

## CONCEPTUAL BASELINE OF BLENDED LEARNING METHOD IN ORTHODONTICS FOR FUTURE MASTERS OF DENTISTRY

Melnyk B. M., Kaniura O. A., Rashchenko N. V.

### INTRODUCTION

According to the approved standard of higher education, the integral competence of the Faculty of Dentistry graduate in the major 221 “Dentistry” of subject area 22 “Health care” is the ability to solve complex tasks and problems in the in “Dentistry” area of health care in their professional activity or in the process of learning<sup>1</sup> 0. The urgent need for the transformation of educational methods at the Faculty of Dentistry prompts us to comprehensively analyse modern pedagogical technologies and search for a didactically sound optimal balance between traditional face-to-face learning and its online form.

During rapid technological changes, the improvement of blended learning methods is a priority area of research. The search for new methods of teaching clinical disciplines is the subject of both research of domestic and foreign scientists of the branch of pedagogy. The paper<sup>2</sup> describes the types of conceptualization of blended learning and their scientific analysis. In the article<sup>3</sup>, based on the experience of the “Australian University” located in Ho Chi Minh City, Vietnam, the advantages of the implementation of blended learning are highlighted. In the publication<sup>4</sup>, the writing staff analysed a number of critical issues for the implementation of blended learning. Staker, H., & Horn, M. B.<sup>5</sup>, experimentally proved the effectiveness of the implementation of blended learning and presented four

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<sup>1</sup> Наказ Міністерства освіти і науки України від 24.06.2019 про «Затвердженого стандарту вищої освіти за спеціальністю 221 «Стоматологія» галузі знань 22 «Охорона здоров'я». URL: <https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/2019/06/25/221-Stomatolohiya-mahistr.20.01.22.pdf>

<sup>2</sup> Hrastinski S. What Do We Mean by Blended Learning? *TechTrends*. 2019. Vol. 63. P. 564–569. URL: <https://doi.org/10.1007/s11528-019-00375-5>

<sup>3</sup> Bouilheres F., Le Thi Viet Ha Le, McDonald S., Nkhoma C., Jandug-Montera L. Defining student learning experience through blended learning. *Education and Information technology*. 2020. URL: <https://doi.org/10.1007/s10639-020-10100-y>

<sup>4</sup> Boelens R., De Wever B., & Voet M. Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review* 2017. Vol. 22. P. 1–18. URL: <https://doi.org/10.1016/j.edurev.2017.06.001>

<sup>5</sup> Staker H., & Horn M. B. Classifying K-12 blended learning. Innosight Institute. 2012.

models of blended learning. N. H. Korniets et al.<sup>6</sup> conducted a detailed analysis of the perspective of implementing blended learning for the training of future doctors not only during the pandemic, but also on an ongoing basis. This scientific search proves the perspective of blended learning in higher educational institutions and the relevance of creating new models of education using information technology.

On the basis of comprehensive scientific research, the relationship between various forms of education and the effectiveness of the educational process in orthodontics of students of dental specialties has been justified and tested with experiment.

For the tasks at hand, the following methods of empirical research were used: analysis of the content of pedagogical documentation, questioning of students, lesson observation; methods of theoretical research – analysis of scientific literature, regulatory documents on the formation of the competence of future specialists of health care subject area; methods of quantitative processing of the pilot study results – mathematical and statistical methods for establishing the relationship between the phenomena under study.

### **1. The problem's prerequisites emergence and the problem's formulation**

Orthodontics is a complex area of scientific expertise, which is an integral part of the system of dental sciences.

It should be noted that the prevalence of orthodontic pathologies in the structure of dental diseases ranks third after dental caries and pathologies of periodontal tissues<sup>7</sup>.

In particular, anomaly of occlusion is found in every second child and adolescent in the world, and their prevalence does not change depending on the age period of occlusion<sup>8</sup>.

According to the research 17, 83.33 % of the examined patients, aged 6–12 years had malocclusion. Quite often, malocclusion and deformations

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<sup>6</sup> Корнієць Н. Г., Слєпiчкo Ю. М., Тертична-Телюк С. В., & Кравцова Ю. А. Змiшане навчання як ефективна форма пiдготовки майбутнiх лiкарiв в умовах COVID-19. *Вiсник Луганського національного унiверситету iменi Тараса Шевченка. «Педагогiчнi науки»*. 2021 (6 (344) Ч. 2), С. 58–65. URL: [https://doi.org/10.12958/2227-2844-2021-6\(344\)-2-58-65](https://doi.org/10.12958/2227-2844-2021-6(344)-2-58-65)

<sup>7</sup> Alhammadi M. S., Halboub E., Fayed M. S., Labib Amr., El-Saaidi C. Global distribution of malocclusion traits: A systematic review. *Dental Press J. Orthod.* 2018. Vol. 23 (06).

<sup>8</sup> Porter W. W., Graham C. R., Spring K. A., & Welch K. R. Blended learning in higher education: Institutional adoption and implementation. *Computers & Education.* 2014. Vol. 75. P. 185–195. URL: <https://doi.org/10.1016/j.compedu.2014.02.011>

are observed in combination with other diseases, namely ENT, gastrointestinal tract disorders, etc.

The authors 15 provide data on 75.83 % anomaly of occlusion in patients aged 4–17.

Complementing the position of scientists, it is important to point out that the continuous development of civilization creates a significant need for a healthy oral cavity and its aesthetic perfection in the population.

The scientific potential of orthodontics and the rapid technological progress of the dental area motivates modern medical specialists to constantly analyse, develop and improve the theoretical base of the discipline.

In our opinion, the complex transformation of all components of the educational process in the M(P) universities, is fundamental namely the methods, forms and means of education. The civilizational challenges of our time have become the impetus for the introduction of new pedagogical technologies in medical universities educational process, in particular, the appearance and use of electronic information products for educational purposes. Along with traditional technologies, distance and blended learning technologies are rapidly developing.

With the outbreak of COVID-19 pandemic, in March 2020, Bogomolets National Medical University was forced to switch to online education. The Neuron online platform was created to consolidate the educational process at the university. Since 2021, training has continued on the improved platform Likar.nmu (<https://likar.nmuofficial.com>), which is based on the Moodle learning management system.

Based on the recommendations of the Ministry of Education and Science of Ukraine on blended learning introduction in institutions of secondary vocational and higher education<sup>9</sup>, we believed that “blended learning is an approach, a pedagogical and technological model, a technique that, along with online technologies, also relies on direct interaction between students and teachers in the classroom”.

At the same time, the so-called “constructive agreement”<sup>10</sup>, should be implemented, providing for the agreement of the following three components of the educational process:

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<sup>9</sup> Рекомендації Міністерства освіти і науки України щодо впровадження змішаного навчання у закладах фахової передвищої та вищої освіти. URL: <https://mon.gov.ua/storage/app/media/vishcha-osvita/2020/zmyshene%20navchanny/zmishanenavchannia-bookletspreads-2.pdf>

<sup>10</sup> Biggs J. Aligning Teaching for Constructive Learning. URL: [https://www.heacademy.ac.uk/sites/default/files/resources/id477\\_aligning\\_teaching\\_for\\_constructing\\_learning.pdf](https://www.heacademy.ac.uk/sites/default/files/resources/id477_aligning_teaching_for_constructing_learning.pdf)

- expected learning outcomes that correspond to the goals of the educational program;
- assessment that checks the specified learning outcomes;
- all types of activities during the course aimed at achieving learning outcomes.

It is important to note that when planning blended educational activities, it is necessary to transform the usual forms of training sessions into forms of interaction between subjects of education, which can be carried out remotely, synchronously and asynchronously, as well as into student's organized independent work. According to the above, the types and forms of educational activities can be conditionally classified into one of two categories:

- contact hours – involve direct interaction of educational process participants with each other in the classroom;
- online activity – involves mediated interaction of educational process participants with each other and with the content in the classroom or outside of it by means of online technologies<sup>11</sup>.

Our position is based on the fact that each model of blended learning is of its own unique kind and combine these types of activities, taking into account the specifics of each specific educational discipline. It should be noted that the conceptualization of blended learning also involves determining the proportions between traditional (contact hours) and distant (online activity) forms of educational activity.

Thus, the authors 9 prove that the share of the educational process that is implemented online can be 30–79 % of the total hours of study number. The paper 10 states that at least 50 % of the total course time should be spent face-to-face. The publication 11 confirms the results of previous authors and provides data: 50 % of online classes and 50 % of “face-to-face” classes.

The author 12 supplements the information presented above, convincingly proving that in the conditions of the scientific and technical process, the dependence of the pedagogical process in higher education institutions on the technical factor, especially informatization, is increasing.

## **2. Choosing a strategy for improving the pedagogical process**

The analysis of scientific publications provides the basis for conducting our own research, which will confirm or refute the relationship between the effectiveness of training and the choice of proportions between face-to-face

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and online forms of educational activity. Designing of the pilot study was carried out on the basis of Orthodontics and Propaedeutics Department of Orthopaedic Dentistry of Bogomolets National Medical University. Blended learning at NMU is implemented using the Neuron distance learning platform, and since 2021, using the university’s own LIKAR\_NMU platform (<https://likar.nmuofficial.com/>), which is synchronized with the automated control system (ACS).

The structure of the “Orthodontics” course unit that has been developed in accordance with the work training program in the direction of the second (Master’s) degree of higher education in major 221 “Dentistry”, is presented in the table (Table 1). For 3rd year students of the Faculty of Dentistry, module No. 1 consists of 120 number of academic hours in total, of which: lectures are 10 hours, 60 hours – practical classes, 50 – student’s independent work.

Table 1

**Description of the “Orthodontics” course unit structure  
for the 3rd year of study.**

Name of indicators	Knowledge area, major, academic level	Course unit features
		full-time education
Number of credits – 4	Subject area 1101 medicine (code and name)	Normative (optional)
	Major 1101 medicine (code and name)	
Module – 1	Specialty: dentistry	Year of study
Content modules – 3		3rd
Individual research task: review of literature, writing abstracts, preparation of presentations		Term
Total academic hours – 120		V
		Lectures
		10 a.h.
		Practical
Weekly hours for full-time education: in-class – 3 student’s independent work – 2	Academic level: complete higher education, qualification: dentist	60 a.h.
		Individual work
		50 a.h.
		Type of control:
		final modular control

In this study, the following basic principles of the pedagogical process were strictly observed:

- the principle of social and value goal of the pedagogical process;
- the principle of comprehensiveness of different types of activities;
- the principle of combining pedagogical guidance with organizing joint activities;
- the principle of student’s inclusion;
- the principle of consciousness, activity, initiative, creativity of students in the pedagogical process;
- the principle of demonstrativeness;
- the principle of scientificity;
- the principle of accessibility;
- the principle of purposefulness.

During the pilot study planning, three concepts of blended learning were created:

1. “70/30” concept; 70 % of classes are conducted traditionally (“face-to-face” method), 30 % are online, with the involvement of modern information technology (Table 2).

2. “50/50” concept; the number of face-to-face and online academic hours is equal (Table 3).

3. “100/0” concept; 100 % of classes are conducted traditionally (Table 4).

Table 2

	<b>Face-to-face (a.h.)</b>	<b>Online (a.h.)</b>
Lectures	–	10
Practical training	45	15

Table 3

	<b>Face-to-face (a.h.)</b>	<b>Online (a.h.)</b>
Lectures	–	10
Practical training	35	25

Table 4

	<b>Face-to-face (a.h.)</b>	<b>Online (a.h.)</b>
Lectures	10	–
Practical training	60	–

In accordance with the purpose of the pilot study, three groups of 3rd year students of the Faculty of Dentistry, totalling 78 people, were formed. In group No. 1 (28 students), classes were held according to the “70/30” concept, i. e. 70 % of all classes were held in a traditional in-class format, and 30 % were distant (Table 1). In group No. 2 (23 students), in-class and

distant forms were combined according to the “50/50” concept (Table 2). In group No. 3 (27 students), the traditional in-class teaching method was applied. This group was chosen as a reference group (Table 3).

We agree with the authors [13] that distance learning technologies provide opportunities that are far from equivalent for the formation of various components of the professional competence of an aspiring physician. The greatest difficulties arise in the formation of practical skills: mastering clinical skills and practicing them on the patient, conducting laboratory assessments and special exams and personal communication during patient intake. When forming the educational concept for each of the three experimental groups, the practical orientation of the initial “Orthodontics” course unit was taken into account and pedagogical technologies were applied, which provided the necessary and sufficient conditions for the formation of the practical component of professional competence in orthodontics.

Exchange of views with professors of Orthodontics and Propaedeutics Department of Orthopaedic Dentistry of Bogomolets NMU made it possible to form proposals for improving the methodology for blended learning organizing. First of all, let us point out the basic issues in the implementation of blended learning and the difficulties in the teaching process:

- lack of a single, clear structure aimed at support and creation of educational content, organization and support of blended learning;
- insufficient technical capabilities of subjects of training;
- significant loss of direct contact between students and the professor;
- insufficient motivation of students in online classes.

After these pilot groups completed the “Orthodontics” course unit of the 3rd year of study, and the students’ knowledge was checked, the results of the assessment were collected and systematized for statistical verification of the correlation between the concept of blended learning and achievements of students.

The final score, which evaluated the student’s success during the experiment, was the sum of the current scores and the scores obtained in the final session. The latter was determined through the results of testing, which determined the formation of the knowledge (cognitive) component, assessment of practical abilities and skills, performance of theoretical tasks that have an integrated nature and contain elements of uncertainty. That is, the assessment of success is the sum of test results + practical skills + theoretical, professionally oriented cases.

The assessment used the traditional national scale and the ECTS scale, the correspondence of which is presented in the table (Table 4).

Score	According to national scale	ECTS grading scale	
		grade	explanation
170–200	Excellent	A	Excellent (excellent progress with minor errors)
155–169	Good	B	Very good (above average with few errors)
140–154		C	Good (generally correct progress with a certain number of significant errors)
125–139	Satisfactory	D	Satisfactory (not bad, but with a significant number of shortcomings)
111–124		E	Sufficient (the progress meets the minimum criteria)
60–110	Unsatisfactory	FX	Unsatisfactory (with the possibility of repassing)
1–59		F	Unsatisfactory (with mandatory re-study of the course unit)

### 3. Statistical verification of the effectiveness of the proposed method

In order to test the law of distribution of the obtained results of students' progress, we used the W criterion of Shapiro-Wilk test. It was found that for all groups the distribution does not differ from the normal one at  $p > 0.1$  significance level. For data presentation, the arithmetic mean ( $\bar{x}$ )  $\pm$  standard deviation ( $\pm$ SD) was calculated (Table 5).

Pilot groups	Sample number (of students)	Average value ( $\bar{x}$ $\pm$ SD)
Group No. 1	28	158.2 $\pm$ 12.56
Group No. 2	23	138.6 $\pm$ 6.7
Group No. 3	27	152.1 $\pm$ 11.72

Multiple comparison of the obtained values was carried out using the Scheffe statistical method:

Variables: Group 1, Group 2.  $F=20.57$ . The difference in means is statistically significant at the  $p < 0.01$  significance level.

Variables: Group 1, Group 3.  $F=2.15$ . The difference in means is not statistically significant,  $p=0.12$ .

Variables: Group 2, Group 3.  $F=9.63$ . The difference in means is statistically significant at the  $p < 0.01$  significance level.

This statistical analysis proves that in the pilot groups where the “70/30” concept (Group 1) and the “100/0” concept (Group 3) were applied, there was no statistically significant difference in the results obtained. However, the results of students' progress when applying these concepts are statistically significantly different from the results of the students' progress who were trained using the “50/50” concept (Group 2) ( $p=0.12$ ). In this group, a lower level of students' progress was revealed.

## CONCLUSIONS

On the basis of a complex scientific analysis, the expediency and perspective of introducing a blended learning to improve the process of studying dental course units has been proved. The advantage of applying the blended learning with the dominance of in-class teaching methods, where online methods fulfill an important function, enriching the educational process with modern educational technologies, has been experimentally proved. The results of the study show a somewhat higher success rate in students who tried blended learning to students who studied in a traditional face-to-face format.

This scientific study demonstrated the didactic potential and the need for comprehensive improvement of the blended learning, which encourages further scientific research.

## SUMMARY

In the face of globalization challenges, the organization of the educational process in higher medical educational institutions needs a radical transformation. The rapid progress of the dental industry, the constant development of information technology and the gradual digitalization of the professional education system encourage academic staff to take an integrated approach in improving the process of training applicants for higher education. While professionally training the students of dental specialties, the formation of a clear chain of all components of the professional competence of the future doctor – knowledge, skills, practical skills, moral and ethical values, goals – is particularly important. When implementing blended learning, the opportunities for the formation of various components of the professional competence of the future doctor are not equivalent. The flexibility of the educational process plays an important role in this. The relevance of this issue is reinforced by the growth of public demands for future dentists, the acceleration in the rate of change in treatment and diagnostic technologies. All this requires improvement of the system of training future health professionals.

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**Information about the authors:**

**Melnyk Bohdan Mykolayovych,**

Postgraduate Student, Assistant at the Department of Orthodontics and  
Propedeutics of Prosthetic Dentistry  
Bogomolets National Medical University  
13, Tarasa Shevchenko Boulevard, Kyiv, 01601, Ukraine

**Kaniura Olexandr Andriyovich,**

Doctor of Medical Sciences,  
Vice-Rector for Scientific-Pedagogical and Clinical Work,  
Professor at the Department of Orthodontics and Propedeutics of  
Prosthetic Dentistry  
Bogomolets National Medical University  
13, Tarasa Shevchenko Boulevard, Kyiv, 01601, Ukraine

**Rashchenko Nataliia Volodymyrivna,**

Candidate of Medical Sciences,  
Associate Professor at the Department of Orthodontics and Propedeutics  
of Prosthetic Dentistry  
Bogomolets National Medical University  
13, Tarasa Shevchenko Boulevard, Kyiv, 01601, Ukraine