

<https://doi.org/10.34142/2709-7986.2026.31.2.18>

INTEGRATING CASE-BASED LEARNING INTO PRE-CLINICAL EDUCATION: FIRST-YEAR MEDICAL STUDENTS' FEEDBACK

ІНТЕГРАЦІЯ НАВЧАННЯ НА ОСНОВІ КЛІНІЧНИХ ВИПАДКІВ У ДОКЛІНІЧНУ
ОСВІТУ: ВІДГУКИ СТУДЕНТІВ-ПЕРШОКУРСНИКІВ

Received: August 16, 2026

Accepted: September 17, 2026

Published: October 07, 2026

**Kseniia HAVRYLENKO¹, Oleksandr PRYKHODKO²,
Oleksandra SHEMETENKO³, & Hanna MALIEIEVA⁴**



¹ Senior Lecturer, Department of Medical Biology, Parasitology and Genetics, Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.

✉ E-mail: gavrilenko2525@gmail.com

ORCID <https://orcid.org/0000-0002-3883-9069>



² Ph.D., DSc, Associate Professor, Head of the Department of Medical Biology, Parasitology and Genetics, Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.

✉ E-mail: Prykhodko.O.B@zsmu.edu.ua

ORCID <https://orcid.org/0000-0002-1974-8188>



³ Assistant, Department of Medical Biology, Parasitology and Genetics, Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.

✉ E-mail: alexandraandreeva8@gmail.com

ORCID <https://orcid.org/0000-0001-6084-537X>

Integrating case-based learning into pre-clinical education: First-year medical students' feedback © 2026 by Kseniia HAVRYLENKO, Oleksandr PRYKHODKO, Oleksandra SHEMETENKO, & Hanna MALIEIEVA is licensed under **Creative Commons Attribution-NonCommercial 4.0 International**. To view a copy of the license, visit <http://creativecommons.org/licenses/by-nc/4.0/>



* Ph.D., Senior Lecturer, Department of Medical Biology, Parasitology and Genetics, Zaporizhzhia State Medical and Pharmaceutical University, Zaporizhzhia, Ukraine.

✉ E-mail: g.maleeva.1985@gmail.com

id <https://orcid.org/0000-0001-6106-4532>

How to Cite this Article (APA Style):

Havrylenko, K., Prykhodko, O., Shemetenko, O., & Malieieva, H. (2026). Integrating case-based learning into pre-clinical education: First-year medical students' feedback. *Educational Challenges*, 31(2), 295–304. <https://doi.org/10.34142/2709-7986.2026.31.2.18>

ABSTRACT

Purpose. The study aims to assess first-year medical students' subjective perceptions of the effectiveness and prospects of applying the case-based learning (CBL) method; determine its impact on increasing interest in the study of medical biology and on students' understanding of the link between fundamental disciplines and practical medicine; analyse the quality of learning of specialist material from the 'Medical Parasitology' module.

Methodology. A comprehensive study was conducted during the second semester of the 2025–2026 academic year at the Department of Medical Biology, Parasitology and Genetics, Zaporizhzhia State Medical and Pharmaceutical University during the final sessions on the modules 'Medical Protozoology' and 'Medical Helminthology'. The survey involved 100 first-year students in field of study 22 'Healthcare' (specialising in 'Medicine', 'Paediatrics' and 'Dentistry'). The work on adaptive situational tasks was organised in small academic groups (13–15 students) with the lecturer acting as a facilitator. Particular emphasis was placed on analysing the key terms of the 'KROK-1' licensing examination. Data were collected via an anonymous questionnaire in Google Forms using a 5-point Likert scale, followed by statistical analysis in Microsoft Excel.

Results. The implementation of the CBL method proved highly well-received amongst first-year students: overall, more than 90% of the responses were positive regarding its impact on the development of clinical reasoning, the acquisition of knowledge

Мета – оцінити суб'єктивне сприйняття студентами першого курсу медичного університету ефективності та перспектив застосування методу навчання на основі клінічних випадків (Case-Based Learning — CBL); визначити його вплив на підвищення інтересу до вивчення медичної біології та усвідомлення зв'язку фундаментальних дисциплін із практичною медициною; проаналізувати якість засвоєння фахового матеріалу з розділу «Медична паразитологія».

Методологія. Комплексне дослідження було проведено протягом II семестру 2025-2026 н.р. на кафедрі медбіології, паразитології та генетики Запорізького державного медико-фармацевтичного університету під час підсумкових занять із розділів «Медична протозоологія» та «Медична гельмінтологія». У опитуванні взяли участь 100 студентів-першокурсників галузі знань 22 «Охорона здоров'я» (спеціальності «Медицина», «Педіатрія», «Стоматологія»). Робота над адаптивними ситуаційними задачами організовувалась в малих академічних групах (13-15 студентів), де викладач виступав фасилітатором. Окремий акцент робився на аналіз ключових слів ліцензійного іспиту «КРОК-1». Дані збиралися за допомогою анонімного анкетування в Google Forms за 5-бальною шкалою Лайкерта з подальшою статистичною обробкою даних в Microsoft Excel.

Результати. Упровадження методу CBL продемонструвало високу сприйнятливність серед першокурсників: сумарно понад 90% позитивних оцінок зафіксовано щодо його впливу на розвиток клінічного мислення, засвоєння матеріалу в команді та

through teamwork, and an increased interest in the subject. The overwhelming majority confirmed that case analysis helped them to memorise the life cycles of parasites (98%), understand pathogenesis (94%), improve their skills in identifying pathogens (95%), and recognise the importance of the epidemiological history (90%). Students identified the analysis of routes of infection (51%) and differential diagnosis (38%) as the most informative stages. The majority of the respondents (94%) noted a sense of psychological comfort whilst adapting to the role of a 'decision-making doctor'. Compared with other approaches, 83% of the students chose CBL as the most effective tool for mastering complex topics, whilst 92% of the respondents were in favour of permanently replacing some traditional oral examinations with the analysis of case studies.

Conclusions. The study demonstrated a high level of receptiveness to the Case-Based Learning (CBL) method among first-year students, with the majority recognizing case discussions as the most effective tool for mastering complex topics and supporting its systematic integration into the curriculum. By immersing students in real-life and adapted clinical scenarios, the method successfully overcame the perception of medical biology as a purely theoretical discipline, helping students establish a clear link between basic biology and their future medical practice. The application of CBL ensured a deeper analytical understanding of the course material, facilitating more effective retention of parasite life cycles, comprehension of disease pathogenesis, acquisition of pathogen identification skills, and appreciation of the role of epidemiological history taking. These findings justify the broader implementation of CBL in pre-clinical medical education.

Key words: active learning methods, case-based learning (CBL), clinical thinking, learning methods, medical education, medical students.

зростання інтересу до дисципліни. Абсолютна більшість підтвердила, що розбір кейсів сприяв запам'ятовуванню життєвих циклів паразитів (98%), розуміння патогенезу (94%), покращенню навичок ідентифікації збудників (95%) та усвідомленню важливості епідеміологічного анамнезу (90%). Найбільш пізнавальними етапами студенти визначили аналіз шляхів зараження (51%) та диференційну діагностику (38%). Більшість респондентів (94%) зазначили психологічний комфорт під час адаптації до ролі «лікаря, який приймає рішення». Порівняно з іншими підходами 83% студентів обрали CBL як найефективніший інструмент для засвоєння складних тем, а 92% респондентів висловилися за постійну заміну частини традиційних усних опитувань розбором ситуаційних задач.

Висновки. Дослідження засвідчило високий рівень сприйнятливості методу Case-Based Learning (CBL) студентами-першокурсниками, більшість з яких визнали розбір ситуаційних задач найефективнішим інструментом для опанування складних тем та підтримали його системне впровадження у освітній процес. Завдяки зануренню в реальні та адаптовані клінічні сценарії метод успішно подолав сприйняття медичної біології як суто теоретичної дисципліни, сформувавши у студентів усвідомлення безпосереднього зв'язку між фундаментальною біологією та майбутньою медичною практикою. Застосування CBL забезпечило глибше аналітичне засвоєння матеріалу, спричинивши ефективне запам'ятовування життєвих циклів паразитів, розуміння патогенезу захворювань, опанування навичками ідентифікації збудників та усвідомлення важливості збору епідеміологічного анамнезу. Отримані результати обґрунтовують доцільність широкого впровадження CBL у викладання доклінічних дисциплін.

Key words: активне навчання, клінічне мислення, медична освіта, метод клінічних кейсів, методи навчання, студенти-медики.

INTRODUCTION

The increasing demands placed on the training of future specialists require a shift in pedagogical approaches, moving away from traditional teaching methods towards active learning methods (Gruppen, 2017; McCoy et al., 2018). These methods include: case-based learning, experiential learning, peer problem-solving, project-based learning and mind maps, which we have already used in our lessons (Havrylenko et al., 2023; Havrylenko et al., 2026). Among other things, lecturers also use gamification and multimedia (McCoy et al., 2016; Popovych et al., 2024), including the use of virtual patients (Moore & Montejo, 2021).

Whilst the introduction of active learning methods in higher medical education institutions has already become standard practice, maintaining high levels of academic motivation among first-year students whilst they are studying non-clinical subjects remains a significant challenge. First-year students tend to perceive fundamental disciplines, particularly medical biology, as purely theoretical, “school-like” subjects that have no direct relevance to their future profession as doctors. In our view, the reason lies in the lack of a clear link between fundamental biological theory and actual clinical practice, to which first-year students do not yet have access due to the structure of the curriculum.

Medical parasitology plays an important role within the field of medical biology. On the one hand, it is a deeply theoretical discipline; on the other, it forms the foundation upon which students will directly build during their studies in the higher-level, clinical departments (infectious diseases, internal medicine, paediatrics, etc.). In view of this, there is an urgent need to introduce innovative methods capable of demonstrating to medical students the practical significance of fundamental science as early as their first year.

One of the most effective tools for bridging this gap is case-based learning (CBL) (McLean, 2016). The introduction of the clinical case study method into the study of medical parasitology makes it possible to transform dry biological facts – such as the life cycles of parasites or their morphological characteristics – into a process of solving a real-life diagnostic problem. Also, analysing case studies enables students to integrate their work with the key terms used in the test questions of the “KROK-1” (an exam in general scientific disciplines, which is taken by applicants for medical and pharmaceutical education after studying the main fundamental disciplines) unified state qualification examination. This not only increases student engagement but also lays a solid foundation for their future successful certification.

Despite the theoretical advantages of CBL, practical experience of its application specifically in the first year – when students haven’t gained clinical experience yet – warrants detailed study. Understanding exactly how first-year students perceive this teaching format, whether it changes their attitude towards the fundamental sciences, and how it affects their readiness for further study is critically important for the subsequent educational process.

The aim of the study was to assess first-year medical students’ subjective perceptions of the effectiveness and prospects of using the case-based learning (CBL) method, determine its impact on increasing interest in the study of medical biology and awareness of the link between fundamental disciplines and practical medicine, and analyse the quality of learning of specialist material from the “Parasitology” module.

METHODOLOGY

Classes using the Case-Based Learning method were held at the Department of Medical Biology, Parasitology and Genetics at Zaporizhzhia Medical and Pharmaceutical University during the second semester of the 2025–2026 academic year. The CBL method was used during the final classes for the modules “Medical Protozoology” and “Medical Helminthology”. The study involved 100 first-year students from medical faculties within field of study 22 “Healthcare”, who were studying for the specialisms 222 “Medicine”, 228 “Paediatrics” and 221 “Dentistry”.

When compiling the case studies, adapted clinical cases were used, which included patients’ complaints, medical histories and laboratory test results. The materials were provided to students in either paper or electronic format, depending on their chosen mode of study.

When developing the case studies, the main focus was on combining fundamental biological knowledge with clinical practice, helping students to develop diagnostic thinking skills, and fostering their analytical abilities. A particular emphasis during work on situational tasks was placed on identifying and analysing the key terms featured in the test questions of the “KROK-1” licensing examination.

The work on the case studies was organised directly within the academic groups. The lecturer acted as a facilitator: guiding the discussion, ensuring that the situation analysis procedure was followed, encouraging active discussion and providing concluding feedback.

A final anonymous survey was conducted to assess students' perceptions of the CBL method, their understanding of the course material and changes in their level of motivation to study medical biology. Data were collected using the Google Forms platform, employing a 5-point Likert scale (ranging from “strongly disagree” to “strongly agree”). Some questions were open-ended. The results were analysed using descriptive statistics in Microsoft Excel.

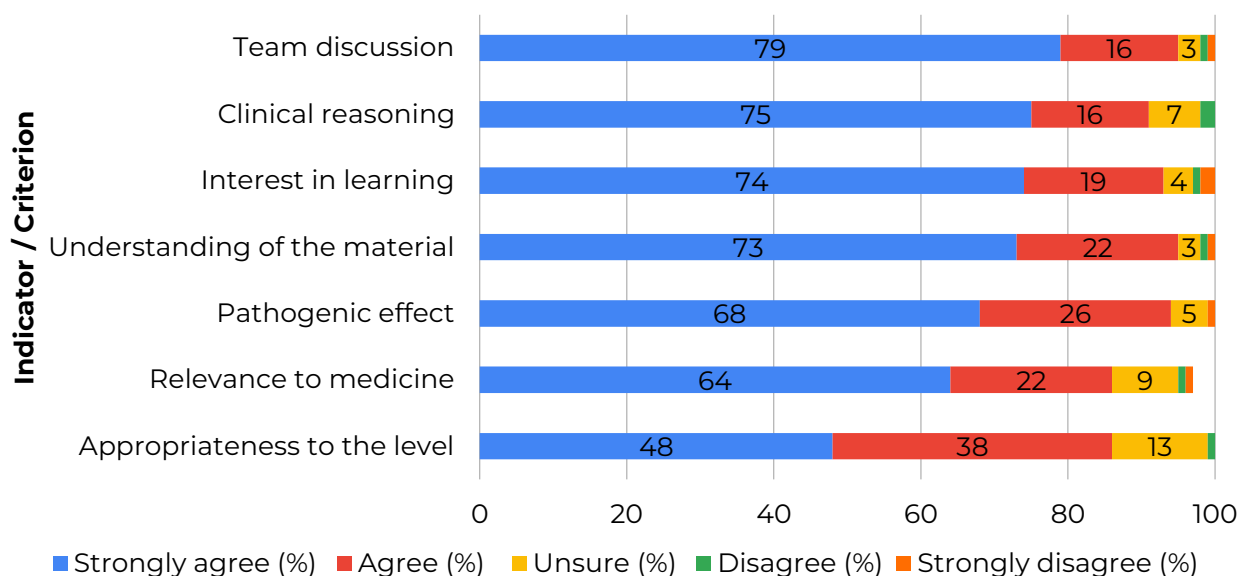
RESULTS

Respondents who voluntarily agreed to participate in the survey were guaranteed complete anonymity. Analysis of the data from the final anonymous survey (N = 100) revealed that first-year students gave a high subjective rating to the effectiveness of implementing the Case-Based Learning method in the medical biology course (the sections “Medical Protozoology” and “Medical Helminthology”).

An analysis of students' subjective assessments revealed an overwhelming majority of positive responses (“strongly agree” and “agree”) across all criteria examined (fig. 1). The highest level of positive feedback was recorded regarding the impact of case studies on the assimilation of material during group discussions, the development of clinical reasoning, and an increase in overall interest in the subject (a total of over 90% positive ratings). At the same time, the least pronounced though still predominantly positive effect was observed in the assessment of how well the level of difficulty of the case studies matched the students' basic knowledge: 13% of the respondents rated this match as moderate. Students rated themselves as feeling ‘quite comfortable’ and ‘very comfortable’ in the role of a ‘decision-making doctor’ at 45% and 49% respectively.

Figure 1

Student survey Likert analysis (%)



Within the scope of the study, particular attention was paid to analysing how the CBL method influences the acquisition of specialist knowledge in parasitology.

The overwhelming majority of the respondents (98%) confirmed that analysing the case studies had helped them to understand and remember the life cycles of parasites (compared with 2% of the students who answered in the negative).

68% rated the usefulness of the case studies in understanding pathogenesis as “very high”, 26% as “good”, 5% as “moderate” and 1% as “none”.

95% of the respondents noted an improvement in their own parasite identification skills, whilst only 5% did not notice any changes.

Among the stages and aspects of case analysis, the students identified the following as the most informative for them: studying and analysing routes of transmission of parasitic infections – 51%; conducting differential diagnosis – 38%; justifying the choice of biomaterial for laboratory diagnosis – 11%.

Furthermore, the case studies proved to be an effective tool for understanding the importance of taking an epidemiological history: 55% stated that analysing the scenarios “helped a lot” in understanding this, 35% said it “helped very much”, 9% said it “helped moderately” and 1% said it “helped little”.

The use of case studies enabled students to adapt safely to professional practice. When taking on the role of a “decision-making doctor” within the case study, 49% of students felt “very comfortable”, 45% felt “quite comfortable”, 5% felt “moderately comfortable” and 1% felt “not very comfortable”.

When comparing different teaching approaches, the students identified the analysis of clinical cases as the most effective tool for mastering complex topics. It is noteworthy that only 7% of those surveyed preferred traditional independent study of the literature.

The high level of acceptance of this method meant that 92% of the respondents considered it appropriate to replace some traditional surveys with the analysis of clinical cases on an ongoing basis, whilst only 8% opposed this initiative.

The questionnaire also included three open-ended questions, one of which was: ‘What were the greatest difficulties you encountered whilst working on the case studies?’ Some students, in answering this question, noted that a drawback of this method is the inability to ask the patient additional questions. This comment highlights the high level of engagement among first-year students, who are already beginning to think like practising doctors but lack a live dialogue with the patient. We suggest that this issue be addressed through the lecturer’s role. The lecturer can present the case in instalments, simulating a real patient’s response. However, we would also like to point out that the aim of introducing the CBL method in the first year is to teach students clinical reasoning and how to interpret existing data.

DISCUSSION

In the literature we have reviewed, the use of the clinical case method in the study of medical and biological subjects has received largely positive feedback, although there are also some negative comments. For instance, Nicklen et al. (2016), in their research into the role of the clinical case method amongst physiotherapy students in both face-to-face and distance learning, noted a certain degree of dissatisfaction amongst the latter. According to the authors, the negative feedback may have been due to technical difficulties: slow internet connections and frequent disconnections hindered discussion and dampened students’ enthusiasm for using this method. Consequently, negative

feedback was primarily provided by distance-learning students, whilst on-campus students responded positively (Nicklen et al., 2016). Interestingly, no technical problems were reported by the distance-learning students at our university.

Gasim et al. (2024) report that final-year medical students responded positively to CBL-based teaching. The students noted the positive impact of this method on improving academic performance, clinical reasoning, group work, memory and information retrieval, which is consistent with the findings of our study. Some facilitators caused dissatisfaction amongst students; according to the respondents, these facilitators provided only brief instructions, and the groups in which the students worked were too large (20) (Gasim et al., 2024). Unlike our colleagues, however, we conducted sessions in smaller groups (13–15), and the role of facilitators was played by lecturers, who ensured adherence to the situation analysis algorithm, encouraged discussion, monitored the timing and provided summary feedback.

De Oliveira Carvalho et al. (2024) report similar findings in their studies. First-year students at Brazilian university used the CBL method whilst studying the subject 'Human Physiology'. Respondents noted that the CBL method encourages the integration of knowledge, provides a positive experience of working with the methodology, is student-centred, fosters significant student participation in active case discussions, and teaches students to work as a team (De Oliveira Carvalho et al., 2024).

Makwana et al. (2025) compared case-based learning (CBL) with traditional teaching methods to improve the analysis and interpretation of electrocardiograms (ECGs) among undergraduate students of medicine and surgery. Statistical analysis showed higher scores immediately following testing with the CBL method than with traditional teaching methods, which included lectures and textbook-based learning. The case-based learning method proved to be more effective in improving understanding of ECG rhythm abnormalities and waveforms (Makwana et al., 2025).

In their study, Bashir et al. (2024) assessed how the presentation of medical case studies influenced the performance of biomedical trainees. The study comprised three stages. In the first stage, the authors conducted an online survey to determine the students' current understanding of the medical case presentation method. In the second stage, a session was held aimed at helping students understand the benefits of this method. Students were required to discuss the results of the patient's laboratory tests, in addition to their treatment. Students were also required to highlight, where appropriate, the role of the multidisciplinary team in patient care. Following this, over a period of six weeks, the students worked on creating their presentations. In the third stage, the students delivered a presentation to their group and answered questions.

Finally, students were asked to complete a post-intervention questionnaire to assess whether their perceptions and understanding of clinical case presentations had changed. The study results demonstrated an increase in students' confidence in understanding clinical cases, linking laboratory results to diseases, and presenting clinical cases to their peers. The respondents also reported an improvement in their ability to verbally communicate scientific concepts and highlighted the role of this method in developing critical thinking. Furthermore, the presentation of clinical cases deepened the students' understanding of interdisciplinary links, and they suggested incorporating this method into the curriculum (Bashir et al., 2024).

Positive feedback was also provided by biochemistry students and first-year students on pre-clinical medical programmes. The study by Zhou et al. (2026) notes that integrating the CBL method into teaching activities, in combination with mind maps, significantly

improved learning outcomes in biochemistry. Students reported improvements in their logical thinking skills and in bridging the gap between fundamental science and clinical practice (Zhou et al., 2026), which is consistent with the feedback from our students. The research by Slieman and Camarata (2019) also showed that student groups integrated fundamental scientific and clinical concepts more deeply as a result of using the CBL method and concept maps (Slieman & Camarata, 2019).

The effectiveness of the case study method and other interactive approaches has been demonstrated not only by international experience, but also by their successful implementation in Ukrainian medical, pharmaceutical, and nursing education. An analysis of the research shows that the use of situational exercises, simulations and discussions of real clinical cases allows for the harmonious integration of theoretical knowledge with practical skills. This helps to develop students' clinical thinking, increases their motivation to learn and prepares them for work in the complex modern conditions of the healthcare system. These methods are actively used at Danylo Halytsky Lviv National Medical University (Zaiachkivska, 2018; Chang et al., 2024) and the O.O. Bogomolets National Medical University (Mykhailova, 2026). Kharkiv National Medical University (Zhuravlova & Lopina, 2019), Zaporizhzhia State Medical and Pharmaceutical University (Ivanchenko et al., 2026), and others.

CONCLUSIONS

1. The results of the study demonstrated a high level of receptiveness to the CBL method amongst first-year students. The majority of respondents recognised the analysis of case studies as the most effective tool for tackling complex topics and supported its introduction into the teaching process.
2. By immersing students in real-life and adaptive clinical scenarios, the method successfully overcame the perception of medical biology as a purely theoretical discipline, helping students to see the link between biology and their future medical practice.
3. The use of case-based learning ensured a deeper analytical understanding of the material and facilitated more effective memorisation of parasite life cycles, an understanding of the pathogenesis of diseases, the acquisition of parasite identification skills, and an appreciation of the role of taking a patient's medical history.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

FUNDING

The authors declare that this study received no specific financial support.

ARTIFICIAL INTELLIGENCE STATEMENT

No artificial intelligence tools were used in the preparation of this manuscript.

REFERENCES

- Bashir, A., Dudley, K., Rana, K. S., Wilkins, K., & Pallett, R. (2024). Measuring the impact of incorporating case study presentations into applied biomedical science placement workshops for trainee biomedical scientists. *British Journal of Biomedical Science*, 81, 12017. <https://doi.org/10.3389/bjbs.2024.12017>

- De Oliveira Carvalho, R., Marques, C. M., Mendes, J. O., Fillmann, H. S., & Mello, R. G. (2024). Perception of medical students on the use of Case-Based Collaborative Learning (CBCL) in the human physiology course. *Educación Médica*, 25(5), 100946. <https://doi.org/10.1016/j.edumed.2024.100946>
- Chang, Y. I., Kovalchuk, I., Savytska, M., & Zayachkivska, O. (2024). Building active learning in medical education: how to bridge vision with real practice? *Proceedings of the Shevchenko Scientific Society. Medical Sciences*, 76(2), 1–7. <https://doi.org/10.25040/ntsh2024.02.25>
- Gasim, M.S., Ibrahim, M.H., Abushama, W.A., Hamed, I.M., & Ali, I.A. (2024). Medical students' perceptions towards implementing case-based learning in the clinical teaching and clerkship training. *BMC medical education*, 24(1), 200. <https://doi.org/10.1186/s12909-024-05183-x>
- Gruppen, L.D. (2017). Clinical reasoning: Defining it, teaching it, assessing it, studying it. *The western journal of emergency medicine*, 18(1), 4–7. <https://doi.org/10.5811/westjem.2016.11.33191>
- Havrylenko, K., Prykhodko, O., & Shemetenko, O. (2023). Zastosuvannia mentalnykh kart yak zasobu vizualizatsii ta katehoryzatsii poniat na zaniattiakh medychnoi biolohii [Application of mind maps as a means of visualization and categorization of concepts in medical biology classes]. *Ukrainskyi Pedagogichnyi zhurnal – Ukrainian Educational Journal*, 3, 227–234. <https://doi.org/10.32405/2411-1317-2023-3-227-234> [in Ukrainian].
- Havrylenko, K., Popovych, A., Shemetenko, O., & Yemets, T. (2026). Effectiveness of using mind maps in the learning process: Teachers' perspectives and students' assessments. *Educational Challenges*, 31(1), 318–328. <https://doi.org/10.34142/2709-7986.2026.31.1.22>
- Ivanchenko, O. Z., Melnikova, O. Z., Lurie, K. I., Mikaelian, H. R., & Lukina, H. M. (2026). Metod klinichnoho keisu yak instrument formuvannia profesiinoho myslennia studentiv medychnykh fakultetiv pry vyvchenni fundamentalnykh dystsyplin [The clinical case method as a tool for forming professional thinking of medical students when studying fundamental disciplines]. *Aktualni problemy suchasnoi medytsyny: Visnyk Ukrainiskoi medychnoi stomatolohichnoi akademii – Aktualni Problemy Suchasnoi Medytsyny Visnyk Ukrainiskoi Medychnoi Stomatolohichnoi Akademii*, 26(2), 251–256. <https://doi.org/10.31718/2077-1096.26.2.251> [in Ukrainian].
- Makwana, S., Sarvaiya, H., & Dalsaniya, V. (2025). A Comparative study of case-based learning (CBL) versus the traditional teaching method for enhanced analysis and interpretation of electrocardiogram (ECG) among medical students. *Cureus*, 17(2), e79587. <https://doi.org/10.7759/cureus.79587>
- McCoy, L., Lewis, J. H., & Dalton, D. (2016). Gamification and multimedia for medical education: A Landscape review. *The Journal of the American Osteopathic Association*, 116(1), 22–34. <https://doi.org/10.7556/jaoa.2016.003>
- McCoy, L., Pettit, R. K., Kellar, C., & Morgan, C. (2018). Tracking active learning in the medical school curriculum: A learning-centered approach. *Journal of medical education and curricular development*, 5, 1–9. <https://doi.org/10.1177/2382120518765135>
- McLean, S. F. (2016). Case-Based Learning and its Application in Medical and Health-Care Fields: A Review of Worldwide Literature. *Journal of medical education and curricular development*, 3, 39–49. <https://doi.org/10.4137/JMECD.S20377>

- Moore, J., & Montejo, L. (2021). Case-based learning: Facilitating nurse practitioner clinical learning with virtual patient cases. *Journal of the American Association of Nurse Practitioners*, 34(1), 129–134. <https://doi.org/10.1097/JXX.0000000000000560>
- Mykhailova, A. H. (2026). Keis-metod yak zasib formuvannia doslidnytskykh i klinichnykh kompetentnostei pry vyvchenni Molekuliarnoi biolohii [Case-based learning as a tool for developing research and clinical competencies in molecular biology education]. *Medytsyna ta farmatsiia: osviti dyskursy – Medicine and pharmacy: educational discourses*, 1, 32–37. <https://doi.org/10.32782/eddiscourses/2026-1-5> [in Ukrainian].
- Nicklen, P., Keating, J., Paynter, S., Storr, M., & Maloney, S. (2016). Remote-online case-based learning: A comparison of remote-online and face-to-face, case-based learning – a randomized controlled trial. *Education for Health*, 29(3), 195–202. <https://doi.org/10.4103/1357-6283.204213>
- Popovych, A.P., Prykhodko, O.B., Yemets, T.I., Havrylenko, K.V., & Malieieva, H.Yu. (2024). Zastosuvannia innovatsiinykh tekhnolohii u vykladanni predmetu “Medychna biolohiia” [Application of innovative technologies in teaching the subject “Medical biology”]. *Medytsyna ta farmatsiia: osviti dyskursy – Medicine and pharmacy: educational discourses*, 4, 119–122. <https://doi.org/10.32782/eddiscourses/2024-4-18> [in Ukrainian].
- Slieman, T. A., & Camarata, T. (2019). Case-Based Group Learning Using Concept Maps to Achieve Multiple Educational Objectives and Behavioral Outcomes. *Journal of Medical Education and Curricular Development*, 6. <https://doi.org/10.1177/238212051987251>
- Zaiachkivska, O. (2018). Tsyfrovi tekhnolohii u navchanni studentiv-medykiv [Digital technology in teaching medical students]. Pratsi Naukovoho tovarystva imeni Shevchenka. *Medychni nauky – Proceedings of the Shevchenko Scientific Society Medical Sciences*, 52(1), 57–64. <https://doi.org/10.25040/ntsh2018.01.06> [in Ukrainian].
- Zhou, T., Wang, H., & Jiang, X. (2026). Integrating Case-Based Learning (CBL) and Concept Mapping (CM) enhances learning outcomes in medical biochemistry. *BMC Medical Education*, 26(1). <https://doi.org/10.1186/s12909-026-08906-4>
- Zhuravlova, L. V., & Lopina, N. A. (2019). *Praktychno-orientovanyi keis-metod navchannia v systemi bezperervnoi medychnoi osvity na osnovi informatsiino-osvitnikh vebtekhnolohii yak sposib symulatsiinoho navchannia: Navch.-metod. posibnyk dlia vykladachiv med. osvitnikh zakladiv* [Practice-oriented case-based learning method within the continuing medical education system, utilizing web-based information and educational technologies as a form of simulation-based training]. KhNMU. <https://repo.knmu.edu.ua/handle/123456789/23802> [in Ukrainian].