IOSR Journal Of Humanities and Social Science (IOSR-JHSS)
Volume 30, Issue 11, Series 3 (November, 2025) 08-13
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Innovative Teaching Mode For The Construction Of Deep Integration Of Generative Artificial Intelligence

Mingyue Zhou, Songzhang Shen, Chi Zhang, Yuxin Fang, Yaqian Duan, Meiyu Lin, Juan Su
School Of Pharmacy, Naval Medical University, Shanghai 200433, China

Abstract:
Background: *A teaching implementation framework that deeply integrates Generative Artificial Intelligence (GAI) and is in line with the characteristics of this course was explored and constructed in response to the current situation of tight class and extensive content in chemistry laboratory courses in medical colleges, as well as the lack of teaching resources, insufficient guidance on experimental operations, and difficulty in meeting personalized learning needs under traditional teaching models.*
Materials and Methods: *DeepSeek, Doubao, and Kimi used domestic GAIs and were innovatively integrated into the entire process of course design, experimental simulation, and personalized learning guidance in Medical Chemistry Experimental Teaching (MCET). This innovative teaching model significantly improves teaching efficiency, greatly reducing the time cost of experimental design and lesson preparation. It stimulates interest in learning and enthusiasm for classroom participation through vivid experimental simulations and personalized guidance.*
Results: *The investigated data show that students using this model achieved an average score improvement of 13.34% in final exams compared to traditional teaching classes, fully verifying the effectiveness of GAI in empowering MCET.*
Conclusion: *On this basis, our group will conduct specialized research and propose optimization strategies to address issues such as technical stability, data privacy protection, and excessive student dependence that were exposed during the GAI application, providing practical experience and theoretical support for promoting the intelligent transformation of medical chemistry experimental teaching.*
Key Word: *Generative artificial intelligence; Medical chemistry experimental teaching; Teaching implementation framework; Teaching reform*

Date of Submission: 08-11-2025 Date of Acceptance: 18-11-2025

I. Introduction

Medical Chemistry Experimental Teaching (MCET) is a crucial component of compulsory courses for chemistry majors in medical colleges. Currently, this course is mainly designed for undergraduate students, and its main teaching task is to cultivate students' practical operation ability, scientific thinking, and innovative spirit, which plays an indispensable role and lays a solid foundation for the subsequent study of related professional courses. However, due to limited teaching resources, complex experimental operations, and difficulties in balancing individual differences among students in traditional MCET, these factors to some extent limit teaching effectiveness and students' comprehensive development. Therefore, it is particularly important to establish a teaching implementation framework that deeply integrates Generative Artificial Intelligence (GAI) and innovatively fully embeds the three commonly used domestic GAIs, DeepSeek, Doubao, and Kimi, into MCET to effectively improve teaching effectiveness. In the current education and teaching reform, DeepSeek[1], which assists teachers in accurately planning experimental steps and teaching difficulties, Doubao, which optimizes experimental teaching plans, and Kimi[2], which organizes experimental theoretical knowledge, are promoting the transformation of chemistry experimental teaching from one-way knowledge imparting to personalized learning. With its powerful natural language processing ability, knowledge integration ability, and content generation ability, this model has brought a new change to the teaching field and is promoting the transformation of chemical experiment teaching from one-way knowledge teaching to personalized learning. This model not only promotes students' in-depth understanding of classroom knowledge, but also improves practical efficiency through accurate error identification and immediate feedback [3, 4]. This model can also cleverly integrate elements of ideological and political education, allowing students not only to deepen their learning of knowledge points, but also to achieve the fundamental task of "cultivating virtue and nurturing people" unconsciously, cultivating students' lifelong learning ability, laying a solid foundation for their future growth, and cultivating talents with innovative spirit and practical ability for the country [5, 6].

In the innovative exploration of artificial intelligence applications in MCET, many scholars have made different innovations and attempts [7]. However, on the eve of the Spring Festival in 2025, DeepSeek's new generation of large model R1 attracted global attention, and domestic GAI rose to prominence. GAI can simulate human thinking and language patterns, generating high-quality text, images, and even code based on input instructions. The inquiry-based learning supported by GAI can effectively cultivate students' abilities in systematic thinking, critical analysis, and innovative problem-solving, forming a composite thinking structure that adapts to the development of medicine[8].

At present, innovative research on the construction of teaching implementation frameworks that deeply integrate GAI into MCET is particularly scarce. Therefore, in the face of this challenge, we need to design a GAI innovative integrated teaching implementation framework that is in line with the characteristics of MCET, and explore the application of GAI to comprehensively update and optimize the dilemma of single teaching resources, insufficient experimental operation guidance, and difficulty in meeting students' personalized learning needs under traditional teaching modes. We hope to integrate GAI with experimental teaching innovation and design multidimensional experimental plans. By constructing intelligent teaching scenarios and virtual simulation systems to complete complex experimental operations, students' experimental skills have been enhanced. The reform of this teaching mode not only improves the efficiency of knowledge transmission but also demonstrates unique value in cultivating students' scientific literacy, cross-disciplinary integration ability, and medical innovation potential.

II. Innovation And Challenges Of GAI Integration Into The Traditional Teaching Mode Of MCET

In traditional MCET teaching, the formulaic paradigm of "teacher lecturing and student reproduction" hinders student development. The classroom presents a teacher-centered approach, with one-way knowledge transmission lacking interactive exploration, resulting in passive learning for students and difficulty in achieving deep cognitive construction. The drawbacks of this teaching model further extend to the curriculum content system. Due to the lengthy update cycle, closed and lagging course content, and serious disconnection from the forefront of medical chemistry and clinical applications, students find it difficult to establish a cognitive connection between theory and practice. In addition, the development of innovative thinking and higher-order practical abilities is also constrained by the low-order design dominated by confirmatory experiments. At the level of teaching technology, the integration of virtual reality (VR) and augmented reality (AR) technology is insufficient, making it difficult to construct virtual scenes to assist teaching and meet the diverse cognitive needs of students. This undoubtedly exacerbates the limitations of teaching effectiveness. Correspondingly, teaching evaluation is mainly summative with low process weight, which encourages students to adopt surface learning strategies and seriously weakens their ability to internalize knowledge and transform practice, forming another shortcoming in the teaching loop.

The integration of GAI has opened up a new path for the reconstruction of the MCET system, from teaching methods to student development. At the level of innovative teaching methods, GAI deeply empowers student-centered, interactive, and exploratory teaching. Students can use GAI to independently search for information, ask questions, and validate their ideas in classroom discussions [9]. This requires teachers to simultaneously enhance their teaching design and management abilities, flexibly adjust teaching strategies, organize efficient classroom activities and group collaboration, and better guide students to explore chemical reaction problems and mechanisms, directly promoting the improvement of learning outcomes. The transformation of teaching methods has put forward new demands for teaching resources. Currently, most laboratories suffer from equipment aging, insufficient high-end instruments, and limited teaching materials, making it difficult to meet the demands of cutting-edge experimental teaching. With the integration of GAI into teaching, the demand for digital and intelligent teaching resources is gradually increasing. Therefore, it is necessary to urgently build an experimental teaching database that includes experimental videos, virtual models, and data cases [10]. At the same time, GAI can intelligently generate resource systems such as experimental plans and courseware templates, significantly improving course preparation efficiency and making up for the shortcomings of traditional resources. The upgrading of teaching resources cannot be achieved without the support of the teaching staff. However, currently, some teachers do not attach enough importance to MCET, their teaching philosophy lags, and their professional background is limited, resulting in a disconnect between teaching and medical practice [11]. GAI can provide multidimensional support, whether it is an AI teaching assistant-assisted solution design, an intelligent lesson preparation system updating case library, or natural language processing technology generating composite teaching cases, all of which can effectively solve existing teaching problems [12]. After optimizing the teaching staff and resources, they should ultimately serve the learning and growth of students. Based on students' basic differences, GAI customizes personalized learning plans according to their learning progress and interest preferences, identifies weak links through precise analysis of learning data, and pushes appropriate materials. Intelligent tutoring and teaching assistant functions enable 24-hour online Q&A and real-time homework correction, helping students master knowledge [13, 14]. Teachers can also use this to dynamically grasp the learning situation of the class and implement hierarchical teaching. However, the application of GAI also puts higher demands on students, who need to improve their information literacy and critical thinking, learn to independently screen information, analyze the accuracy of GAI-generated content, and thereby stimulate their experimental design and innovative research abilities.

III. GAI Empowers MCET With Unique Advantages In Multi-Scenario Applications

With the innovation of GAI, large-scale language models DeepSeek, Doubao, and Kimi in China have reconstructed the MCET system through multimodal cognitive architecture [15, 16]. These models demonstrate significant technological empowerment effects in MCET based on diversified technologies [17], including auxiliary experimental design, experimental operation guidance, data analysis, and report writing.

Experimental Design

In the MCET system, experimental design as a core element can directly affect the scientificity and reliability of experimental results. Under the traditional teaching mode, the development of experimental plans highly relies on the teacher's experience and textbook content, which leads to complex processes and limited student innovation. DeepSeek may be able to quickly construct multiple complete experimental plans based on natural language processing and machine learning algorithms, according to user input experimental parameters, providing systematic support for students to master experimental design methods. After completing the design of the basic experimental plan, the expansion and innovation of experimental ideas have become teaching difficulties. Due to cognitive inertia and limited knowledge reserves, students often fall into fixed thinking patterns in experimental design. Doubao relies on the medical chemistry knowledge database, analyzes and associates knowledge through language systems, and outputs innovative experimental strategies based on experimental keywords, effectively promoting the development of students' creative thinking [18]. Finally, the scientificity and operability of the experimental plan need to be systematically optimized and validated [16]. Kimi uses intelligent algorithms to identify defects in the overall experimental plan through multidimensional evaluation and proposes optimization strategies based on past experimental data and literature case libraries to achieve dynamic adjustment and optimization of the experimental process, significantly improving the quality and efficiency of experimental teaching.

Experimental operation

In the experimental operation guidance section, GAI collaborates with the virtual chemistry laboratory, relying on high-precision graphic rendering and molecular dynamics simulation technology, to construct a highly realistic virtual experimental environment that can accurately reproduce laboratory operations and reaction phenomena, providing students with a new learning experience. Before the experiment, the system establishes an operational behavior evaluation model by presetting standardized operating procedures and parameter thresholds. During the experiment, a multimodal perception system based on instrument sensor fusion captures real-time data of student operations and dynamically monitors them against preset standards, providing real-time operational feedback to ensure the accuracy and standardization of experimental operations. At the same time, the system pushes personalized experimental strategy reports based on students' proficiency and knowledge weaknesses, assisting students in optimizing experimental plans. After the experiment is completed, the system automatically collects multidimensional indicators and generates an experimental report containing operational standardization scores, error reports, and improvement suggestions through algorithm analysis. In addition, GAI can also develop layered training plans for individual weak links based on the entire experimental data, and design progressive improvement paths using reinforcement learning techniques to help students systematically enhance their experimental skills and scientific exploration abilities.

Analysis of data

In the MCET research system, the processing and visualization of experimental data are crucial. DeepSeek has powerful data intelligence processing and analysis capabilities, automatically matching appropriate calculation methods based on input experimental data to transform complex data into intuitive and understandable charts. Dou Bao can predict and analyze experimental results and trends using large amounts of data. By inputting key parameters, the experimental results can be calculated based on relevant theories and calculation formulas. Subsequently, the trends of the experimental results can be analyzed in depth to uncover potential relationships between the experimental results and various factors. Kimi focuses on data quality control, building anomaly recognition algorithms through real-time data stream monitoring. When data deviates from the confidence interval, the anomaly tracing mechanism is automatically triggered, and a correction plan is generated based on theoretical knowledge to ensure the scientific validity of experimental data. The collaboration of the three forms a complete scientific research support chain from data processing, result prediction, to quality control.

Writing the report

At the level of experimental report writing, the GAI system forms a specialized collaborative mechanism, and DeepSeek can quickly retrieve literature and cutting-edge research results related to experiments, assisting students in integrating the latest research progress in the discipline into the report and enhancing academic depth. Doubao uses language processing to perform grammar verification, language standardization, and expression optimization on reports, ensuring language accuracy and academic standardization. Kimi relies on structured writing to automatically generate standardized report frameworks that include experimental objectives, principles, methods, data processing, discussions, and more.

Therefore, GAI can provide full process assistance from experimental design, operational feedback, data processing, and report writing in MCET, which not only strengthens the cultivation of students' scientific research thinking and innovation ability, but also enhances the standardization and efficiency of experimental teaching through intelligent means.

IV. Construction Of An Innovative Teaching Framework That Deeply Integrates MCET And GAI

Construction of innovative teaching models in the classroom

The teaching in the classroom mainly includes the teacher's pre-class preparation and guidance content, as well as classroom teaching. In the preparation stage of teaching, teachers accurately anchor chapter teaching objectives based on curriculum standards and use GAI to carry out bilingual lesson plan translation work. GAI not only ensures the accuracy of keywords and professional terminology but also generates teaching sentences that conform to oral expression habits, significantly improving the comprehensibility and effectiveness of bilingual teaching. To deepen students' autonomous construction of knowledge, teachers can design pre-class guidance tasks based on the learning situation. The traditional mode suffers from the problems of rigid knowledge introduction and insufficient student interest due to class time limitations. By guiding students to use GAI in groups, bilingual organization of cognitive materials, slide production, and mind mapping can be completed, which not only achieves self-directed knowledge learning but also exercises professional English skills and critical thinking. In classroom teaching, a teaching model of "case analysis, intelligent assistance, autonomous exploration" is constructed. Teachers systematically explain basic theoretical knowledge, design gradient exploration questions, and guide students to use GAI to overcome language and knowledge comprehension barriers. This interactive teaching method stimulates students' active thinking, effectively cultivates their logical thinking ability, and achieves the efficient achievement of teaching objectives.

Construction of innovative teaching modes outside the classroom

The learning content outside the classroom covers post-class exercises and knowledge expansion, solving the problem of traditional monotonous homework and low student motivation. Teachers use GAI to design assignments, create situational questions, and arrange them in a gradient from easy to difficult to help students consolidate their knowledge points. Students complete exercises online, and teachers answer and correct questions synchronously to improve teaching efficiency. In the independent exploration stage, teachers assign research tasks on the platform to guide students to explore. Students use GAI to retrieve data, summarize patterns, and construct a knowledge system through mind maps. At the same time, professional chemistry tools are used to ensure the scientific nature of the research. In the knowledge expansion reading section, teachers use GAI to assist in literature updates, generate literature knowledge summaries, and reduce workload. Students can also use GAI to reduce reading difficulty. After the chapter teaching is completed, students are divided into groups to write their paper reports, using GAI to assist in data collection and framework construction, and improving their information retrieval and paper writing abilities in practice, laying a foundation for subsequent learning.

V. Evaluation And Feedback Of Teaching Implementation

After adopting the innovative teaching framework of GAI fusion in MCET, the evaluation and feedback of students' learning effectiveness are key links in the subsequent adjustment and optimization of course teaching and teaching implementation framework. Therefore, teachers design multiple assessment points to comprehensively evaluate the effectiveness of students' self-directed learning, and provide precise reinforcement for students' weak grasp of knowledge points, continuously improving the quality of course teaching. This study conducts a comparative analysis of the application effects of teaching modes. After adopting the new teaching mode, the formative assessment data for clinical undergraduate students in 2024 showed a significant improvement in their enthusiasm for completing online assignments, a strong interest in research-based tasks, an increase in the frequency of actively discussing problems with teachers after class, and a higher quality of homework completion. The total score of the formative exam for 18 students exceeded 90 points, with an average score of 92.6 points. On the other hand, for students in the same major who did not adopt this model in 2023, their enthusiasm for completing traditional after-school exercises is insufficient, and there is a phenomenon of missed or insufficient completion of questions. Among the 23 students, 4 of them scored below 90 points in the formative exam, with an average score of 88.7 points. In addition, according to the research results, the newly designed homework stimulates students' exploratory desire due to its rich background content, and the use of GAI technology significantly enhances their intrinsic motivation for after-school learning. In the final exam, the 2024 students performed better on the paper, with 9 students scoring above 80 points and an average score of 82.4 points. Although they lost more points on expansion problems, they firmly grasped the basic knowledge and self-directed learning points. Only 2 people scored above 80 points in the 2023 class, and 2 people failed, with an average score of 72.7 points, reflecting a weak grasp of basic knowledge. This teaching model effectively enhances learning motivation, improves self-directed learning ability, promotes the internalization and transfer of key and difficult knowledge, and has achieved significant teaching results in post-class learning and final assessment.

Moreover, students can provide feedback on teaching doubts and issues through online platforms, which is beneficial for teachers to adjust their learning mode and improve teaching effectiveness. After the end of the semester, an anonymous survey was conducted among clinical students of 2024 through Questionnaire Star, focusing on the evaluation of pre-class guidance, course teaching, and post-class learning. A total of 19 valid questionnaires were collected. The results showed that 94.7% of students recognized the help of pre-class guidance in understanding knowledge, and only one person provided feedback on excessive content. All students agree that the interactive participation in classroom teaching is enhanced, and 94.7% of students believe that GAI-assisted teaching content is highly attractive. One student suggested adding more professional knowledge points. All students acknowledge the importance of homework and expansion for improvement after class. The research results show that this model has achieved high satisfaction among students, can enhance learning interest and teaching quality, and stimulate research interest.

VI. Challenges And Coping Strategies Of GAI Application In MCET

Although GAI has significant advantages in MCET, it still faces technical limitations [19]. At the linguistic level, GAI is prone to generating incorrect content due to professional biases in complex medical chemistry terminology and semantics, as well as rare chemical reaction mechanisms or novel drug molecular structures, which can mislead students' understanding of the knowledge. At the logical level, medical chemistry experiments involve complex logical relationships involving multiple steps and multiple factors interacting with each other. GAI is difficult to derive and analyze comprehensively like professional teachers, resulting in insufficient accuracy in interpreting experimental phenomena and results. In addition, in terms of data processing, the quality of GAI content generation highly depends on the quantity and quality of data. If there are deviations, incompleteness, or a lack of timely updates to new research results and experimental methods in the field of medical chemistry, it will limit students' access to cutting-edge knowledge. In terms of data security, the recording of student experimental operations and the writing of experimental reports contain data that contains privacy and sensitive professional information. If the data is leaked, it will not only violate students' privacy rights but may also be exploited by criminals. Teachers also need to guide students to use GAI correctly and distinguish the reliability of generated content, cultivate students' critical thinking and self-learning abilities, which puts higher demands on teachers' teaching philosophy and knowledge and skills level. However, some teachers have limited mastery of advanced AI technology and lack training, which hinders the application of AI in teaching. At the same time, in terms of ethics and morality, students may overly rely on AI to complete tasks, violating the principle of academic integrity [20], and disputes over copyright ownership of AI-generated content and algorithmic biases also affect teaching effectiveness.

Therefore, multidimensional measures are needed to effectively address these challenges, increase research and development in technology, optimize algorithms, and timely update and expand professional data to enhance GAI's understanding and reasoning ability of professional knowledge. In terms of data security, we will establish a sound data security management system, encrypt students' personal learning data, strengthen supervision of GAI service providers, conduct regular security checks and vulnerability repairs, and ensure the integrity and immutability of data. In teacher training, regularly carry out AI technology and teaching integration courses, establish communication platforms, and enhance teachers' AI teaching abilities. In terms of ethical standards, it is necessary to establish clear ethical norms, clarify academic integrity, copyright ownership, and algorithm review mechanisms, establish an academic integrity monitoring system and an interdisciplinary supervisory body composed of educational ethics committees, technical teams, and student representatives, conduct regular fairness audits, and ensure the fairness and impartiality of algorithms. Through comprehensive measures such as technological advancement, data security reinforcement, teacher training enhancement, and ethical regulation improvement, the challenges of using generative AI in medical chemistry experimental teaching can be effectively addressed. This will promote the effective application of generative AI in medical chemistry experimental teaching, improve teaching efficiency and quality, while safeguarding students' privacy and academic integrity.

References

[1]. Luo Shengquan, Li Ni, Song Huan, Rong Qing, Li Hongxiu, Wang Mengmeng. Deepseek Empowers High-Quality Development Of Basic Education (Written Discussion). Journal Of Tianjin Normal University (Basic Education Edition). 2025;26 (03):1-14.

[2]. Xie Hui, Zhu Shouping, Liu Peng,&Chen Xueli. The "Dual Intelligence" Of Big Language Models And Intelligent Evaluation Empowers Modern Engineering Microbiology Blended Course Teaching Research And Practice. Microbiology Bulletin. 2025;52 (01), 445-456.

[3]. Chen Tianheng, Ma Zhiqiang, Zhang Yunchang, She Lan, Guo Beibei,&Yang Feng. Construction Of Autonomous Learning Mode For Basic Chemistry With The Assistance Of Artificial Intelligence. Medical Education Research And Practice. 2025;33 (01): 49-54.

[4]. Dong Huasong,&Wang Zhiguang. Design Of Embedded System Experimental Teaching Based On OBE And AI Assisted Tools. Chinese Journal Of Multimedia And Online Teaching (First Ten Issues).2025; (01), 1-4.

[5]. Chen Hong, Yu Chuanming, Hu Zhang, Xie Xiangyu,&Huang Siqing. Construction And Practice Of A Diversified Assessment And Feedback System For Ideological And Political Education In University Basic Chemistry Courses Based On OBE Concept. Scientific Consultation. 2024;(14):148-152.

[6]. Li Jiajia, Li Zhuoning, Tang Yuping, Liu Huan, Meng Qinghua, Zhang Guanghui, Wang Qizhao. Exploration And Practice Of Ideological And Political Education In Medical Basic Chemistry Curriculum Based On The Concept Of "Chemical Learning Community" . Chemistry Education (Chinese And English),2024;45 (06), 66-75.

[7]. Li Ling, Weng Yue, Xiang Zuhui,&Guo Fengwan. A Preliminary Exploration Of Teaching Reform In General Education Courses Empowered By AI- Taking The Course Of "Chemistry And Human Civilization" As An Example. College Chemistry, 2025; 40(09):49-58.

[8]. Kuang Yuanyuan, Yu Shuyan, Gegentana,&Wang Min (2024). The Construction And Teaching Reform Of Smart Classrooms Based On Artificial Intelligence Technology Continues. Medical Education. 2024; 38(12):1-4.

[9]. Chen Shuhuang, Feng Zhiying, Tang Gengqiu,&Hong Chengming. The Application Of Virtual Augmented Reality Technology In Chemistry Courses For Pharmaceutical Majors In Higher Vocational Education. High Tech And Industrialization. 2024; 30 (11), 125-127.

[10]. Huo Mingming. Exploration Of Teaching Reform In Basic Chemistry In Higher Vocational And Technical Colleges. Inner Mongolia Petrochemical. 2022; 48 (05), 61-64

[11]. Ma Xiaona, Ji Liangliang, Xu Bei. Exploration Of Digital Teaching Mode For Basic Chemistry Experiments In Colleges And Universities. Technological Style, 2024; (34), 83-85.

[12]. Tao Xin, Liu Yang, Ma Chengzhang. Optimization Of Teaching And Management System For Basic Chemistry Laboratory In Digital Universities. Tianjin Chemical Industry. 2025; 39(03):171-174.

[13]. Huang Tingzhu. The Active Transformation Of Teaching Forms In The Era Of Artificial Intelligence. Teaching In Chinese Universities. 2025;(Z1), 85-91+107.

[14]. Xu Shanshan. The Reconstruction Of The Role Of Teachers In The Era Of Artificial Intelligence: Opportunities, Challenges, And New Positioning. Science And Education Cultural Exchange. 2025; (05):36-39.

[15]. Li Wei. Exploration Of The Application Of Artificial Intelligence Assisted Geography Teaching In Middle Schools: Taking Generative Artificial Intelligence "Kimi", "Iflytek Spark", And "Doubao" As Examples. Huaxia Teachers. 2025;(01):117-120.

[16]. Xu Tianyang. The Encounter Of Deepseek In Higher Education Has Given Rise To A New Cognitive Paradigm. Service Outsourcing. 2025; (03), 28.

[17]. Wei Yuming, Jia Kai, Zeng Runxi, He Zhe, Qiu Lin, Yu Wenxuan, Jiang Yuhao. Exploration Of The Application Of Artificial Intelligence Assisted Geography Teaching In Middle Schools: Taking Generative Artificial Intelligence "Kimi", "Iflytek Spark", And "Doubao" As Examples. Huaxia Teachers. 2025; (03), 2-39.

[18]. Xie Jingjing. The Deep Integration Strategy Of Information Technology And High School Chemistry Classroom. China New Communications. 2024;26 (02), 239-241

[19]. Yang Zongkai, Wang Jun, Wu Di, Chen Xu. Analysis Of The Impact Of Chatgpt/Generative Artificial Intelligence On Education And Corresponding Strategies. Journal Of East China Normal University (Education Science Edition), 2023; 41 (07), 26-35

[20]. Zhang Aijun, Chen Ruiqi. The Ethical Risks And Regulatory Pathways Of Deepseek Empowering Political Communication. Research On Public Governance. 2025,37(03):5-18.