International Journal of Social Science, Education and Humanities
ISSN Print: 3104-4239
ISSN Online: 3104-4247
CD ISSN: 3104-4255
https://doi.org/10.63313/IJSSEH.2002

Research and Reform of Functional Experiment Teaching Based on Generative Artificial Intelligence

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How to cite this paper: Yang, X. L., Chen, X. G., Hu, Y., Liu, Z. Z., & Guo, J. W. (2025). Research and Reform of Functional Experiment Teaching Based on Generative Artificial Intelligence. International Journal of Social Science, Education and Humanities, 1(3), 1-6. ISSN Print: 3104-4239, ISSN Online: 3104-4247.
https://doi.org/10.63313/IJSSEH.2002
Published: 2025-11-06

Abstract

With the rapid advancement of technology, generative artificial intelligence is gradually permeating the field of education. Functional experiment teaching constitutes a vital component of medical education. However, traditional models struggle to meet the demands of personalized learning and innovation capacity cultivation due to limitations in experimental equipment and resources, rigid teaching methodologies, and untimely resource updates. This paper delves into the reformative concepts and practical pathways for applying generative artificial intelligence in functional experiment teaching, analyzing its notable advantages in enhancing teaching effectiveness and fostering students' innovative abilities. Simultaneously, it reflects on potential challenges during implementation, aiming to provide valuable insights for the innovative development of functional experiment teaching.

Keywords

Generative artificial intelligence; Functional experiment; Teaching reform; Innovative ability; Practical ability

1. Introduction

With the rapid development of generative artificial intelligence technologies such as ChatGPT and Midjourney, human society is stepping into a new era of intelligent creation. Centered on large language models and multimodal generation algorithms, these technologies not only demonstrate revolutionary potential in research fields like natural language processing and image generation but also trigger profound changes in the education sector. Generative artificial intelligence can dynamically generate customized teaching content, simulate complex problem scenarios, and provide real-time feedback and guidance based on learners' cognitive characteristics and learning needs. This "on-demand customization" education service model is gradually breaking through the limitations of standardization and large-scale pro-

duction in traditional teaching, offering a new approach to achieving precision and personalization in education.

Functional experiment is a highly comprehensive experimental course. As a key bridge between theoretical knowledge and clinical practice, it integrates the knowledge and technologies of multiple disciplines, such as physiology, pathophysiology, and pharmacology. The goal of this course is to cultivate students' in-depth understanding of the laws of life activities and their ability to solve practical problems, which plays a crucial role in improving students' practical and innovative abilities. However, traditional functional experiment teaching faces problems, such as insufficient experimental equipment, rigid experimental content, and slow updates of teaching resources. These problems restrict the satisfaction of students' personalized learning needs and hinder the cultivation of innovative thinking; therefore, there is an urgent need to achieve breakthroughs with the help of emerging technologies. In this context, applying generative artificial intelligence to the teaching reform of functional experiments and exploring its application potential in aspects, such as experimental design optimization, virtual scenario construction, and personalized guidance implementation, is not only an inevitable trend to conform to the development of education in the intelligent era but also an important practical direction to improve the teaching efficiency of functional experiments and cultivate high-quality innovative talents.

2. Current Situation and Problems in Functional Experiment Teaching

2.1. Limitations of Experimental Equipment and Resources

In actual teaching environments, experimental equipment is insufficient to meet the needs of every student for adequate hands-on practice. Additionally, issues such as high costs of experimental animals, complex management procedures, and ethical restrictions make it difficult to fully carry out some experiments. Meanwhile, teaching resources like videos and case libraries are updated slowly, failing to keep pace with disciplinary developments. These problems restrict the satisfaction of students' personalized learning needs and hinder the cultivation of innovative thinking, creating an urgent need for breakthroughs using emerging technologies.

2.2. Single Teaching Mode

Traditional functional experiment teaching mostly involves teachers explaining and demonstrating, while students imitate operations. In this mode, students passively receive knowledge, lacking opportunities for active thinking and innovation. Moreover, the unified teaching content and progress fail to adapt to the learning needs of students at different levels—both students with weak foundations and those with strong abilities struggle to obtain personalized guidance.

2.3. Insufficient Cultivation of Students' Innovative Abilities

Functional experiment teaching aims to develop students' experimental skills, innovative thinking, and problem-solving abilities. However, in the current teaching model, students mostly follow preset experimental steps mechanically, lacking in-depth exploration of the experimental process and independent design. This prevents their innovative potential from being fully stimulated.

3. Advantages of Generative Artificial Intelligence in Functional Experiment Teaching

3.1. Enriching Teaching Resources

Generative AI can quickly generate massive teaching resources such as experimental cases, virtual experimental scenarios, and experimental video scripts based on themes and requirements set by teachers. For example, it can generate various pathophysiological cases, including rare disease cases, providing students with diverse learning materials and broadening their knowledge horizons. Virtual experimental scenarios generated by AI allow students to repeatedly practice operations in a virtual environment, freeing them from constraints of experimental equipment and animal resources.

3.2. Providing Personalized Learning Support

Generative AI can customize learning suggestions and guidance according to students' learning status and questions. When students encounter problems during experiments, interacting with AI enables it to explain principles in an accessible manner based on their knowledge level and provide solutions. For advanced learners, AI can offer cutting-edge research results and the latest experimental methods in related fields to meet their further learning needs.

3.3. Stimulating Innovative Thinking

In experimental design, generative AI can interact with students to help improve their experimental plans. After students propose initial ideas, AI can provide insights from perspectives like feasibility, innovation, and safety, inspiring students to think beyond traditional frameworks and effectively fostering their innovative thinking. For instance, if students design an experiment to explore a new drug's effects on the cardiovascular system, AI can provide research background, existing similar protocols, and evaluate and optimize their designed steps.

4. Teaching Reform Practice of Functional Experiments Based on Generative AI

4.1. Building an Intelligent Experimental Teaching Platform

Integrate generative AI technology to construct a functional experiment teaching platform, including virtual experiment, intelligent tutoring, and resource library modules. The virtual experiment module allows students to operate in AI-created virtual scenarios; the system automatically tracks and records operations and data, then provides analysis feedback. The intelligent tutoring module enables real-time dialogue between AI and students to answer questions and offer personalized guidance. The resource library aggregates AI-generated cases, teaching videos, and academic literature for independent learning.

4.2. Experimental Curriculum Design Integrating AI

Incorporate generative AI-related teaching links into curriculum design. During pre-experiment preparation, students can master objectives, principles, and key steps through dialogue with AI, which generates preview materials with rich charts and text based on their questions. During experiments, set up AI-assisted design sessions: students propose ideas, collaborate with AI to refine plans, conduct virtual pre-experiments, adjust schemes based on results, and finally perform actual operations. In report writing, AI can check grammar, data rationality, and suggest references.

4.3. Cultivating Students' Ability to Collaborate with AI

Emphasize training students' collaboration skills with generative AI. Teachers guide students to use AI tools correctly, train them to ask precise questions, and understand AI feedback. Meanwhile, teach students to critically evaluate AI-generated content and discern information accuracy. For example, organize group discussions on AI-generated experimental plans or case analyses to explore strengths and weaknesses, fostering independent thinking and judgment.

5. Challenges and Countermeasures In Applying Generative AI

5.1. Limitations of Technical Application

Although generative AI excels in processing large datasets and providing decision support, its knowledge accuracy and depth in specific professional fields (e.g., agricultural statistical analysis) need improvement. For instance, it may make errors or provide incomplete explanations of complex medical mechanisms. Countermeasures: Teachers should strictly review AI-generated content, correct and supplement it with professional knowledge. Encourage students to consult academic literature to verify and improve AI-provided information.

5.2. Information Security and Ethical Issues

The application of generative AI may involve ethical issues such as students' personal information security and academic integrity. Countermeasures: Select formal

and secure AI platforms, formulate strict data protection policies to ensure information security. Regarding academic integrity, clearly define boundaries for students' AI use, prohibit cheating, and guide rational use of AI to assist learning and research.

5.3. Challenges in Teachers' Role Transformation

Introducing generative AI into teaching requires teachers to shift from traditional knowledge transmitters to learning guides and supervisors, challenging their information technology capabilities and teaching concepts. Schools should strengthen teacher training to improve their ability to use AI, help them understand role changes in the new model, and encourage exploration of AI-integrated teaching methods.

6. Conclusion

Generative AI opens new paths for functional experiment teaching reform. Its advantages—enriching resources, providing personalized support, and stimulating innovation—can effectively enhance teaching effectiveness and cultivate students' comprehensive abilities. However, challenges such as technical limitations, security issues, and teachers' role transformation exist. By building intelligent platforms, designing reasonable curricula, developing students' AI collaboration skills, and addressing related challenges, integrating generative AI with functional experiment teaching is expected to promote innovative development in teaching and cultivate high-quality medical talents adapting to the times. Future advancements in AI will broaden its application prospects in functional experiment teaching; educators should continuously explore and integrate AI with traditional teaching to provide students with more diverse and in-depth learning experiences, fostering greater creativity and problem-solving abilities.

References

[1] Zuo Teng, Wu Tong, Song Xiaowei, et al. Dilemmas and Path Exploration of Artificial Intelligence Empowering the Transformation of Higher Education [J]. Higher Education Development and Evaluation, 2025, 41(04): 30-41+130-131.

[2] Chu Ming. Thoughts and Prospects on Artificial Intelligence Empowering the Reform of Immunology Teaching [J]. Chinese Journal of Immunology, 2025, 41(06): 1281-1285.

[3] Su Fugen. Risks and Governance of Generative Artificial Intelligence Promoting Higher Education Development from the Perspective of Complex Systems [J/OL]. Research in Higher Education of Engineering, 1-6 [2025-07-02].

[4] Song Qi, Sui Feng, Huo Hairu, et al. Exploration of Generative Artificial Intelligence Promoting Multimodal Interactive Teaching Mode in "Pharmacology of Chinese Materia Medica" [J/OL]. Lishizhen Medicine and Materia Medica Research, 1-4 [2025-07-02].

[5] Xing Yuanyuan, Qian Ling. Reform Actions and Reflections of Top American Universities in Responding to the Teaching Application of Artificial Intelligence [J]. Open Education Research, 2025, 31(02): 24-35.

[6] Liu Chang, Hu Jue, Lu Fangguo, et al. Research on the Reform and Development of Medical Education in the Era of "Artificial Intelligence + Education" — Taking Fundamentals

of Immunology and Pathogen Biology as an Example [J]. Chinese Journal of Immunology, 2025, 41(06): 1315-1319.

[7] Zhang Fan. Research on Artificial Intelligence Technology Empowering the Reform and Innovation of Ideological and Political Theory Courses in Colleges and Universities [J]. School Party Building and Ideological Education, 2025, (04): 53-56+60.