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**A. V. Bambuliak, N. B. Kuzniak, L. Ya. Lopushniak\*, R. R. Dmytrenko**

*Departments of Surgical Stomatology and Maxillofacial Surgery (head – Prof. N. B. Kuzniak); \*of Human Anatomy named after M. G. Turkevich (head – Prof. V. V. Kryvetskyi) of the higher education institution of the Bukovinian State Medical University, Chernivtsi*

## **APPLICATION OF SIMULATION TECHNOLOGIES AND CASE-METHOD IN PROFESSIONAL TRAINING OF FUTURE DENTISTS**

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### **ЗАСТОСУВАННЯ СИМУЛЯЦІЙНИХ ТЕХНОЛОГІЙ ТА КЕЙС-МЕТОДУ ПРИ ПРОФЕСІЙНІЙ ПІДГОТОВЦІ МАЙБУТНІХ СТОМАТОЛОГІВ**

**Резюме.** Для подальшого ефективного розвитку вищої стоматологічної освіти потрібно впроваджувати інноваційні методи навчання й викладання, засновані на сучасних педагогічних технологіях. На сучасному етапі розвитку сфери охорони здоров'я все більше уваги приділяється безпеці пацієнтів, етичним питанням, збільшенню відповідальності медичних працівників, високому рівню професійної кваліфікації та швидкій еволюції процедур та методів. Вищезазначене вимагає адаптування навчальних програм та використання усіх наявних освітніх інструментів й технологій при професійній підготовці майбутніх стоматологів. *Метою дослідження* було провести теоретичний аналіз наукових психолого-педагогічних, методичних та медичних публікацій, навчально-методичної роботи кафедри щодо застосування педагогічних технологій в процесі професійної підготовки майбутніх стоматологів. *Матеріал і методи дослідження.* Аналіз психолого-педагогічної, методичної літератури, матеріалів науково-практичних конференцій, навчально-методичної роботи кафедри. Для досягнення мети, уточнення сутності та особливостей використання сучасних педагогічних технологій в освітньому процесі застосовано теоретичні методи: аналіз, синтез, узагальнення, порівняння, систематизація, педагогічне моделювання, теоретичне прогнозування. *Висновки.* Застосування технологій симуляційного навчання та кейс-методу при підготовці майбутніх стоматологів сприяє формуванню умінь та практичних навичок, професійної компетентності, розвитку особистості, здатності володіти оптимальною поведінкою та відрізнитися ефективністю дій в різних клінічних ситуаціях. Симуляційне навчання дозволяє багаторазово та точно відтворювати важливі сценарії та алгоритми дій і надає можливість адаптувати навчальну ситуацію для кожного студента. Використання сучасних педагогічних технологій під час вивчення навчальної дисципліни «Хірургічна стоматологія» забезпечує контролюючу, оскільки виявляє знання та навички студентів, навчальну, тому що вимагає досягнення ними певного рівня навчання та виховну функції, оскільки відбувається формування особистісних якостей здобувачів освіти. Ефективно організовуючи самостійну й аудиторну діяльність студента, викладач сприяє розвитку клінічного мислення, що неодмінно стає основою формування кваліфікованих та успішних лікарів.

**Ключові слова:** педагогічні технології, симуляційне навчання, метод кейсів, викладач, студент, стоматологія.

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Today, higher medical education institutions face a number of tasks, among which almost the main one is a change of teaching style and the necessity

to reduce the gap between theoretical knowledge and clinical practice. Training of an educated, creative individual able to provide public requirements in

his/her professional activity both on the national and international levels is the most important task in educational reform in Ukraine. Introduction of a competence approach and formation of professional adequacy of future specialists is the highest quality indicator of the education received [1]. More and more attention is paid to patient safety, ethical issues, increasing responsibility of medical staff, high level of professional qualification and rapid evolution of procedures and methods [2]. The above requires adaptation of educational programs and the use of all the educational instruments. One of the basic conditions in the formation of future medical specialist is development and application of modern pedagogical technologies. Their implementation is the fulfilment is one of the basic tasks of modern education – management of the learning process [3]. Nowadays, strict requirements stipulate higher education institutions to achieve a qualitatively new level in presentation of educational material. Therefore, in addition to traditional methods modern pedagogical technologies are widely used.

**Objective:** to conduct a theoretical analysis of scientific psychological-pedagogical, methodological and medical publications, educational-methodological activity of the Department concerning application of pedagogical technologies in the process of professional training of future dentists.

**Material and methods.** Psychological-pedagogical, methodological literature, materials of scientific-practical conferences, and educational-methodological activity of the Department were analyzed. To achieve the goal, specify the essence and peculiarities of application of modern pedagogical technologies in the educational process the following theoretical methods were used: analysis, synthesis, substantiation, comparison, systematization, pedagogical modeling, theoretical prognosis etc.

**Results and discussion.** The reform of higher education institutions and the demands of the labor market faced by the graduates encourage changes in the established authoritarian pedagogy and move from the level of accumulation of knowledge to the ability of effectively operate it, from group learning to individual one. This determines the renewal of professional training and is closely related to radical changes in education in the context of a competence approach occurring in the majority of countries of the world [4]. Each competency contains a list of relevant knowledge and skills formed in the process of learning certain educational subjects. At the same time, formation of every definite competency occurs due to integration of knowledge and skills from different educational subjects. It is indicative of possibility to

apply inter-disciplinary approach to the formation of the education content. The teacher today increasingly feels the need to implement pedagogical technologies that would help realize a personal approach to the student, since it is an important constituent in the development of professional competence of future specialists. Trends in the development of modern professional training actualize further research on the introduction of the latest pedagogical technologies into various branches of education and medical one in particular. The task of teachers in the educational process of professional training of future dentists is to give students deep knowledge on the subjects and to teach them to integrate theoretical knowledge into the issues of practical medicine.

The aim of the educational program on «Dentistry» is to ensure the training of a highly qualified specialist based on the academic training in fundamental and clinical medical sciences, and training of graduates able to perform their professional duties in the corresponding primary position. Learners of higher education in the process of learning should acquire general and special competencies. The sphere of application of these competencies is determined by the list of syndromes and symptoms of various diseases, urgent conditions requiring special tactics of patient management; laboratory and instrumental studies, medical manipulations; the issues of labor examination etc. In the process of learning future dentists should master general professional and integral competencies, fundamental and professional-oriented knowledge, abilities and practical skills essential for performing typical professional tasks associated with medical work.

Formation of competencies in the process of professional training of future dentists is carried out during the study of a number of standard and selective subjects. The study of the academic discipline «Surgical dentistry» occupies a significant place in professional training of future dentists. The course of the discipline consists of three years – the third, fourth and fifth, and Internship. The principal tasks of the discipline «Surgical dentistry» are determined by the list of competencies that should be mastered by a future specialist. They are contained in the educational program of the discipline. Analysis of the professional training process of future doctors according to the educational program «Dentistry», analysis of the educational program of the discipline «Surgical dentistry», and our own pedagogical experience allow asserting that among leading tasks in front of future professionals in the process of professional training are formation and development of clinical thinking. It enables to occupy an active

cognitive position, generate ideas, and choose the right decisions [5]. Clinical thinking is formed as an ability to highlight the main thing, generalize, identify differences, synthesize information obtained by the student, which will certainly help in future professional activity. The process of studying an academic discipline cannot consist only in the accumulation of theoretical and practical knowledge. It must have an important motivation component, since motivation is a key to consciously mastering the profession. To realize the above tasks and to form professional competence of future dentists while teaching the academic discipline «Surgical Dentistry» it is reasonable to apply the pedagogical technologies promoting the development of clinical thinking and strong assimilation of knowledge. In our opinion, such technologies are simulation training and case-methods. The application of simulation training technologies is one of the main areas in practical training of medical professionals in Europe and the whole world. Practicing skills on simulators and in virtual operating rooms have proven their effectiveness. In the system of medical education simulation technologies make the foundation of a number of methods helping to reproduce clinical situations according to the purpose of the learning, revision, assessment and research. Simulation training is an integral component of professional training. It uses the model for giving an opportunity for every student to perform professional activity or its element according to professional standards and/or the rules of giving medical aid [6]. Simulation can be represented by a person or a device or a set of conditions that help reproduce a real issue. The student should react to the situation in the same way as he/she would in real life. Thus, simulation is a technique that replaces or enriches the practical experience of a learner with an artificially created situation reflecting and reproducing real-world issues in a completely interactive manner. Simulation training is an educational method that involves an interactive type of immersion activity into the professional environment by reproducing real clinical manifestation in whole or in part without the associated risk for the patient [7]. Simulators range from simple physical models of anatomical structures (for example, models of skull bones, simulators for practicing certain skills) to complex devices and manikins with high mechanical reality and computer control. The purpose of training with simulation scenarios is getting and assimilation of skills (technical, cognitive, behavioral) that constitute the competence of a future specialist. Increasingly, simulation technologies help to develop practical skills in various medical specialties, and emergency medicine in particular. The simulation training method

is of great importance for practicing skills in rare or critical situations.

Different types of stimulators are used in medical training including: *computerized manikins*, *screen simulators*, which allow imitating an appropriate reaction; *anatomical models* that are used for training and mastering certain practical skills; *phantom* – a model of the human body or its part promoting formation of abilities and skills; *manikin* – a figure for practicing interrelated skills and abilities; *training simulator* – a device for artificial creation (simulation) of various situations or objects allowing the formation of individual skills and abilities; *standardized patients*; *the system of situational tasks*; *clinical type training games*, helping to develop clinical thinking; *organization activity training games* promoting formation of professional skills and abilities of an organizational character [8].

The main difference between the training simulator and visual aids is that the latter only give knowledge and make skill formation easier. The former allows formation of the skills necessary in real working conditions. Training by means of computer simulation programs foresees the development of clinical thinking in any medical specialty. Computer programs imitating various pathological conditions and their progress help compare certain disorders with any pathology. Realistic computer simulation helps acquiring certain skills with less risk and cost. Moreover, stimulation provides objective assessment of training results and certifies them. Modern means of virtual reality are considered as a source of technological possibilities in education and medicine. They supplement a set of traditional approaches in education. A rapid decrease in the price of computing power and the elemental base of computers, a sharp growth of the market for mobile devices and applications contribute to the mass spread of virtual reality technologies and make it possible to considerably reduce the costs of educational facilities. The use of virtual reality in professional training of future dentists radically changes the principle of the visual content of education and corresponds completely to the world trend in teaching disciplines when traditional approaches are supplemented with up-to-date methods of information supply. They include expanding the availability of electronic libraries, anatomical and surgical data bases, development of perfect stimulators that present the models of the parts of the human body according to the systemic and topographic principles with the possibility to make plane projections and volumetric three-dimensional body parts. Virtual identity of real objects, their universal and multifunctional characteristics can give

more life experience for the future doctor concerning perception and implementation of practical actions. The high efficiency of implementation, the use of virtual reality as a full-fledged educational equipment that competes with traditional approaches, requires the presence of educational programs having a scenario, a strict algorithm of actions, allowing them to act as an educational technology. In case they are not available, only the teacher can provide the student with knowledge. As a method of transfer and assimilation of knowledge, the existing means of virtual reality make high demands on the teaching staff, whose active and competent position will allow the introduction of new technologies. The introduction of the tools of virtual reality expands the range of the principles of visual aids and their accessibility. At the same time, inadequate processing of a specialized content and lack of installed educational technologies can provoke certain difficulties in a wide implementation of these training means on the part of the teaching staff. Anticipatory work in this segment consists in the creation of specialized educational programs for the professional training of dentists with the introduction of virtual reality technologies into the practice of teaching medical disciplines.

In order to form clinical thinking of future dentists, the case study is introduced into the educational process together with the improvement or traditional methods. Case-method or the method of situational exercises enables to make the process of learning closer to the real practical work of specialists. The method promotes development of initiative, ability to solve problems, develops skills to make analysis and diagnose the problems. This pedagogical tool helps better understand the subject. It develops imagination, checks the theory in practice, examines ideas, finds regularities and interrelations, deduces hypotheses, increases motivation, encourages thinking and discussion, gets additional information, makes the knowledge deeper, applies analytical thinking, prepares to solve problems and draw rational conclusions, develops communication skills, combines theoretical knowledge with practical skills in problematic issues, and transforms abstract knowledge into real skills and abilities. In the area of medical pedagogy, this method helps develop clinical thinking on the principles of evidence-based medicine and improve practical skills. Case-method is successfully used all over the world in teaching medical sciences. This pedagogical technology can be realized by different ways: it can be a format of working in small groups, role game, discussion, standardized patients etc. [9]. However, one of the important ways of implementing the case study methodology is the use

of information and educational web technologies, which makes the training process interactive, effective and allows making the range of educational materials wider to a large audience at the same time. With the help of information and educational web technologies, opportunities for a wider range of clinical cases, including rather rare ones, for qualitative visualization of additional research methods are revealed, which is impossible with traditional training format. The access to interactive clinical cases is open and realized by means of Internet approach. An important advantage of the case study is that this experience can be repeated and if necessary mastered according to the individual learning trajectory at a convenient pace with the help of Internet access. Interactive cases are widely presented on the sites of some medical institutions and Internet-versions of medical journals, world associations of doctors of different specialties. Cases are illustrated materials that are shown to the user in a certain sequence. The user gets the information about the patient using video, graphic images, diagrams etc. Then the user gets the opportunity to choose one of the actions, suggest the diagnosis, make differential diagnosis, and prescribe examination and treatment. The system Open Labyrinth is an interesting foreign project, where case study is realized by means of special platform for creation and watching cases. In Ukraine, training of medical disciplines with the help of case method has started recently. It requires development and implementation into practice of training future specialists. Case study is a complicated and effective tool of innovation educational technologies. It not only reflects a practical issue, but updates a certain complex of knowledge essential for its solution. It successfully combines training, analytical and educational activity, which increases effectiveness of modern educational tasks [10]. Due to case study, the students deal with a real clinical situation. On the one hand, description of the clinical situation reflects any practical issue, and on the other hand, it updates a certain complex of knowledge necessary to have for completion of a certain task. Until now, there is no certain standard for the presentation of cases from medical disciplines [11]. Cases are usually presented in printed form or on electronic media, and multimedia presentations. They include photos, diagrams, tables that make them more attractive and visual for students. Case study is an active problem-situation analysis based on group learning when students solve certain tasks – cases. It is necessary to work together to analyze symptoms, possible causes of their occurrence, find practical solution, assess the suggested variants of problem solving, and choose the

best one. Cases for independent unsupervised work are wider, and they contain more information [12]. The use of case study in teaching the educational discipline «Surgical Dentistry» helps students better memorize difficult topics, develop and train clinical thinking, master the skills of differential diagnostics of various pathologies, clearly and laconically formulate one's thoughts, promote ability to listen to, and therefore stimulates the interest to education.

Organization of the educational process of professional training of future doctors with the use of cases makes it possible to prepare specialists to pass «KROK» licensed exams maximally better. Taking this exam, the learners must demonstrate their ability to apply their acquired knowledge and skills in real clinical situations, assess the actions, and make their own substantiated and reasonable decisions. Cases with real clinical situational tasks reactivate practical classes. Scientific discourse promotes development of interest in getting knowledge, motivates to expand knowledge, and makes information perception in clinical disciplines easier.

**Conclusions.** Application of simulation educational technologies and case-method in training

of future dentists promotes formation of abilities and practical skills, professional competence, personal development, ability to possess optimal behavior and differ in the effectiveness of actions in various clinical situations. Simulation training allows you repeatedly and accurately reproduce important scenarios and algorithms of actions, and provides the opportunity to adapt the educational situation for every student. Application of modern pedagogical technologies in learning and teaching the academic discipline «Surgical Dentistry» provides controlling, teaching and educational functions. Controlling function includes assessment of student knowledge and skills, teaching function requires certain level of knowledge achieved, and educational function provides formation of essential individual qualities by learners. Effective organization of independent and classroom activities of students by the teacher promotes development of clinical thinking, which is an integral basis for the formation of qualified and successful doctors.

**Prospects of further studies.** In the future, experimental check of the effectiveness of the application of modern pedagogical technologies in teaching the academic discipline «Surgical Dentistry» is planned.

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#### APPLICATION OF SIMULATION TECHNOLOGIES AND CASE-METHOD IN PROFESSIONAL TRAINING OF FUTURE DENTISTS

**Abstract.** Implementation of innovative learning and teaching methods based on modern pedagogical technologies is essential for further effective development of higher stomatological education. At the current stage of development of the public health sphere, more and more attention is paid to patient safety, ethical issues, increasing responsibility of medical staff, high level of professional qualification and rapid evolution of procedures and methods. The above requires adaptation of educational programs and the use of all the educational instruments and technologies available in professional training of future dentists. *Objective of the study* was to conduct a theoretical analysis of scientific psychological-pedagogical, methodological and medical publications, educational-methodological activity of the Department concerning application of pedagogical technologies in the process of professional training of future dentists. *Material and methods.* Psychological-pedagogical, methodological literature, materials of scientific-practical conferences, and educational-methodological activity of the Department were analyzed. To achieve the goal, specify the essence and peculiarities of application of modern pedagogical technologies in the educational process the following

theoretical methods were used: analysis, synthesis, substantiation, comparison, systematization, pedagogical modeling, and theoretical prognosis. *Conclusions.* Application of simulation educational technologies and case-method in training of future dentists promotes formation of abilities and practical skills, professional competence, personal development, ability to possess optimal behavior and differ in the effectiveness of actions in various clinical situations. Simulation training allows you repeatedly and accurately reproduce important scenarios and algorithms of actions, and provides the opportunity to adapt the educational situation for every student. Application of modern pedagogical technologies in learning and teaching the academic discipline «Surgical Dentistry» provides controlling, teaching and educational functions. Controlling function includes assessment of student knowledge and skills, teaching function requires certain level of knowledge achieved, and educational function provides formation of essential individual qualities by learners. Effective organization of independent and classroom activities of students by the teacher promotes development of clinical thinking, which is an integral basis for the formation of qualified and successful doctors.

**Key words:** pedagogical technologies, simulation training, case-method, teacher, student, dentistry.

*Відомості про авторів:*

**Бамбуляк Андрій Васильович** – доктор медичних наук, доцент кафедри хірургічної стоматології та щелепно-лицевої хірургії закладу вищої освіти Буковинського державного медичного університету, м. Чернівці;

**Кузняк Наталя Богданівна** – доктор медичних наук, професор, завідувачка кафедри хірургічної стоматології та щелепно-лицевої хірургії закладу вищої освіти Буковинського державного медичного університету, м. Чернівці;

**Лопушняк Леся Ярославівна** – кандидат медичних наук, асистент кафедри анатомії людини ім. М. Г. Туркевича закладу вищої освіти Буковинського державного медичного університету, м. Чернівці;

**Дмитренко Роман Романович** – кандидат медичних наук, доцент кафедри хірургічної стоматології та щелепно-лицевої хірургії закладу вищої освіти Буковинського державного медичного університету, м. Чернівці.

*Information about the authors:*

**Bambuliak Andriy V.** – Doctor of Medical Sciences, Associate Professor of the Department of Surgical Dentistry and Maxillofacial Surgery of the Higher Education Institution of Bukovinian State Medical University, Chernivtsi;

**Kuzniak Natalya B.** – Doctor of Medical Sciences, Professor, Head of the Department of Surgical Dentistry and Maxillofacial Surgery of the Higher Education Institution of Bukovinian State Medical University, Chernivtsi;

**Lopushniak Lesia Ya.** – Candidate of Medical Sciences, Assistant Professor of the Department of Human Anatomy named after M. G. Turkevich Institute of Higher Education of Bukovinian State Medical University, Chernivtsi;

**Dmytrenko Roman R.** – Candidate of Medical Sciences, Associate Professor of the Department of Surgical Dentistry and Maxillofacial Surgery of the Higher Education Institution of Bukovinian State Medical University, Chernivtsi.

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Рецензент – проф. О. І. Годованець (Чернівці)