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Clinical thinking as a key professional competence: modern approaches to development

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The aim of the study *is to analyze the process of developing clinical reasoning in medical students and to evaluate the pedagogical strategies that facilitate its evolution. The article examines the primary teaching methods influencing medical personnel training and highlights the drawbacks of the traditional educational system, which prioritizes factual knowledge over the critical and analytical skills necessary for clinical decision-making in real-world scenarios.* ***Research methods*** *include an analysis of existing pedagogical strategies, such as Problem-Based Learning (PBL) and case-based methods, as well as the implementation of interactive technologies, specifically simulation platforms and virtual patients. Furthermore, the study evaluates the effectiveness of a multidisciplinary approach to education, which promotes comprehensive clinical thinking and teamwork. A comparative analysis of traditional and innovative teaching methods was conducted using various educational institutions as examples.* ***Results****. The findings indicate that traditional teaching methods, focused primarily on theoretical training, have significant limitations in fostering clinical reasoning. They fail to provide adequate development of the analytical, critical, and prognostic skills required for effective medical practice. Conversely, the use of modern pedagogical technologies, particularly PBL and case-based methods, shows a marked improvement in the quality of clinical reasoning. Students demonstrate a better ability to adapt quickly to changing clinical environments, formulate accurate diagnoses, and determine effective treatment strategies.* ***Conclusions****. The integration of digital*

technologies, the use of a multidisciplinary approach, and an emphasis on practical training significantly enhance clinical reasoning and prepare specialists capable of effective decision-making in real clinical situations. Additionally, ensuring consistent feedback is crucial for error analysis and the continuous refinement of decision-making skills.

Keywords: *clinical reasoning, medical education, Problem-Based Learning (PBL), case-based methods, interactive technologies, multidisciplinary approach, pedagogical strategies, clinical decisions, critical thinking, digital technologies.*

Клінічне мислення як ключова професійна компетентність: сучасні підходи до формування

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Анотація: ***Мета*** *дослідження полягає в аналізі процесу формування клінічного мислення у здобувачів медичної освіти та оцінці педагогічних стратегій, які сприяють його розвитку. У статті розглядаються основні методи навчання, що впливають на підготовку медичних кадрів, а також виокремлюються недоліки традиційної системи освіти, орієнтованої на засвоєння фактологічних знань, а не на розвиток критичних і аналітичних умінь, необхідних для прийняття клінічних рішень у реальних ситуаціях.* ***Методи дослідження*** *включають аналіз існуючих педагогічних стратегій, таких як проблемно орієнтоване навчання (PBL), казусні методи, а також використання інтерактивних технологій, зокрема симуляційних платформ і віртуальних пацієнтів. Крім того, проведено оцінку ефективності мультидисциплінарного підходу до навчання, що сприяє розвитку комплексного клінічного мислення та командної роботи. У роботі здійснено теоретичний аналіз традиційних і новітніх методів навчання на прикладі різних освітніх установ.* ***Результати дослідження*** *вказують на те, що традиційні методи навчання, орієнтовані на теоретичну підготовку, мають суттєві обмеження у формуванні клінічного*

мислення. Вони не забезпечують належного розвитку аналітичних, критичних та прогностичних умінь, що необхідні для ефективної роботи лікаря в умовах клінічної практики. У результаті використання новітніх педагогічних технологій, зокрема PBL та казусних методів, спостерігається значне покращення в якості клінічного мислення, здатності студентів швидко адаптуватися до змінних умов медичної практики, формулювати діагнози та визначати тактику лікування. ***Висновки****. Інтеграція цифрових технологій, використання мультидисциплінарного підходу та акцент на практичну підготовку студентів сприяють розвитку клінічного мислення та підготовці фахівців, здатних до ефективного прийняття рішень у реальних клінічних ситуаціях. Також важливим є забезпечення зворотного зв'язку для аналізу помилок і вдосконалення навичок прийняття рішень.*

Ключові слова*: клінічне мислення, медична освіта, проблемно орієнтоване навчання, казусні методи, інтерактивні технології, мультидисциплінарний підхід, педагогічні стратегії, клінічні рішення, критичне мислення, цифрові технології.*

Problem statement. In the current conditions of healthcare system development and higher medical education transformation, the issue of training doctors who are capable not only of reproducing theoretical knowledge but also of effectively applying it in complex, dynamic and often non-standard clinical situations is becoming particularly relevant [1, 2]. The central factor in such professional readiness is clinical thinking, which ensures a holistic perception of the clinical picture, a sound analysis of symptoms and syndromes, the construction of diagnostic hypotheses, the prediction of the course of the disease and the selection of the optimal treatment tactics. In this regard, the formation of clinical thinking in medical students is one of the key pedagogical problems of modern higher education [3, 4, 5, 6].

Despite the significant amount of educational information and constant updating of educational programmes, the process of professional training of future doctors often remains focused primarily on the acquisition of factual knowledge, algorithms, and standards, which is not always accompanied by the proper development of analytical, synthetic, and prognostic skills [7, 8]. Under such conditions, clinical thinking is formed fragmentarily, spontaneously or deferred to the postgraduate training stage, which can negatively affect the quality of clinical decisions and the level of professional responsibility of young specialists. This necessitates a pedagogical rethinking of approaches to the organisation of the educational process in higher medical education institutions [9].

Another important aspect of the problem is the increasing complexity of clinical practice, the integration of evidence-based medicine, the multidisciplinary nature of modern treatment and diagnostic processes, and the introduction of digital technologies into medical practice [10, 11, 12]. In such conditions, doctors must possess not only knowledge in specific disciplines, but also the ability to think critically, perform clinical analysis, and quickly adapt to new informational and professional challenges.

Analysis of recent studies and publications.

The scientific work by Huang L. et al. (2026) focuses on enhancing clinical reasoning in medical students through the integration of a virtual patient platform and mind mapping techniques [13]. The study highlights the challenges faced in clinical education, such as increased student numbers and strained clinical resources, which can impact the quality of training. Virtual patient simulations, as explored in this study, provide a solution to these challenges by offering an interactive learning environment where students can practice diagnosis and treatment. The research, conducted with 114 clinical medical students, compared a reform group using the DxR-Clinician virtual patient platform and mind mapping techniques with a conventional group taught by traditional methods. The results showed that the reform group had significantly better engagement (89.87% vs 39.06%) and clinical competence (87.67% vs 50.28%)

compared to the conventional group. However, students in the reform group reported an increased workload (81.4%) and insufficient class time (73%). Despite these challenges, the reform group demonstrated a significant improvement in clinical reasoning and learning efficiency. The study concludes that integrating virtual patient simulations and mind mapping enhances clinical reasoning and student engagement, but further optimization of workload and time allocation is needed for broader implementation.

Shevchenko V. et al. (2023) is devoted to the systematic formation and development of clinical thinking in medical students within the framework of a competency-based approach to higher medical education [14]. The authors consider clinical thinking to be a basic cognitive and professional ability of a doctor, which ensures the analysis of clinical data, diagnosis, prediction of the course of the disease, and selection of the optimal treatment tactics. It is emphasised that the formation of clinical thinking is a long and gradual process that requires not only thorough theoretical training but also targeted pedagogical influence. The work substantiates the expediency of using problem-based learning methods as a key tool for the development of clinical thinking. It is shown that problem-based, case-oriented, interactive and simulation-based learning, applied in lectures, practical classes and during independent work by students, contributes to the development of critical and problem-based thinking, analytical skills, independent decision-making and professional communication. The authors emphasise the importance of moving from informative forms of teaching to a ‘problem-to-knowledge’ model, which brings the educational process as close as possible to real clinical practice.

Ishizuka K. et al. (2025) investigated the effectiveness of team-based learning (TBL) in developing clinical thinking in medical students [15]. The study involved 92 fourth-year students who took a course on ‘Symptoms and Pathophysiology’ using the TBL methodology. The results showed a significant improvement in the quality of students' clinical thinking after the training programme. They demonstrated

improvement in areas such as formulating diagnoses, selecting appropriate examinations and tests, and the ability to critically reflect on their mistakes. Students also rated the TBL methodology as useful for developing important teamwork and clinical reasoning skills that are essential for future doctors.

Su T. et al. (2025) analysed the effectiveness of problem-based learning (PBL) in developing critical thinking among medical students [16]. A systematic review and meta-analysis of 11 studies was conducted, including both randomised controlled trials (RCTs) and non-randomised studies, particularly in countries such as China, Korea and the United States. The results showed that PBL significantly improves students' critical thinking compared to traditional teaching methods, particularly in areas such as interpretation, analysis and evaluation of medical data. This reinforces the need to integrate PBL into medical programmes to improve the development of critical thinking, which is critical for medical professionals.

Tekes E. and Tekin M. (2025) investigated the relationship between clinical reasoning, academic success, and professional commitment among medical students [17]. Professional commitment has a greater impact on the development of clinical reasoning than academic success. The authors recommend that medical programmes place greater emphasis on the development of therapeutic thinking and professionalism, which will help students better prepare for real clinical situations.

The development of clinical thinking in medical students is a pressing pedagogical issue that requires targeted educational and methodological solutions. Contemporary research demonstrates that the traditional model of education, focused on memorising facts and algorithms, does not ensure the sustainable development of analytical, synthetic, and diagnostic skills necessary for effective clinical practice. Instead, interactive educational technologies, such as problem-based learning, team learning, and modelling real clinical situations, contribute to a significant strengthening of competencies related to critical thinking, reasoned decision-making, and adaptation to dynamic professional challenges. It is important to effectively combine theoretical

training with the resolution of clinical cases that simulate complex real-life situations, as well as to use feedback to reflect on the results of decision-making. Effective development of clinical thinking is only possible through the systematic combination of active educational strategies that promote the development of independence, critical analysis of information, and a creative approach to solving professional problems [18, 19, 20, 21, 22].

Identification of previously unresolved parts of the overall problem. Despite significant progress in the field of medical training, a number of aspects related to the development of clinical thinking remain under-researched and require further study. One such problem is the lack of a clear methodology for the effective integration of theoretical knowledge and practical skills in a real clinical environment. Teaching strategies that focus on developing students' analytical and critical thinking skills often fail to take into account the modern challenges of medical practice, such as the integration of the latest digital technologies and a multidisciplinary approach to the treatment and diagnostic process. In addition, it is important to understand the specifics of clinical thinking development at the postgraduate training stages, as a significant proportion of specialists develop these skills on the job.

Effective teaching methods and the use of innovative educational technologies that can significantly improve the level of clinical thinking in medical education also remain under-researched. There is also no unified system for assessing and monitoring the development of clinical thinking that could serve as a guideline for teachers and educational institution administrators.

Formulation of the article's objectives

The aim of the article is to study the process of clinical thinking formation in medical students and to analyse pedagogical strategies aimed at its development. The main task is to study existing pedagogical strategies and teaching methods that contribute to the development of clinical thinking; identify shortcomings in traditional approaches to medical training, particularly in terms of the development of analytical

and critical skills; to assess the possibilities of integrating the latest technologies, such as digital tools and multidisciplinary approaches, into the pedagogical process.

These objectives reflect the relevance of the research topic and aim to make a concrete contribution to improving the training of future doctors, taking into account the current challenges in the field of healthcare and education.

Presentation of the main research material.

The importance of developing clinical thinking in students is critical for training highly qualified specialists capable of making informed decisions in real clinical practice [23]. Traditional teaching methods, although they provide students with the necessary theoretical foundation, do not always meet the requirements of modern medicine, which requires the ability to quickly analyse situations, predict possible outcomes, and make decisions in conditions of uncertainty. Given the rapid development of medical technologies and changes in the organisation of medical care, teaching strategies should be focused on integrating theoretical knowledge with practical skills, allowing students to adapt to the real conditions of clinical work. Reviewing existing approaches to teaching and their effectiveness will help to formulate recommendations for improving teaching methods in medical higher education institutions.

Traditional teaching methods, such as lectures and seminars, remain the basis of medical education, but their application is limited to a theoretical approach, which does not allow students to effectively develop clinical thinking [24, 25]. Lecture-based teaching provides basic theoretical knowledge but does not include enough practical tasks that allow students to develop the analytical skills and critical thinking necessary for working in complex clinical situations. As a result, traditional teaching methods may be insufficient to prepare students for real clinical cases.

Problem-based learning is one of the most effective pedagogical approaches for developing clinical thinking. This method gives students the opportunity to work with real clinical cases, helping them to independently seek solutions, form hypotheses and

draw conclusions [26]. PBL significantly improves the ability to critically analyse situations and promotes the development of teamwork skills, which are important for future doctors. The use of this approach contributes to the formation of the ability to integrate theoretical knowledge with practical skills.

Case-based methods, which involve detailed analysis of specific clinical cases, allow students to immerse themselves in real clinical situations, which helps develop important skills: diagnosis, decision-making in complex conditions, and predicting the course of the disease. This method allows students not only to apply theoretical knowledge in practice, but also to develop the ability to respond quickly to changing circumstances. However, to achieve maximum effect, it is important that case-based learning is interactive, i.e. students are given the opportunity to actively discuss and choose the most reasonable strategies.

In modern conditions, interactive technologies are actively developing, allowing students to practise in conditions close to real life [27, 28, 29]. Simulation trainers and virtual patients enable students not only to acquire practical skills but also to improve their clinical thinking [30, 31]. The use of such technologies creates a safe environment for mistakes, allowing students to analyse their actions and correct errors without risk to patients. This prepares future doctors for real clinical situations where quick and informed decisions are critical.

Multidisciplinary education promotes the development of clinical thinking, as it allows students to interact with specialists from various medical disciplines. This approach is important for developing the ability to comprehensively analyse clinical cases, where the involvement of several specialists can influence the quality of decisions made. In addition, a multidisciplinary approach promotes the development of communication skills that are important for teamwork in real clinical practice [32, 33].

Traditional approaches to medical training, while providing basic theoretical training, have significant shortcomings in the development of the analytical and critical

skills necessary for effective clinical practice. One of the main problems is the excessive emphasis on theoretical training, which often lacks sufficient connection to real clinical situations. Traditional methods, such as lectures and seminars, provide students with large amounts of information but do not allow them to develop the ability to apply this knowledge in practice in the uncertain conditions characteristic of clinical work. This approach can result in students being unable to correctly assess a patient's symptoms, construct a correct diagnostic hypothesis, or quickly adapt to changes in the clinical situation, which is important for effective decision-making.

Another serious drawback of the traditional system is the lack of sufficient emphasis on the development of critical thinking. Critical thinking involves the ability to analyse, evaluate and integrate diverse data to make the most informed decisions, which is the basis of clinical practice. However, in traditional medical education, learning often boils down to memorising facts, standard algorithms and clinical protocols, which does not contribute to the development of the necessary analytical skills. Students who are unable to independently formulate diagnostic hypotheses or adapt their approach to a specific patient may find themselves in a situation where their knowledge is insufficient to make complex clinical decisions [34].

Another significant limitation is the insufficient integration of interdisciplinary knowledge in traditional curricula. Modern medical practice requires doctors to be able to integrate knowledge from different disciplines, as clinical cases are often complex and require a multidisciplinary approach. However, in traditional curricula, individual disciplines are often taught in isolation, limiting students' ability to understand the interrelationships between different medical aspects and to apply a comprehensive approach to solving clinical problems. The lack of an interdisciplinary approach in education not only reduces the quality of training for doctors, but can also affect their ability to work in teams where it is necessary to take into account the opinions of specialists from different fields of medicine.

Finally, modern technologies such as simulation trainers and virtual platforms for analysing clinical cases are not always integrated into traditional training programmes, which limits students' opportunities to immerse themselves deeply in the practical aspects of medical work [35]. These tools create a safe learning environment where students can develop their analytical and critical thinking skills without risk to patients by conducting numerous practical exercises and analysing a variety of clinical scenarios.

The integration of the latest technologies into medical education opens up new opportunities for the development of clinical thinking in students, as it allows the creation of an environment that is as close as possible to real clinical practice. The use of digital tools such as simulation platforms, virtual patients, and interactive simulators allows students to work with realistic clinical cases without risk to patients. These technologies not only help to improve practical skills, but also develop analytical thinking, as students have the opportunity to re-analyse their actions, learn from their mistakes and seek alternative solutions in a simulated environment.

In addition to technological innovations, an important aspect is the integration of multidisciplinary approaches into the teaching process. Modern medicine requires close cooperation between specialists from different disciplines, which allows for a better assessment of the patient's condition from different points of view and the formulation of a comprehensive treatment plan. The inclusion of multidisciplinary teams in the educational process allows students to gain an understanding of teamwork, where each participant contributes their expertise and everyone works together to solve a specific clinical problem. It also promotes the development of communication skills, which are important for effective interaction between healthcare professionals and patients.

Integrating these technologies and approaches into the learning process creates a more effective learning environment that not only develops clinical thinking but also prepares students for the real-world challenges they may face in their future

professional careers. At the same time, it is important that teachers are prepared to adapt new technologies and methodologies to the specific conditions of the educational process and ensure continuous monitoring of their effectiveness. The introduction of the latest technologies and multidisciplinary approaches into the teaching process is a necessary step towards improving the quality of medical education and developing clinical thinking in students. These innovations open up new horizons for the development of practical skills and analytical thinking, which are important for the professional training of future doctors.

Conclusions. Traditional teaching methods do not always ensure sufficient development of clinical thinking in medical students due to their focus on theoretical knowledge without proper integration of practical skills. To improve the situation, innovative pedagogical strategies such as problem-based learning, case-based methods, and the use of interactive technologies (simulators, virtual patients) that bring learning closer to real clinical conditions may be considered. It is also important to integrate multidisciplinary approaches and ensure constant feedback to help develop critical thinking and decision-making skills.

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