

## ORIGINAL ARTICLE

# PROFESSIONAL TRAINING OF MASTERS OF DENTISTRY WITHIN QUARANTINE RESTRICTIONS AND MARTIAL LAW: A COMPARATIVE ANALYSIS OF EDUCATIONAL PROCESS

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## ABSTRACT

**The aim:** To present a comparative analysis of the educational technologies effectiveness that were used in the process of professional training of masters of dentistry during quarantine restrictions and martial law.

**Materials and methods:** To perform the set tasks, the following empirical methods of scientific research were used: quantitative data were collected based on analyzing the results of students' educational achievements, as well as implementing special questionnaire that was sent to the students of the Faculty of Dentistry of NMU; qualitative data were collected with the help of several focus groups formed from students and teachers of the faculty. Analysis was undertaken using statistical methods (Pearson's test), and qualitative data were analyzed descriptively.

**Results:** This paper analyzes the effectiveness of educational technologies used during quarantine restrictions and martial law, the role of phantom classes in providing professional training of dentistry specialists, summarizes the results of a comprehensive analysis of scientific literature, teaching experience at the dental faculty and the results of sociological research (student surveys, discussion in focus groups).

**Conclusions:** The outbreak of the COVID-19 pandemic and the full-scale war unleashed by the Russian Federation in Ukraine forced to quickly find and implement mixed forms of teaching future masters of dentistry, which, in combination with digital technologies, enables implementing high-quality and effective training.

**KEY WORDS:** Professional training, masters of dentistry, blended learning, distance learning, simulation training, special competence

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## INTRODUCTION

The modern actuals have shown that high-quality professional training of healthcare specialists is particularly vulnerable to the conditions in which Ukraine has been forced into in recent years – the COVID-19 pandemic and Russian large-scale invasion afterwards. One of the best tools in facing these challenges can be blended learning technologies in combination with digital ones. The wide use of digital technologies in professional training is also important because the healthcare industry is undergoing significant transformations, one of the determinants of which is the use of digital technologies in everyday medical practice. Modern dentistry is one of the leading medical specialties as for the implementation of transformative innovations. Moreover, it widely involves leading scientists in the development and improvement of digital equipment and methods of its application in various dentistry areas and at various stages of medical interventions: in diagnosis, planning, treatment, prevention, processing of results, etc. It is obvious that the

use of digital methods has become the paradigm of the dental industry in the 21st century. Undoubtedly, the use of digital technologies in the professional activities of dentists should be reflected in corresponding changes of training specialists. Such challenges and technological innovations require constructive, didactically justified transformations in the educational process of training specialists at the dental faculties of higher education medical institutions, e.g., revising the programs of educational disciplines, forms and methods of teaching, updating the material and technical base of departments, creating university clinics, etc.

## THE AIM

The aim of the article is to conduct a comparative analysis of the educational technologies effectiveness that were used in the process of professional training of masters of dentistry during quarantine restrictions and martial law.

## MATERIALS AND METHODS

To accomplish the tasks set were studied of blended learning that used experimental and theoretical methods has been conducted. First, quantitative data were collected based on analyzing the results of students' educational achievements, as well as implementing special questionnaire that was sent to the students of the Faculty of Dentistry of NMU. Second, qualitative data were collected with the help of several focus groups formed from students and teachers of the faculty. These groups discussed and analyzed the peculiarities of organizing the educational process in extreme conditions: strengths and weaknesses, opportunities and cautions regarding the use of various blended learning technologies. The survey was organized online via Gmail, the discussions in focus groups were conducted full-time and via MS Teams. Quantitative data were analyzed using statistical methods (Pearson's test), and qualitative data were analyzed descriptively.

## RESULTS

With the beginning of the COVID-19 pandemic, higher education institutions around the world faced globalization challenges, the solution to which was found through the remote form of organizing the educational process under quarantine restrictions. The restoration of traditional (analogue) forms and methods of education was apparently an inevitable process that took place gradually, taking into account the epidemiological situation, in attempt to preserve valuable positive experience gained during 2020 and 2021. The large-scale Russian invasion of the territory of Ukraine broke off all the plans rudely and cynically. The terrorist country destroyed the path to the exit of the education system from the pandemic state, along which the country was moving with international educational academic community.

By the beginning of 2022, virtually all the teachers of dental departments of Bogomolets National Medical University had clear ideas about the organization of the educational process in the conditions of blended learning, tested approaches to special support that proved to be effective during the active phase of COVID, formed skills in working with various distance learning platforms, prepared educational and methodological materials in electronic and paper forms. However, the challenges that had to be faced required new non-standard solutions and special efforts to deal with them. In the period from February 28, 2022 to March 13, 2022, in accordance with the Decree of the President of Ukraine "On the introduction of martial law in Ukraine" dated February 24, 2022 No. 64/2022

[1] and the Letter of the Ministry of Education and Culture of Ukraine "On the organization of the educational process" dated February 25, 2022 No. 1/3277-22 [2], holidays were introduced for all programs at all levels of education. Furthermore, the educational process in a blended format was implemented continuously, with the exception of relatively short periods of time. The validity of this order was later extended to October 21, 2022. The unstable circumstances in which it was necessary to carry out every day educational process at the university since the beginning of the full-scale invasion forced the personnel to change approaches very quickly. Stress resistance, adaptability, and creativity became the traits that helped teachers to qualitatively reorganize and conduct classes under various circumstances (air alert, lack of electricity, mobile telephony, internet connection, etc.), choosing appropriate forms and means while taking care, first of all, of the safety and health of students.

The development of a blended form of educational process (online and full-time studying) has acquired special significance, becoming an urgent requirement of the time and the only possible way of training qualified specialists in the field of health care in wartime conditions. Digital and blended learning technologies have become a powerful tool in confronting the challenges faced by the Ukrainian medical education system in recent years.

An important element was involving the students in decision-making processes, which fully corresponds to the principle of "student-centeredness" and helps to effectively take into account students' offers. In a short period of time, a flexible system of online and offline meetings was implemented, which helped to achieve a balance in the level of feedback received from students.

Next, a survey of dental faculty students using Google forms was conducted. Those were related to the assessment of the approaches, methods, and means of organizing the educational process (which were tested during quarantine restrictions and martial law) and the prospects for their development and improvement. The questionnaire was sent to 70 students of 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grades, and 56 of them sent complete answers. According to the results of the survey, 78% of respondents consider it expedient to introduce separate selective disciplines aimed at forming the digital competence of the future dentists. It is important to distinguish the presence of skills covering five spheres of human activity being oriented towards information literacy, communication and cooperation, creation of digital content, security tools and strategies, creative use of digital tools for problem solving and creativity in the digital competence of a modern doctor [3]. Thus, three groups of skills that differed in the level of their application in professional activity were

identified. These are basic skills of a general nature, namely those required for effective daily work and communication (searching and evaluating information, organizing digital security activities, working with Google survey forms, Excel and PowerPoint skills, working with Google Meet platforms and Zoom, etc.); professionally oriented skills of a general nature (work in medical information systems, DICOM, e-Health system); and special skills determined by the specifics of the specialists' professional activity, their specializations, and positions occupied. It was necessary to investigate the students' opinions on these groups of skills with the help of a questionnaire and to understand what skills are primarily to be further shaped and developed. More than 70% of respondents consider it necessary to have special professional digital skills that will enable them to use digital technologies for diagnosis and treatment planning in their own dental practice. In the comments, many students added that the use of digital technologies in dentistry can ensure "high accuracy of data acquisition" (56% of them) and "convenience for both the patient and the doctor" (51%). The vast majority of respondents (91%) noted that they have sufficient awareness in the field of general skills.

According to medical students' opinion, among the latest technologies, the most effective one is working in a phantom class, which is a kind of simulation center for applying practical skills. Hence, 86% of respondents consider it appropriate to use phantom classes to practice medical manipulations. Therefore, 75% believe that the skills learned while working in phantom classrooms will become fundamental in their future professional activities. The vast majority of interviewees considered the following main advantages of working in simulation classes: "absence of risk for the patient" (90%), "an unlimited number of attempts to practice medical manipulations" (95%).

A number of offers related to the form of study at the Faculty of Dentistry were also made: traditional (auditorium training), remote (online), and blended. Next, 92% of respondents preferred a blended form of study while answering the following question: "Which form is the most effective for the professional training of a future doctor?" In their opinion, the main advantages of a blended form of education are "flexibility of the educational process", "accessibility", and "increased motivation to study". This result is fully consistent with the assessment of the "American Society for Training and Development", which identified blended learning as one of the top ten trends in education [4] and predicted 80-90% of its use among all educational courses in the near future.

According to teachers, the main advantage of blended learning is the possibility of combining interchangeable tools and methods of learning, which ensures the flexibility and efficiency of the latter.

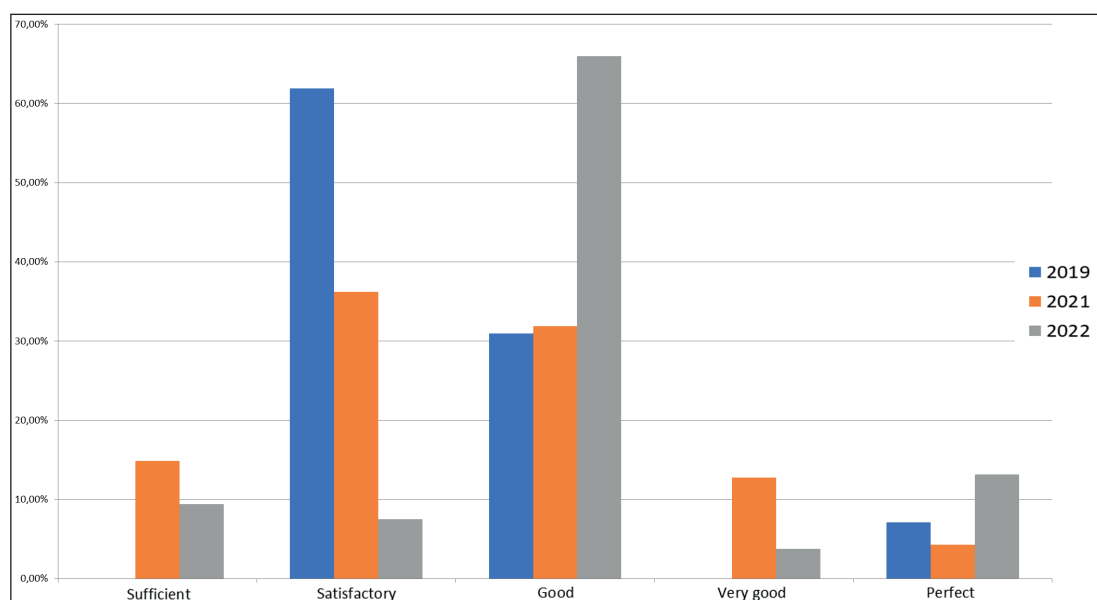
Naturally, the format of training and the method of organizing feedback have an impact on educational achievements (the acquisition of clinical skills primarily) and the psychological state of dentistry students. With distance learning only, the students demonstrated a decrease in success level, growing sense of insecurity, and deterioration in communication skills. The severity of the problem was partially decreased when focus groups shifting from distance learning to auditorium and blended one.

During the period of martial law, the intensity of the use of digital laboratories and simulation centers increased, and the classes were held in group rotation mode on the basis of the Dental Medical Center of Bogomolets NMU. The technical tools used in dental digital laboratories can vary from standard, easy to purchase and use ones to quite complex systems of patient simulators or virtual reality devices and holographic images of three-dimensional objects. The laboratory of computer modeling and digital technologies of the Dental Medical Center of Bogomolets NMU has the following equipment: a laboratory 3D scanner, a CAD/CAM milling machine, a 3D printer, etc. Additionally, the dental center is equipped with three phantom classrooms, each having 12 dental phantom heads with models of jaws, necessary dental equipment, and a multimedia system for conducting theoretical classes.

The structure of a typical class involving a digital laboratory, a dental phantom class, a multimedia system, and students' personal computers will be shown below with the use of an example. The developed method of conducting "Indirect placement of braces with the involvement of digital technologies" class involves implementing an activity change algorithm, mixing online and classroom training, content of the LIKAR\_NMU corporate network, and independent and group training. Students master the basic theoretical knowledge on their own in the mode of the flipped class according to the recommended plan and information resources, and the practical component is exercised directly in the digital laboratory and phantom classroom. There are four stages in the structure of the 6-hour lesson on the specified topic, which is held for 4<sup>th</sup> grade students of the Faculty of Dentistry:

1. A short discussion
2. Work in a digital laboratory.
3. Work in a phantom classroom.
4. The final stage solves two tasks: objective assessment of the knowledge and skills acquired by students (test control is often used); generalization of acquired knowledge and skills, analysis of typical mistakes (conducted as a discussion).

Due to the objective circumstances of learning under martial law, it was sometimes necessary to change the above order of the lesson stages implementation, to reduce the time



**Fig. 1.** Distribution in the studied groups after the pedagogical experiment

**Table I.** The results of data processing after the implementation of pedagogical experiment

N <sup>o</sup>	Groups	$\chi^2_{exp}$	$\chi^2_{cr} (\alpha = 0,05)$
1.	2019 (full-time studying) 2021 (blended studying, quarantine restrictions)	14,993	9,488
2.	2019 (full-time studying) 2022 (blended studying, full-scale war)	33,999	9,488
3.	2021 (blended studying, quarantine restrictions) 2022 (blended studying, full-scale war)	21,397	9,488

of working in a phantom classroom or digital laboratory, to shift the discussion to independent work with individual (or small group) counseling. The students' opinions regarding these forced (due to air alerts/raids, power outages, etc.) transformations were also interesting for the study. Only 10% of respondents believe that the order of actions does not matter, while the vast majority (86.6%) would prefer the abovementioned logical sequence. Moreover, many students also noted the positive role of working in digital laboratory and phantom classroom, mentioning their importance for shaping a practical component of professional competence and confidence in one's own actions. The respondents positively assessed the quality of theoretical material offered for independent study, with the vast majority of students considering it as "good" or "excellent", with 96.6% of the material rated in one of these two categories. Only 1.6% of students indicated that the content of the materials was poorly structured and not logically presented. The fact that the method of indirect braces positioning with the involvement of laboratory scanners and specialized software has become widely used among practicing orthodontists was important for the students as well. This method demonstrates precise positioning accuracy, due to which the process of orthodontic treatment becomes more advanced, comfortable, and faster for patients.

The analysis of the educational achievements of medical students at the department of orthodontics and propaedeutics of orthopedic dentistry was conducted. Three homogeneous samples of students were formed, whose education was realized differently: classroom form of education (2019) – group I, blended form of education with a predominance of distance learning during the period of quarantine restrictions (2021) – group II, blended form of education in the period of full-scale invasion (2022) – group III. To compare the results, the total points of current success, points of assessing practical skills, points for passing the test, and points for creative theoretical works (professional cases) were taken. It is worth mentioning that a pairwise comparison of the entrance control results of student groups proved the statistical homogeneity of the samples at the beginning of studying the "Orthodontics" academic discipline.

In order to test the null and alternative hypotheses after the pedagogical experiment, the  $\chi^2$  criterion was used since: the samples are random; the samples are independent, and their members are also independent from each other; the measurement scale is a 5-category designation scale. A comparison of the educational achievements results (Figure 1) gives reasons for rejecting the null hypothesis  $H_0$ , and indicates the presence of statistically significant differences in the studied student groups (Table I) at the level of significance  $\alpha = 0.05$  and  $v = 4$ .

Upon completion of studying the discipline, 14.9% of the sample group II and 9.4% of the sample group III had a sufficient level. A satisfactory level was demonstrated by 36.2% of group II and 7.5% of group III. 31.9% of the students of group II and 66.0% of group III had the total points corresponding to the "Good" level. 12.8% of the students of group II and 3.8% of group III received the rating "Very good"; respectively, 4.3% of group II and 13.2% of group III had "Excellent" mark. The difference in the percentage ratio within the groups is explained by the increase in the number of students with a higher level of educational achievements.

## DISCUSSION

The conducted analysis of students' success gave reasons for making an assumption that a didactically justified, balanced, and adapted to the requirements of the time combination of forms and methods of blended learning, classes in the digital laboratory and in the simulation, center is able to ensure the proper theoretical and practical preparation of dentistry students for mastering the professional basics of their future profession.

The share of classroom activities and face-to-face communication have increased in the conditions of martial law. This contributed to restoring the sense of confidence in one's own abilities, integration into the educational community, demand and security and, presumably, was partly reflected in the academic achievements of students. Indeed, the researchers argue that the sense of confidence is central to personal development and continuous learning. This, firstly, leads to an improved ability to perform tasks; secondly, the confidence is a product of relationship and trust of the people associated with a person or professional; and, thirdly, the right level of challenge is important for confidence [5].

Comparing the peculiarities of education during the period of quarantine restrictions and martial law, the majority of respondents and the analysis of statistical data indicate an improvement in the students' educational achievements. The reasons for this fact are not entirely clear at the moment. Apparently, one of them implies that learning acquires features of inclusiveness in such conditions, and the synergy between theoretical online learning and practical acquisition of clinical skills is significantly enhanced. Other researches obtained similar

results, for example, educational model developed in Singapore during the active phase of the pandemic, which combines traditional (analogue) and digital educational technologies [6], achievements of our colleagues [7-11] and other authors [12].

A special feature of wartime education war is that the proportion of students who work in practical medicine, primarily on a volunteer basis in a military hospital, increases significantly. A great number of injured people require the intervention of specialists in maxillofacial surgery, orthodontics, gnathology, etc. This provides many specific professional cases that students try to formulate independently and bring to the classroom for joint discussion and consideration. At the same time, it stimulates emotional involvement in the learning process and the growth of motivation, which is the basis of increased students' confidence.

During the period of martial law, the technologies of blended learning acquired development and transformational changes, both in terms of methods of combining traditional and distance methods and in the use of digital potential of higher education along with traditional forms and means of education.

All this enables achieving the results that are comparable (or even better in some cases) than the ones before 2020. This improvement inspires optimism, but the long-term impact of extreme conditions on the education of dental students, especially on such aspects as the practical component of professional competence, communication skills, etc., requires time-deferred studies.

## CONCLUSIONS

The outbreak of the COVID-19 pandemic and the full-scale war unleashed by the Russian Federation in Ukraine forced to quickly find and implement mixed forms of teaching future masters of dentistry, which, in combination with digital technologies, enables implementing high-quality and effective training.

The wide implementation of online and mixed forms of education has a significant impact on the psychological state of students and requires research and development of adaptive methods that correspond to new psychological and pedagogical conditions of implementing the educational process.

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#### **Conflict of interest:**

*The Authors declare no conflict of interest.*

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