *International Journal of Environmental Research and Public Health*, 17(9), 3269. doi:10.3390/ijerph17093269 PMID:32392877

Ilana Gor is a PhD, Assistant Professor of the Department of Surgical Dentistry, I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia. Research interests: an e-learning system in dental education.

Edita Margaryan is PhD, Professor of the Department of Therapeutic Dentistry at I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia. Research interests: an e-learning system in dental education.

Zoya Snezhko is Senior Lecturer of the Institute of Linguistics and Intercultural Communication at I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia. Research interests: effectiveness of e-learning in dental education.

Olesya Dudnik is PhD, Associate Professor of the Department of Pediatric Dentistry and Orthodontics, I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia. Research interests: internet technologies and education systems.