



Research on the Empowerment of Computer Course Teaching by Generative Artificial Intelligence

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Abstract. Based on the characteristics of generative artificial intelligence (GenAI) and its significant impact on the education sector, this paper constructs an application mode of GenAI in computer course teaching, detailing its specific applications in diversified teaching content generation, personalized learning support, interactive human-machine collaborative classroom construction, and diversified learning effectiveness assessment. It also analyzes the negative impacts in teaching applications and proposes corresponding countermeasures to address these challenges. This teaching mode is conducive to enhancing students' learning interest and enthusiasm, improving their practical abilities, and enhancing teaching effectiveness.

Keywords: Generative Artificial Intelligence; Learning enthusiasm; Teaching Mode; Teaching Effectiveness.

1 Introduction

In the era of educational digital transformation, the development of GenAI technology has triggered a new educational ecology, bringing new opportunities and challenges to computer course teaching. Literature^[1] suggests that GenAI assists teachers in teaching, promotes personalized learning for students, reforms educational evaluation models, optimizes learning environments, and fosters the development of students' critical thinking. To align with the new trends in education and teaching in the era of artificial intelligence, applying GenAI to computer course teaching necessitates the construction of a more efficient, flexible, and personalized new teaching model.

2 Overview of Generative Artificial Intelligence

Based on advanced technologies such as deep learning and natural language processing, GenAI generates works similar to or entirely new from existing content in various modalities and styles, such as text, images, audio, video, etc., exhibiting creativity, diversity, adaptability, rapid development, and riskiness^[2].

Since the emergence of GenAI, the global education community has actively promoted its application in education. Renowned universities such as MIT, Stanford, and Harvard in foreign countries have released AI-empowered education action plans, providing GenAI service resources and guidance for teachers and students. China has carried out the strategic deployment of the "AI+" initiative, actively promoting the integrated development of higher education and artificial intelligence technology.

The emergence of GenAI will profoundly change educational methods, entering a situation of actively embracing while minimizing negative impacts^[3], which poses new challenges for educators.

3 Application Mode of Generative Artificial Intelligence Empowering Computer Course Teaching

3.1 Diversified Teaching Content Generation

3.1.1 Teaching Resources Based on Knowledge Graphs.

Leveraging its powerful deep learning and content generation capabilities, GenAI extracts course-related knowledge points from vast amounts of text, databases, and other data sources through processes such as data acquisition, knowledge acquisition, knowledge extraction, knowledge fusion, and knowledge processing and storage. Knowledge graphs can clearly represent the associations and hierarchical relationships between knowledge points, making teaching resources more logically rigorous and systematic^[4]. Based on the well-constructed knowledge graphs, GenAI can generate various types of teaching resources related to specific knowledge points, including teaching plans, courseware, instructional designs, mind maps, cases, test questions, etc., to help students better understand and grasp basic theoretical knowledge points.

3.1.2 Application-Oriented Cases.

GenAI can generate diverse, application-oriented computer course practice cases for different professional needs such as navigation, remote sensing, communication, and so on, aiming to help improve students' ability to solve problems with their knowledge. The teaching cases designed by GenAI are not only targeted and practical but can also be personalized based on students' interests and proficiency levels. The forms of case studies can be diverse. Cases can cover different programming languages and difficulty levels, meeting the needs of improving basic skills while also expanding and improving. The content includes interesting cases such as game development and artistic creation, and can also be targeted towards specific fields such as machine learning and data analysis.

3.1.3 Ideological and Political Materials that Expand Emotional Values.

Utilizing GenAI technology, a "Computational Ideological and Political Intelligence Agent" can be constructed, to automatically generate ideological and political elements based on course knowledge points. GenAI serves as a mentor, collaborator, and

evaluator, providing multi perspective and multi-dimensional ideological and political examples to enrich the ideological and political case library. By creating a variety of rich educational resources and providing an open, free, and inclusive AI learning environment, instant feedback on the learning process can be achieved. On the basis of deepening students' experience, their cognitive scope and learning interests can be expanded, changing the traditional teaching method of ideological and political courses that uses lecture based indoctrination. This can promote students' emotional resonance with ideological and political teaching content^[5].

3.2 Personalized Learning Support

Students can utilize GenAI for learning path planning and resource customization. Simultaneously, GenAI can push resources to students to improve their learning efficiency.

Firstly, based on the pre-class learning content provided by the teacher, students can clarify learning objectives and generate a personalized preview plan based on their individual circumstances. Secondly, generating learning content. Before class, students can generate preview resources based on knowledge points, including documents, videos, courseware, etc.; after class, students can generate targeted content based on their classroom learning to consolidate learning effects. AI teaching assistants utilize AI technology to deeply analyze students' learning data, identify knowledge weaknesses, and customize the push of learning materials based on each student's knowledge base and learning pace, guiding them in autonomous learning. Thirdly, question answering and discussion. Students may encounter difficult questions during the learning process. Utilizing GenAI can provide answers or explanations, offering multiple possible solutions. At the same time, by continuously improving prompt words, it promotes understanding of the problem and enhances self-learning efficiency and effectiveness.

3.3 Construction of Human-Machine Collaborative Classrooms

In the digital intelligence era, teachers transition from knowledge transmitters to learning guides. The classroom is no longer just traditional human-to-human interaction but guides students to reasonably use GenAI for cognitive exploration, actively construct knowledge, and build human-machine collaborative classrooms, promoting highly conscious generative learning.

3.3.1 GenAI Facilitating Blended Learning.

Before class, students can study by themselves online and use GenAI to answer questions. The AI teaching assistant system categorizes and summarizes students' questions, and teachers appropriately adjust the focus of instruction based on system feedback. In the offline classroom, teachers communicate with students face to face, explain common problems according to the feedback of the system, and explain in detail the important and difficult points, so as to solve the difficulties in learning and deepen the understanding of knowledge. Teachers can propose extension questions in the classroom, allowing students to ponder over the correctness of GenAI's answers and guide

corrections. In this process, the knowledge graph is continuously updated and optimized.

3.3.2 GenAI Facilitating Flipped Classrooms.

Using generative artificial intelligence, we can design various interactive teaching classes such as gamified learning, collaborative learning, group reporting, etc., so as to stimulate students' learning interest and participation. For instance, in Python programming courses, the concepts related to object-oriented programming are abstract and difficult to understand. With GenAI, relevant game cases can be generated to guide students in completing the tasks. Teachers can also use GenAI to create collaborative learning classrooms, allowing students to work in groups to jointly complete specified tasks. Through this gamified and cooperative learning approach, a student-centered classroom is established, enhancing students' learning enthusiasm and improving classroom learning outcomes.

3.3.3 GenAI Facilitating Project-Based Learning.

Project-based learning centers on students, with students engaging in inquiry learning activities around certain tasks, fostering their innovative thinking and practical abilities [6]. It is divided into the stages of task assignment, grouping, analysis and research, implementation, and summary evaluation.

Task Assignment Stage: Teachers assign different tasks such as aerospace application projects, maze games, chatbots, etc., based on course objectives and student interests. **Grouping Stage:** Students form groups based on personal interests and abilities, with 3 to 5 people in each group, creating an atmosphere of collaborative learning, and each group self-assigns roles. **Analysis and Research Stage:** Students use GenAI to collect relevant materials about the task, analyze them, and discuss specific implementation plans within the group. **Implementation Stage:** Students code according to their roles to implement tasks. Students need to collaborate, communicate, and cooperate with each other to jointly solve problems. During this process, teachers provide supervision and guidance to ensure the smooth progress of the project. Students can write their own code or use GenAI to generate code, constantly debugging and improving it. **Summary Evaluation Stage:** Students report on the completion of the project, the problems encountered and their solutions, the knowledge and skills learned, etc. Teachers evaluate students' works, including code quality, functional effects, team collaboration abilities, etc.

Project-based learning can enhance students' interest, students can build a more solid knowledge system, and thus improve students' problem-solving ability and innovative thinking ability. Through division of labor, mutual communication and cooperation, the students' team spirit and communication ability are cultivated.

3.3.4 GenAI Facilitating Programming Practice.

GenAI can detect errors and problems in students' programming code through intelligent analysis and provide corresponding correction suggestions. During the programming process, students often encounter issues such as syntax errors and logical errors

that prevent the program from running correctly. In traditional teaching methods, teachers need to check each student's code one by one and provide guidance. With GenAI, errors and problems in the code can be quickly identified through intelligent analysis technology, and specific correction suggestions can be given. This instant tutoring and feedback helps students correct errors in a timely manner, improve their programming abilities, and reduces the workload of teachers. Besides code error detection and correction, GenAI can also assess students' programming skills and mastery of techniques by analyzing their programming behavior and results, and recommend suitable programming techniques and methods for them.

3.4 Diversified Learning Outcome Assessment

GenAI can conduct objective and accurate assessments of students' programming abilities, learning process data, classroom interactions, and other multivariate data through intelligent assessment systems, avoiding the subjectivity of traditional teacher assessments and the incompleteness of single-indicator assessments. This assessment not only provides students with continuous feedback and learning path planning but also helps reflect students' comprehensive abilities and development potential, providing teachers with a more scientific basis for teaching decisions.

One is the intelligent assessment of students' programming ability. The intelligent evaluation system is used to analyze the students' code, automatically evaluate the correctness, efficiency and readability of the code, provide suggestions for correcting errors and improving the code, and analyze what knowledge points students are lacking in, so as to provide personalized learning suggestions for students.

The second is the intelligent analysis of students' learning process data. Intelligent evaluation system is used to continuously track students' learning process data, detect code plagiarism, analyze students' learning time, practice completion, discussion participation, code error rate, modification time and other data, so as to build students' learning trajectory.

The third is classroom interactive evaluation. The intelligent evaluation system was used to analyze the students' interaction participation, participation time and participation times, and extract the facial expressions and gestures of students and teachers to evaluate the classroom interaction effect.

4 Negative Impacts and Coping Strategies

4.1 Negative Impacts

GenAI is a double-edged sword. While it brings many conveniences and advantages to computer course teaching, it may also produce some negative impacts.

4.1.1 Spread of False Information.

Due to the uncertain sources of training data sets and limited ability to understand knowledge, GenAI may generate false or erroneous content, leading students to regard erroneous information as the correct answer.

For instance, when solving the following problem: "A leasing company has a van, and there are n freight orders, with each order taking T_i time to complete. If the required delivery deadline for each order is F_i (all orders can be delivered early), how should these orders be selected to maximize the number of orders the leasing company can complete?" Multiple AI models provided incorrect answers, and after modifying the prompts several times to point out the problem, they still could not provide the correct answer. They all directly apply method of meeting scheduling problem, some are sorted by deadline, some are sorted by urgent time, but all use the greedy algorithm to solve it. In fact, this is a dynamic programming problem.

Such false information may disrupt students' knowledge systems and have adverse consequences on their cognition. Once students accept false information, they may trust it and continue to adopt it in future learning, further entrenching the false cognition.

4.1.2 Potential Impact on Students' Autonomous Learning Ability.

One is technological dependence. If students overly rely on intelligent tools or software to solve problems, it may weaken their independent thinking and autonomous learning abilities. This dependence may render students helpless when tools are not available, thereby restricting their autonomous learning and growth space. The second is the selection and integration of learning resources. In computer course learning, students need to choose from the vast amount of generated resources and exercises. Without good study habits, they may blindly engage in problem-solving exercises or fail to efficiently utilize resources. The third is lack of deep learning and understanding. When students overly rely on GenAI to complete assignments, they only pursue the correctness of answers and neglect the understanding and application of knowledge, thus unable to form a systematic knowledge structure.

4.1.3 Confusion of Teaching Subject Status.

GenAI utilizes its powerful learning capabilities to creatively generate diversified content and can even directly provide correct answers, which may reduce teachers' authority and prestige, questioning their subject status and affecting teacher-student relationships.

Firstly, it affects teachers' authority. When teachers rely more on GenAI to assist in teaching rather than guiding students using their own professional knowledge and teaching experience, students may feel that since AI can directly provide answers, the role of teachers becomes less crucial, thereby weakening students' trust and respect for teachers. Secondly, it affects teacher-student relationships. As artificial intelligence takes over some of the responsibilities of teachers, traditional teacher-student interactions become interactions between students and machines, greatly reducing opportunities for teacher-student exchanges. Consequently, teachers may not directly understand the difficulties students encounter during the learning process, and students may also

fail to appreciate the hard work of teachers, further negatively impacting teacher-student relationships.

4.1.4 Data Privacy and Security Risks.

When using GenAI services, students often need to rely on third-party platforms or tools. These platforms may collect, analyze, and store students' data, such as their majors, institutions, and subjects, posing data privacy and security risks. Furthermore, through big data analysis, sensitive information such as the key construction majors of schools and countries can even be obtained, involving national security.

4.2 Coping Strategies

4.2.1 Establishment of a Dynamic Large Model Evaluation Database.

Due to the numerous existing Large Language Models (LLMs) of GenAI, each with different characteristics and areas of expertise, a relevant statistical evaluation database should be established to provide reference for teachers and students in teaching activities, enabling the selection of suitable models for different problems and needs. Firstly, conduct in-depth research and evaluation on existing LLMs, analyzing their abilities, response speeds, intelligence levels, and advantages and disadvantages in specific fields. Secondly, with reference to the data in the evaluation database, teachers should guide students to use LLMs reasonably, correctly, and appropriately, improving efficiency and the accuracy of solutions to a certain extent. Thirdly, collect feedback and evaluations from teachers and students during the use of GenAI, subscribe to updates and news from major models and related platforms, promptly investigate and analyze new models, new versions, and new features, and update the database in time.

4.2.2 Maintaining Teachers' Dominant Role in Teaching.

Under the influence of GenAI, it is crucial to maintain teachers' dominant role in teaching to enhance students' learning interest, guide their learning direction, ensure learning progress, and improve teaching quality.

Firstly, provide teacher training to enhance teachers' professional literacy and teaching abilities, including their understanding and application of GenAI technology. In addition, teachers should carefully assess the accuracy and authority of the Artificial Intelligence Generated Content (AIGC) to avoid scientific errors in classroom teaching. Secondly, strengthen teacher-student interaction and feedback. Teachers should pay attention to students' learning situations, actively interact with students, and encourage them to express their opinions. By promptly responding to students' questions and needs, teachers can deepen communication with students and establish trust. Thirdly, focus on heuristic teaching. During the process of students utilizing GenAI for autonomous learning, teachers should guide students to think by posing questions from different angles, stimulate students' interest in autonomous learning, and reduce dependence on tools. Fourthly, rationally utilize GenAI. Teachers should only use GenAI as a teaching aid, rationally and effectively leveraging its advantages, but must not overly rely on it, always maintaining their dominant role in teaching. Fifthly, make good use of

counterexamples for teaching. Sometimes GenAI provides incorrect answers, which teachers can cleverly use to encourage students to dare to question, while also enhancing teachers' teaching status.

4.2.3 Correct Guidance for Students.

The widespread application of GenAI poses potential challenges to students' autonomous learning abilities, but we can adopt a series of effective measures to actively address them. Firstly, cultivate technical literacy. Teachers should guide students to correctly use intelligent tools and software, encourage them to try different tools and methods to solve problems, and cultivate their technical literacy and independent thinking abilities. Secondly, provide personalized guidance. Teachers should closely monitor students' learning dynamics, grasp each student's learning progress and difficulties, and provide targeted learning resources and tutoring to help students overcome learning barriers. Thirdly, stimulate learning interest and motivation. Teachers should carefully design attractive and challenging tasks to stimulate students' interest in learning and exploration desires, thereby reducing dependence on tools and cultivating students' autonomous learning abilities.

4.2.4 Enhancing Information Security Management.

Firstly, enhance the information security awareness of teachers and students. When using GenAI platforms, they must strictly comply with relevant regulations of the country and school. They can choose to remain anonymous and try not to register or log in. If the platform restricts anonymous users, when registering for the platform, one should always be vigilant in protecting personal identity information and try not to provide true personal identity information. In addition, data obfuscation can be performed, which means replacing sensitive keywords or using other everyday language when inquiring through GenAI. Secondly, establish standardized data management systems. Data management systems can regulate data collection, storage, analysis, and other aspects. Data is encrypted to protect personal privacy, and is supervised to promptly identify potential security risks.

5 Conclusion

The application of GenAI in computer course teaching brings new opportunities and challenges for teaching innovation. In the future, it will develop in the following aspects: Firstly, generating more intelligent and student-demand-oriented teaching content; secondly, constructing a more comprehensive and accurate evaluation system to provide a more scientific assessment of students' learning outcomes; thirdly, building a more efficient human-machine collaborative classroom; fourthly, establishing closer teacher-student interaction to promote mutual learning and progress; and fifthly, maximizing the mitigation of potential risks to ensure that the direction of education always points towards the comprehensive development and intelligent growth of individuals.

We need to continuously explore and practice, fully leveraging advantages and roles of GenAI, to make greater contributions to cultivating high-quality talents.

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