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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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ARTIFICIAL INTELLIGENCE-ASSISTED TEACHING MODEL AS A STRATEGY TO ENHANCE CORE COMPETENCIES OF CLINICAL MEDICINE UNDERGRADUATES: A SCIENTIFIC HYPOTHESIS

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Abstract.

Undergraduate clinical education is currently facing severe challenges, including the widening gap between theoretical knowledge and clinical practice, the explosive growth of evidence-based medical information, and the difficulty of traditional teaching models in providing personalized guidance and large-scale high-fidelity clinical scenario simulation. Conventional teaching methods, especially traditional Problem-Based Learning (PBL), are insufficient in real-time feedback, adaptive case generation, and immersive skill training. Artificial intelligence (AI) technologies represented by natural language processing (NLP), machine learning (ML), virtual reality (VR), and augmented reality (AR) provide a transformative solution. This paper proposes a scientific hypothesis: implementing a comprehensive AI-assisted teaching model integrating AI-generated personalized clinical cases, immersive simulation platforms, intelligent clinical reasoning support, real-time data-driven feedback, and AI-moderated collaborative PBL groups into the undergraduate curriculum can significantly improve the six core competencies of clinical medicine undergraduates, with significantly better effects than traditional PBL or lecture-based teaching. The mechanism lies in that the AI-assisted model activates personalized knowledge scaffolding, immersive skill practice, data-driven metacognition, and AI literacy development, which can more effectively solve the problems of insufficient clinical exposure, lack of personalized tutoring, and delayed feedback in traditional education. This hypothesis provides a complete theoretical framework, operational sub-hypotheses, and feasible testing strategies for the innovation and empirical research of AI-integrated medical education.

Key words. Artificial intelligence, AI-assisted teaching, clinical medicine undergraduates, core competencies, PBL, medical education reform, immersive simulation, personalized feedback.

Introduction.

Undergraduate clinical education is the core stage for cultivating clinicians' professional qualities, clinical skills, and lifelong learning abilities. In the era of intelligent medical care, medical knowledge updates at an exponential rate, clinical decision-making models are rapidly transformed by artificial intelligence (AI) tools [1], and medical services are increasingly moving toward precision, individualization, and interdisciplinary integration [2]. These changes put forward higher requirements for the core competencies of clinical medicine undergraduates, not only requiring solid basic medical knowledge and standardized clinical operation skills, but also

needing to master AI literacy, clinical ethical judgment ability, team cooperation ability, and system-based practice thinking adapted to the new medical model.

However, the current undergraduate clinical education is still restricted by many practical problems. Traditional lecture-based teaching positions teachers at the center of the educational process, emphasizing knowledge transmission [3]. This approach often fails to engage students' active thinking and clinical reasoning skills effectively [4]. Although traditional Problem-Based Learning (PBL) enhances students' autonomous learning and collaborative exploration abilities to some extent, it still exhibits significant limitations [5]. Clinical cases are predominantly fixed and singular, failing to accommodate the diverse learning progress and knowledge gaps of individual students. Furthermore, students often lack access to low-risk, repeatable, high-fidelity clinical scenario practice opportunities. Feedback from instructors tends to be delayed, subjective, and insufficiently comprehensive to address the needs of all students. Participation in group discussions is uneven, resulting in inconsistent individual learning outcomes. Additionally, traditional teaching models lack systematic training modules for AI literacy, hindering students' ability to meet the demands of clinical work in the intelligent era.

In recent years, the rapid advancement of AI technology has led to increasingly profound applications in the field of medical education. Natural language processing enables intelligent analysis of learning behaviors and the automatic generation of clinical cases. Machine learning facilitates personalized learning path planning and real-time performance evaluation. Furthermore, virtual reality (VR) and augmented reality (AR) can construct highly realistic clinical scenarios, including outpatient clinics, emergency rooms, and wards. The integration of these technologies presents new opportunities to address the challenges faced in traditional medical education. At present, many studies have confirmed the positive effects of single AI tools in medical education, but there is still a lack of systematic scientific hypotheses to clarify the causal relationship, internal mechanism, and comprehensive effect of the integrated AI-assisted teaching model on the improvement of clinical medicine undergraduates' core competencies.

Based on constructivism learning theory, experiential learning theory, adaptive learning theory, and metacognitive learning theory, combined with the existing empirical research basis of AI in medical education, this paper puts forward a complete scientific hypothesis that the AI-assisted teaching model can enhance the competency level of clinical medicine undergraduates, and systematically elaborates its theoretical

basis, model composition, hypothesis content, evolution logic, testing scheme, and potential impact, so as to provide a standardized and testable theoretical framework for the follow-up empirical research and curriculum reform practice of AI-integrated medical education.

Theoretical Background and Conceptual Framework.

AI-Assisted Teaching Model for Undergraduate clinical education:

The AI-assisted teaching model for clinical medicine undergraduates is a hybrid instructional framework that deeply integrates AI technology with PBL pedagogy, aiming at the learning characteristics of students in the pre-clinical and early clinical stages (grades 2–4), with personalization, immersion, interaction, and iterative feedback as core features. The model includes five interrelated and synergistic core components, which together support the improvement of students' comprehensive competencies.

AI-generated personalized clinical cases: Using natural language processing and machine learning algorithms, the system automatically collects and analyzes students' historical learning data (examination scores, classroom performance, case completion, knowledge mastery), then generates clinical cases with appropriate difficulty, rich context, and dynamic adjustment to meet individual learning needs. These cases can simulate real disease progression, adjust symptoms and examination results in real time according to students' diagnosis and treatment decisions, and achieve "teaching students in accordance with their aptitude" that is difficult to realize in traditional PBL.

Immersive clinical simulation platforms based on VR/AR: VR/AR technologies are used to build high-fidelity clinical environments (outpatient clinics, emergency rooms, general wards, operating rooms, etc.). Students can conduct standardized training of basic clinical skills such as history taking, physical examination, and first aid in virtual environments. AI-driven virtual patients provide realistic feedback based on students' actions and inquiries, simulating the emotional and linguistic responses of real patients, which significantly enhances the authenticity and effectiveness of skill training.

Intelligent clinical reasoning support system: During case discussions and clinical analysis, the AI system provides real-time scaffolding guidance for students, including identifying knowledge gaps, recommending evidence-based medical literature, prompting differential diagnosis, and clarifying pathophysiological mechanisms. Instead of giving direct answers, the system guides students to reason logically and integrate knowledge, gradually cultivating standardized clinical thinking.

Real-time data-driven personalized feedback: Machine learning algorithms comprehensively evaluate students' performance in case analysis, simulation operations, group discussions, and other activities, generating objective and detailed feedback reports in real time. The reports highlight strengths and deficiencies in clinical skills, knowledge application, and communication, and deliver targeted learning resources and improvement plans. This approach transcends the limitations of manual feedback in time and quantity, significantly improving the efficiency and accuracy of learning evaluation.

AI-moderated collaborative PBL groups: The AI assistant helps instructors manage group discussion dynamics by tracking each student's participation frequency and speech quality, balancing the participation ratio of group members, pushing public learning materials in a timely manner, and reminding the progress of discussion tasks. This component effectively avoids the problems of "dominance by a few students" and "off-topic discussions" in traditional PBL, ensuring the fairness and effectiveness of collaborative learning.

Core Competency Framework for Undergraduates in Clinical Medicine:

Combined with the Accreditation Council for Graduate Medical Education (ACGME) core competency framework, World Federation for Medical Education (WFME) international medical education standards, and Chinese national undergraduate medical education quality standards, this study constructs a competency system adapted to the AI-assisted teaching environment, including six core competency domains, covering the key capabilities that clinical medicine undergraduates should possess in the intelligent medical era.

Basic clinical care ability: Proficient application of basic clinical skills (medical history taking, physical examination, standardized operations) in simulated and real clinical settings; accurate understanding and interpretation of clinical data (laboratory results, imaging reports) with the assistance of AI tools.

Integration of medical knowledge and AI literacy: Effective connection between basic medical principles and clinical practice; explanation of clinical phenomena with scientific theories; basic AI literacy including understanding the working principles, application scenarios, limitations, and potential risks of clinical AI tools in decision-making.

Patient-centered communication ability enhanced by AI: Effective communication with virtual/real patients, families, and medical teams; mastery of empathy, breaking bad news, health education; clear and reasonable explanation of AI-generated diagnosis and treatment plans to patients.

Professionalism-based medical ethics: Adherence to medical ethical standards; cultivation of humanistic care and responsibility; attention to ethical issues arising from AI application (patient data privacy, algorithmic bias, balance between machine decision-making and physician independent judgment).

Autonomous learning ability supported by AI tools: Use of AI learning platforms, personalized dashboards, and intelligent recommendation systems to independently identify knowledge gaps, conduct targeted learning, and continuously reflect and optimize learning strategies.

Preliminary system-based practice ability integrated with AI: Understanding of the composition and operating rules of the health system; recognition of AI's role in team collaboration, patient safety, medical resource allocation, and public health; establishment of systematic clinical thinking.

The Hypothesis.

Central Hypothesis:

If undergraduate clinical medicine education programs implement a comprehensive AI-assisted teaching model that

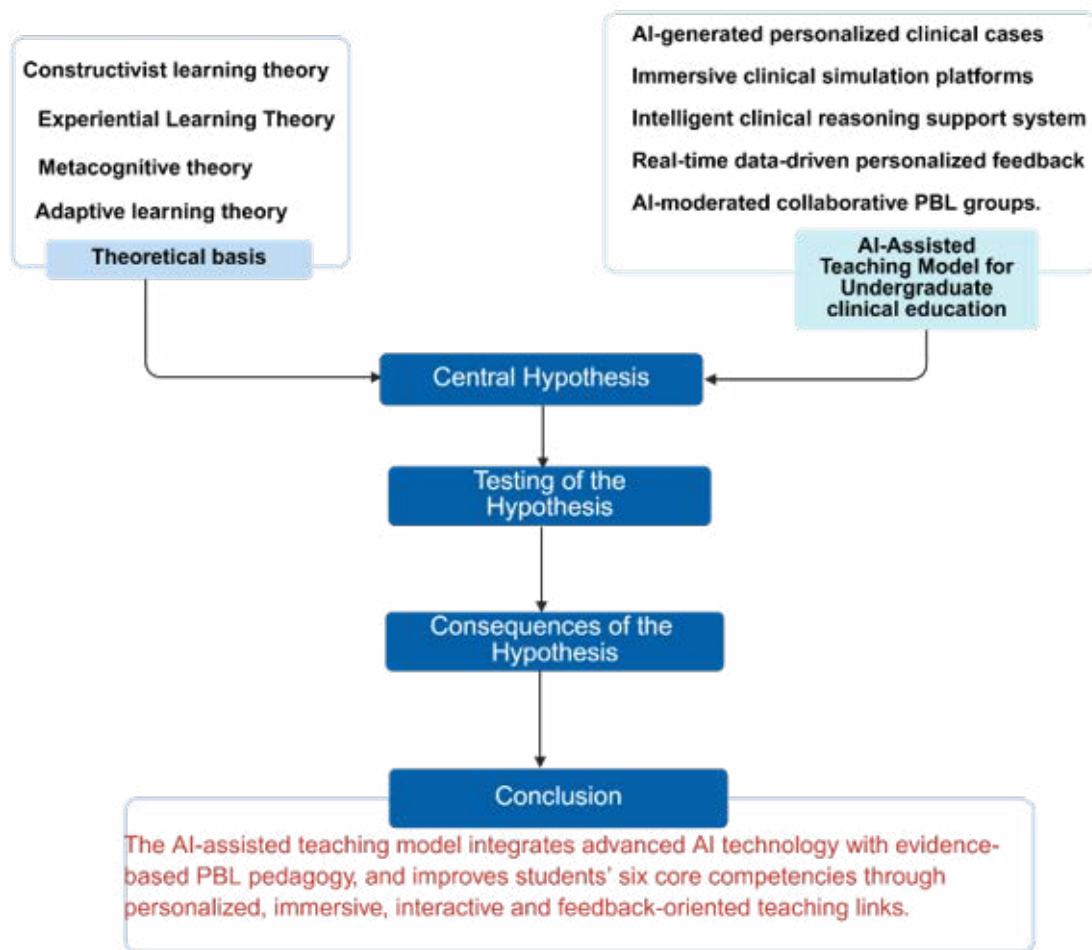


Figure 1. A schematic diagram illustrating the hypothesis.

integrates AI-generated personalized clinical cases, VR/AR immersive simulation platforms, intelligent clinical reasoning support systems, real-time data-driven feedback, and AI-moderated collaborative PBL groups into the regular curriculum, then clinical medicine undergraduates will demonstrate significant improvements across all six core competency domains. Furthermore, the effectiveness of this model is markedly superior to that observed in traditional PBL and lecture-based teaching groups. The internal mechanism underlying this enhancement is that the AI-assisted teaching model activates synergistic effects, including the construction of personalized knowledge scaffolding, immersive clinical skill practice, improvements in data-driven metacognitive abilities, and the cultivation of synchronous AI literacy. This model more effectively addresses the deficiencies of traditional teaching methods, such as insufficient clinical exposure, lack of personalized guidance, delayed feedback, and challenges in accommodating individual differences. A schematic diagram illustrating the hypothesis (Figure 1).

Sub-Hypotheses:

In order to make the central hypothesis more operable and testable, six specific sub-hypotheses are further derived, corresponding to the six core competency domains one by one.

Sub-Hypothesis 1: AI-assisted immersive simulation training and personalized clinical cases can significantly improve the

basic clinical care ability of clinical medicine undergraduates. Students in the AI-assisted teaching group will have significantly higher scores in OSCE-U (objective structured clinical examination for undergraduates) and AI-assisted clinical data interpretation ability than those in the traditional PBL group and lecture group. The mechanism is based on experiential learning theory. AI simulation provides a low-risk and repeatable practice environment, and personalized cases maintain the appropriate challenge level, promoting students to master clinical skills through deliberate practice.

Sub-Hypothesis 2: AI-assisted case discussion and intelligent reasoning support can significantly enhance the integrated medical knowledge level and AI literacy of clinical medicine undergraduates. Students in the experimental group will perform better in knowledge integration tests and AI literacy assessments. Because the AI system dynamically connects basic medical principles with clinical scenarios in real time, and continuous exposure to clinical AI tools helps students naturally establish cognitive structures adapted to intelligent medicine.

Sub-Hypothesis 3: AI-driven virtual patient training and real-time communication feedback can effectively improve the patient-centered communication ability of clinical medicine undergraduates. The experimental group students will get higher scores in empathy evaluation, communication skills evaluation and other dimensions. AI virtual patients provide a safe

environment for practicing difficult conversations, and AI can analyze language expression, question structure and empathy-related words, giving targeted optimization suggestions.

Sub-Hypothesis 4: AI-assisted teaching cases embedded with ethical scenarios and AI-moderated ethical discussions can significantly improve the professional ethics and humanistic quality of clinical medicine undergraduates. The experimental group will show better performance in ethical judgment, empathy level and professional responsibility. The model integrates data privacy, algorithm bias and other AI-related ethical dilemmas into clinical cases, guiding students to think deeply about professional values.

Sub-Hypothesis 5: AI personalized learning dashboard, intelligent resource recommendation and real-time feedback can significantly enhance the autonomous learning ability of clinical medicine undergraduates. The experimental group students will have higher scores in autonomous learning readiness scale and metacognitive awareness scale. AI tools transform abstract learning progress into visual data, helping students accurately locate deficiencies and take the initiative to carry out targeted learning.

Sub-Hypothesis 6: AI-simulated interdisciplinary team cooperation and medical system scenario cases can significantly improve the preliminary system-based practice ability of clinical medicine undergraduates. The experimental group will have a deeper understanding of medical team roles, patient safety norms and the role of AI in the medical system. AI simulation restores the real medical system operation process, allowing students to establish systematic thinking in the early learning stage.

Evolution of the Hypothesis.

The formation of this hypothesis is based on a complete logical chain and multi-dimensional evidence support, evolving from theoretical deduction to practical verification.

Theoretical rationality: Supported by constructivist, experiential, adaptive, and metacognitive learning theories, the AI-assisted model creates authentic clinical situations and collaborative environments. It provides immersive experiences, matches personalized resources, and enhances self-monitoring through real-time feedback.

Practical necessity: This study addresses critical challenges in clinical undergraduate education, including insufficient clinical resources, inconsistent teaching quality in traditional PBL environments, and the difficulties associated with large-scale personalized teaching. AI offers viable technical solutions to these pressing issues.

Preliminary empirical evidence: Existing studies have confirmed the positive effects of AI in medical education, including active reflection, self-directed learning, and increased clinical skill confidence. These findings lay a robust empirical foundation for the comprehensive hypothesis presented in this paper.

Testing of the Hypothesis.

To verify the hypothesis, a rigorous research design is required. A three-group, pre-test-post-test, randomized controlled trial (RCT) is recommended, and a phased implementation or

factorial design can be introduced to isolate and evaluate the efficacy of single AI components, so as to clarify which module contributes most to competency improvement and avoid unclear causal attribution of composite interventions.

The evaluation indicators include quantitative and qualitative two categories. Quantitative evaluation tools include: modified OSCE-U examination for AI-related skills; AI Literacy Assessment Scale (AILAS); Jefferson Empathy Scale (JSE-UM); Autonomous Learning Readiness Scale (SDLRS); and Undergraduate System-Based Practice Ability Assessment Scale (SBPA). These tools can objectively quantify the level of students' core competencies. Qualitative evaluation methods include: students' structured reflection logs focusing on AI tool use and competency growth; focus group interviews with students and teachers; and case analysis portfolios used to evaluate students' clinical reasoning processes. Qualitative data can supplement and explain quantitative results and reveal deep-seated influence mechanisms. Some study found that the incorporation of ChatGPT into the surgical clerkship teaching model substantially enhances learner compliance and satisfaction, offering notable advantages in educational effectiveness [6].

Consequences of the Hypothesis.

If this hypothesis is substantiated by adequate empirical evidence, it will have substantial theoretical and practical implications for the reform of medical education, talent cultivation, and policy-making.

This paper advocates for the transformation of clinical teaching into a student-centered and personalized paradigm. It aims to improve the quality of clinical talent training by enhancing both professional competencies and those related to artificial intelligence (AI). Furthermore, it seeks to provide a theoretical and decision-making foundation for educational authorities to standardize AI-assisted teaching practices. The paper emphasizes the importance of raising awareness regarding the ethical risks associated with AI in medical education, as well as promoting effective risk governance. Additionally, it supports the implementation of cost-effectiveness analyses, phased implementation plans, and long-term follow-up research to establish a practical path for large-scale promotion, particularly in resource-constrained institutions. Finally, it advocates for strengthening the 'human-in-the-loop' governance mechanism to ensure the accuracy, safety, and ethical compliance of AI-generated medical content through instructor supervision and quality control.

Limitations.

The implementation of this model requires high infrastructure investment (VR/AR devices, real-time AI feedback systems) and ongoing maintenance costs, which may pose challenges for resource-limited educational institutions. AI systems may have medical hallucinations or algorithmic bias, so strict human-in-the-loop supervision and regular quality audits are necessary to ensure clinical safety and educational reliability. Phased deployment and prioritized module implementation are recommended to balance effectiveness and feasibility.

Conclusion.

This paper systematically proposes the scientific hypothesis that an AI-assisted teaching model enhances the core competencies of clinical medicine undergraduates, and constructs a complete theoretical framework including model composition, competency system, hypothesis content, evolutionary logic, testing strategy, and potential impact. The hypothesis takes into account theoretical rationality, practical plausibility, and empirical testability, aiming to solve key problems in current clinical undergraduate education and adapt to the development trend of intelligent medicine.

The AI-assisted teaching model deeply integrates advanced AI technology with evidence-based PBL pedagogy and improves students' six core competencies through personalized, immersive, interactive, and feedback-oriented teaching links. If verified, this hypothesis will strongly promote the innovation of global clinical undergraduate medical education and provide a new path for cultivating high-quality clinical talents with solid clinical ability and AI literacy in the new era.

Consent statement/ethical approval.

Not applicable.

Ethical statement.

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Declaration of Competing Interest.

The authors declare no conflict of interest.

REFERENCES

1. Kassab SE, Rathana R, Taylor DC, et al. Understanding how medical students learn in the era of artificial intelligence: a mixed methods study. *BMC Med Educ.* 2025;25:1521.
2. Zheng K, Shen Z, Chen Z, et al. Application of AI-empowered scenario-based simulation teaching mode in cardiovascular disease education. *BMC Med Educ.* 2024;24:1003.
3. Mun K, Park HJ. Medical students' perspectives on effective and ineffective teaching behaviors in lectures. *Korean J Med Educ.* 2025;37:219-24.
4. Jiang J, Yu H, Hu C, et al. Application effect of problem-based learning teaching model in respiratory critical medicine. *Front Med (Lausanne).* 2025;12:1648744.
5. Ullah H, Huma S, Naeem L, et al. Bridging the gaps in problem-based learning: an evidence-based intervention in bachelor of medicine and surgery (MBBS) program. *BMC Med Educ.* 2025;25:410.
6. Hui Z, Zewu Z, Jiao H, et al. Application of ChatGPT-assisted problem-based learning teaching method in clinical medical education. *BMC Med Educ.* 2025;25:50.