Exploration and Practice of Classroom Teaching Revolution Supported by Large Models

Yumei Cui[a], Xiaoqiang Jiang[b*], Meng Liu[c]

Shanghai Urban Construction Vocational College, Shanghai, 200438, China

[a]cuiyumei@sina.com, [b*]jxqiang2007@163.com, [c]mengliutj@hotmail.com

Abstract. Against the background of the advancement of the digitalization strategy in education, large models have become a key force driving the revolution in classroom teaching. From the perspective of reconstructing the educational ecosystem, this paper analyzes the trilateral interactive classroom ecosystem structure of 'teacher-machine-student' supported by large models from the dimensions of educational subjects, space, and elements, and explores the systematic transformation of teaching methods, content acquisition, and learning patterns. Taking the practical course on the application of Internet of Things technology as a case study, human-machine collaborative teaching classrooms are constructed using Coze and DeepSeek series models. The teaching process is reconstructed through four stages: scenario design and problem construction, knowledge understanding and solution iteration, hands-on practice and structural optimization, and transfer application and innovation expansion. Practice has shown that large model technology empowers teaching to achieve precise teaching, dynamic content, and active learning, thereby improving the quality and effectiveness of teaching. It provides a feasible path for classroom teaching reform in the intelligent era.

Keywords: Large models; Human-machine collaboration; Technological empowerment; Classroom teaching

1 Introduction

In recent years, China's strategy for educational digitization has continued to advance. The Outline of the Plan for Building an Educational Power (2024-2035) proposes to open up new development tracks through educational digitization and promote artificial intelligence to drive educational reform. The Opinions on Accelerating the Promotion of Educational Digitization explicitly states that artificial intelligence technology should be the core driving force for systematic reform of the education system, with a focus on advancing the construction of large educational models, improving multimodal corpora, and reconstructing the digital educational resource system. The successive emergence of large models such as ChatGPT and DeepSeek has become an important force in driving educational revolution. Education has leaped from an ecosystem centered on people and empowered by tools to a data-intelligent ecosystem of human-machine symbiosis and intelligent collaboration [1]. This emerging data-intelligent

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educational ecosystem driven by generative artificial intelligence technology has already transcended the scope of mere technical application and has gradually developed into a systematic and organic whole that integrates physical and digital spaces, combines human wisdom and machine intelligence, and supports adaptive learning and personalized development .

The classroom is the primary channel for learners to acquire knowledge and enhance their abilities [2]. Large models, with their powerful natural language understanding, content generation, real-time interaction, and data analysis capabilities, have broken through the spatiotemporal limitations and subject boundaries of knowledge transmission in traditional teaching, driving classroom instruction to transform from a teacher-dominated unidirectional teaching model to a tripartite collaborative co-creation model involving teachers, machines, and students. Taking the course on the application of Internet of Things technology as an example, this study employs Coze and DeepSeek's V3 and R1 models as teaching agents. It reconstructs the classroom teaching process by designing situational teaching and constructing problems, iterating on knowledge understanding and solutions[1], optimizing hands-on practice and results, and then migrating and applying knowledge for innovation and expansion. This aims to build a human-machine collaborative teaching classroom where teachers take the lead, large models provide empowerment, and students are the main body, offering reference for conducting and promoting human-machine collaborative teaching.

2 Classroom Education Ecosystem Structure Supported by Large Models

Large model technology can expand the cognitive field of human thinking. When using intelligent technology reasonably to complete work tasks, it will far exceed one's own capabilities in terms of both efficiency and effectiveness. Artificial intelligence large models have constructed a more open, accurate, and efficient classroom teaching ecological structure by reshaping the relationship between educational subjects, expanding the form of educational space, and reconstructing the logical structure of educational elements. This new ecological structure is a deep integration of technology and education, laying a solid foundation for the high-quality development of future education.

2.1 Educational Subjects: Reshaping the New Relationship of the Trilateral Interaction between Teachers, Machines, and Students

In traditional teaching, the classroom is primarily characterized by a binary subject relationship where the teacher dominates instruction and students passively receive lectures. Today, with the support of large models, the educational subjects have undergone a diverse reconstruction, evolving into a tripartite interactive model of 'teacher-machine-student, [3]' forming a dynamic organic system that mutually supports each other. For teachers, their role has shifted from knowledge transmitters and instructors to learning designers and thinking guides. Large models have become core assistants for teachers in personalized teaching, assuming dual roles as intermediaries between teachers and students and personalized teaching aids. This allows teachers to focus more energy on designing classroom teaching goals, gaining insights into student learning situations and conducting differentiated analysis, fostering innovative thinking, and shaping values. For students, they have transformed from passive knowledge recipients into active knowledge explorers and constructors. Large models empower students' autonomous learning; through natural language interaction, students can engage with large models to independently explore problems, access extended resources, and cultivate critical thinking and autonomous learning abilities in the process of solving problems themselves. A virtuous closed loop has been formed among the three: teachers set learning goals and tasks, large models adapt learning paths based on student characteristics, and students' learning data feed back to teachers to optimize teaching strategies, enabling precise alignment between teachers' instruction and students' learning.

2.2 Educational Space: All-round Field Where Physical and Digital Spaces Integrate and Interact

Large model technology has broken through the boundary restrictions of traditional classroom physical spaces, constructing an integrated educational field that takes physical space as the foundation and digital space as the wing, thereby achieving full-time and all-space extension of learning scenarios. The physical classroom remains the core scenario for emotional exchange and focused discussions between teachers and students. The digital teaching space powered by large models has become an important extension of the classroom, infusing intelligence into it and forming a full-process learning support system covering before, during, and after class. Before class, students conduct self-directed exploration and learning through preview resources pushed by large models. In class, teachers and students can achieve real-time linkage between physical and digital spaces, using large models to conduct online voting, real-time Q&A, group collaboration activities, integrating concentrated learning with personalized learning; teachers can retrieve digital resources in real time via large models, demonstrate virtual experiments, carry out human-machine collaborative design, discussions, and exchanges; students interact with large models through terminal devices, converting abstract knowledge into visual learning content to enhance knowledge comprehension efficiency. After class, large models push personalized review resources and expansion tasks based on students' in-class performance and homework, while also building an online communication community to support asynchronous interactions between teachers and students, as well as among students. This integrated field has completely shattered the traditional perception that teacher-student communication is limited to classrooms and that classrooms are the entirety of student learning, allowing learning and communication to move from fixed times and spaces to anytime and anywhere.

2.3 Educational Elements: Reconstructing the Intrinsic Logic of Educational Subjects, Educational Resources, and Educational Activities

The integration of large model technology does not simply optimize the forms of educational elements, but rather reconstructs the inherent logic among three educational entities: educational subjects, educational resources, and educational activities, forming a new interactive mechanism characterized by subject-driven, resource-adaptation, and activity-enabling. In terms of the relationship between subjects and resources, the traditional one-way logic of resource supply to passive subject acceptance is broken, giving rise to a two-way cyclical logic of subject demand, large model matching, and precise resource supply. Large models can generate, screen, and reorganize educational resources in real time based on teachers' teaching objectives and students' learning needs, achieving precise and dynamic matching between resource supply and subject demand. In terms of the relationship between subjects and activities, educational activities have shifted from one-way instruction led by teachers to diverse interactions among three-party subjects. Large models have become intelligent participants in educational activities, capable of designing diverse activity formats such as inquiry-based, collaborative, and project-based learning according to learning goals, and providing real-time support for activity implementation. For example, during thematic project-based learning, large models can assist students in grouping, provide guidance on research methods, and analyze research data in real time, while teachers focus on controlling the direction of activities and deepening students' thinking. With dual support from large models and teachers, students actively engage in problem exploration and result presentation. This logical reconstruction enables educational elements to move from being scattered and independent to organic integration, making the educational ecosystem more adaptive and innovative, and providing solid support for the implementation of education goals oriented towards core competencies.

3 Classroom Teaching Transformation Supported by Large Models

Large AI models, with their strong technical advantages, are deeply penetrating the entire process of classroom teaching, driving the transformation of traditional classroom teaching from a teacher-centered model to a learner-centered human-machine collaborative system. This transformation is not a partial optimization of a single link, but a comprehensive change covering classroom teaching methods, ways of acquiring teaching content, and student learning patterns, under the dual influence of new educational concepts and technological environments. It has constructed a new teaching paradigm that meets the educational needs of the intelligent era.

3.1 A Profound Transformation in Classroom Teaching Methods: From 'One-way Lectures' to 'Comprehensive Empowerment'

Large model technology has completely broken through the traditional one-way teaching mode of teachers, driving a comprehensive and in-depth transformation of teaching methods towards precision, personalization, and inquiry. In terms of precision teaching, large models overcome the difficulty of traditional classrooms in meeting the needs of students at different levels. Teachers can use large models to generate tiered task lists, differentiated exercises, and personalized learning paths, allowing top-performing students to receive extension challenges and struggling students to get foundational consolidation guidance. In personalized teaching, large models track data throughout the entire process, including pre-class preview data collection, real-time interactive feedback during class, and post-class homework analysis, to build personalized learning profiles of students. Teachers then conduct teaching according to individual aptitudes based on these profiles. In inquiry-based teaching, large models serve as an intelligent toolkit for students to engage in project-based learning and interdisciplinary exploration: from providing suggestions for inquiry topics and retrieving literature resources, to assisting in designing experimental plans and analyzing inquiry data, and even optimizing the presentation format of results, large models provide full support for inquiry-based learning throughout the process, promoting the transformation of teaching methods from knowledge know ledge infusion to ability cultivation.

3.2 Transformation in the Way Classroom Content is Acquired: From 'Teacher-Prescribed' to 'Dynamic and Open'

The learning content in traditional classrooms is mainly designed by teachers based on textbooks, teaching aids, and internet materials, characterized by strong pre-setness and high teacher dominance. The application of large models has driven the acquisition of classroom teaching content towards a dynamic and open transformation, achieving diversified and real-time integration of resources. The content provided by machines can be tailored to the needs of cognitive subjects, breaking through the limitations of closed and static knowledge in textbooks, transcending school walls, extending the knowledge boundaries of classroom content [4], and connecting with real-world application scenarios, making knowledge alive and socially meaningful[5]. When facing disciplines with rapid knowledge iteration, teachers no longer rely on limited materials; they can quickly aggregate multi-modal resources through keyword retrieval to supplement cutting-edge content. The knowledge base of large models has rich associativity, allowing teachers and students to better extend their existing knowledge and promote knowledge transfer and application. More importantly, the content generated by large models is interactive. Students' sudden questions in class can be answered instantly by large models, which can also generate extended materials to deepen understanding and facilitate personal growth. Teachers can also rely on the model to generate differentiated materials based on students' learning situations, achieving resource supply tailored to 'each student, each strategy'. This transformation shifts teaching content from being given by teachers to being co-created by teachers, students, and machines. Large models become dynamic resource pools, while teachers focus on content screening and design, truly realizing teaching that is determined by learning needs.

3.3 Innovative Reconstruction of Student Learning Models: From 'Passive Reception' to 'Active Construction'

The empowerment brought by large model technology has transformed students' learning methods from passive knowledge reception into an active construction of a new learning model that deeply integrates autonomous learning, collaborative learning, and inquiry-based learning. In terms of autonomous learning, large models serve as personalized learning tutors for students. Students can interact with large models through natural language to ask questions, request knowledge explanations, or obtain extended resources, enabling on-demand learning. In terms of collaborative learning, large models drive collaboration from formal group division to in-depth synergy. Large models can assist students in completing group task assignments, synchronously sharing learning resources, and real-time coordination of collaborative progress. Additionally, they can record and analyze group discussion content in real time and provide optimization suggestions. Furthermore, the application of large model technology also cultivates students' inquiry-based learning abilities. With their rapidly updated knowledge reserves and efficient learning support functions, large models enable students to learn to solve problems independently using intelligent tools, forming a closed loop of autonomous learning that involves problem identification, inquiry, and resolution.

4 Teaching Practice Case

Taking the teaching case 'Smart Lighting System' from the course on the Application of Internet of Things Technology as the teaching content, this approach employs Coze and DeepSeek's V3 and R1 models as teaching intelligent agents to construct a human-machine collaborative classroom where teachers take the lead, large models provide empowerment, and students are the main body. The classroom teaching process is reconstructed through four stages: contextual teaching design and problem construction, knowledge understanding and iterative solution development, hands-on practice and result optimization, knowledge transfer application, and innovative expansion. This aims to achieve an organic integration of knowledge transmission, ability cultivation, and innovative thinking development.

4.1 Scenario Design and Question Construction: Large Model Collaboration to Activate Learning Motivation

In this stage, by creating real-life scenarios and designing step-by-step questions, students' desire to explore is stimulated, and learning objectives are clarified. The teacher takes the lead in determining the direction of the scenario, while dual models undertake the tasks of concretizing the scenario and refining the questions.

First, the teacher clarifies the core teaching objectives: to master the composition of intelligent lighting systems, the working principle of perception modules, and control logic. Subsequently, the teacher issues a scenario design instruction to the Coze agent: to construct intelligent lighting scenario requirements for three typical scenarios—school smart classrooms, home living rooms, and underground parking lots—including key elements such as environmental light changes, personnel movement, and energy-saving requirements, presented in the form of 3D interactive scenes combined with situational stories. Coze quickly generates an interactive scene model, allowing students to immerse themselves in experiencing the application effects of intelligent lighting in different scenarios through terminal devices, such as the dynamic process where lights in underground parking lots automatically turn on when people or vehicles enter and delay turning off after people leave.

DeepSeek V3 synchronously engages in problem construction, generating a stepwise chain of questions based on scenario characteristics: Firstly, at the basic level, what are the features and core advantages of smart lighting compared to traditional lighting? What environmental information does the smart lighting system need to perceive in three scenarios? Secondly, at the exploratory level, what hardware modules are required to achieve automatic adjustment of lighting in a scenario based on light intensity? Then, at the innovative level, how to balance the energy-saving requirements of underground parking lots with the safety lighting needs for vehicles and personnel? What measures are needed to achieve energy-efficient lighting? And so on. Teachers, combined with students' initial feedback, adjust the difficulty of questions through DeepSeek V3 to ensure that the questions are both aligned with students' cognitive levels and target the key and difficult points of teaching, ultimately forming a launch loop of scenario experience, initial exploration of problems, and clear goals.

4.2 Knowledge Understanding and Solution Iteration: Dual-Model Division Supports Solution Design

This phase focuses on the core knowledge transfer and preliminary solution design of the intelligent lighting system, achieving a closed loop of knowledge input, solution output, and iterative optimization. DeepSeek V3 leads knowledge parsing, while Coze is responsible for solution visualization and iterative feedback.

To address the research questions from the previous stage, the teacher guides students to identify knowledge needs, and DeepSeek V3 explains core knowledge through modular decomposition and visual demonstrations. It uses animations to illustrate the three-tier architecture of the smart lighting system: the perception module (light-dependent resistor, human body infrared sensor), the control module (microcontroller), and the execution module (LED lights). Combined with formula derivation and example calculations, it analyzes the pattern of how the resistance value of the light-dependent resistor changes with light intensity, provides parameter comparisons for different sensors, and clarifies selection criteria. Throughout this process, students can ask DeepSeek V3 questions in natural language, such as 'How to adjust the detection distance of the human body infrared sensor?' The model can provide real-time technical parameters and debugging methods.

After laying the groundwork of knowledge, students work in groups to select and design an initial plan for one of the scenario-based smart lighting systems, clarifying module selection, connection logic, and control rules. Each group inputs the framework of their plan into Coze, where the model automatically generates a visual prototype of the plan, marking module connection nodes and key parameters. Additionally, they can invoke the logical verification capabilities of DeepSeek V3 to highlight unreasonable aspects of their plans, such as mismatched interface models between components and microcontrollers (with suggestions for replacement models), excessively short or long delay-off times in control programs (which may cause lights to turn off before people leave or result in energy waste), and other issues. Teachers patrol the groups, provide comments on the innovativeness and feasibility of the plans based on model feedback, and guide the groups to optimize their plans according to model suggestions and teacher opinions, forming an iterated version of the plan.

4.3 Hands-on Practice and Result Optimization: Dual-Model Collaboration to Ensure Practical Effectiveness

This phase is the core link of knowledge implementation, through hardware construction, program writing and data collection, process review, and result optimization, to help students sort the problems in practical operation, and cultivate students' practical operation ability. DeepSeek R1 dominates practical guidance, DeepSeek V3 dominates thinking analysis, and Coze is for result presentation and optimization suggestions.

Each group receives a hardware kit (including: microcontroller, photoresistor, human infrared sensor, LED light, etc.) based on the iterated, and DeepSeek R1 pushes a step-by-step practical guide to each group through the terminal device: the first step is hardware connection, providing a high-definition diagram with positive and negative pole connection points marked; the second step is program writing, providing a basic code framework with key parameter modification locations marked, and students can consult the model code error issues and how to solve them through voice.

After each group completed the hardware setup and program download, demonstrated the testing effects of the intelligent lighting system, and based on the recorded practical data the students' oral recap, the DeepSeek V3 thinking mirror analysis was launched: generate a group practice thinking path map, mark key decision nodes and the problem-solving, such as when the group encountered sensor calibration failure, first tried to replace the sensor if it was ineffective, and then adjusted the calibration parameters through model guidance to succeed, which the problem-solving idea of combining trial and error with technical consultation; at the same time, the model compared the thinking paths of each group and extracted common issues. The teacher a brainstorming seminar for the whole class and guided the students to analyze the advantages and disadvantages of their own schemes and practical operations. Try to apply Coze based on the content of seminar and the test data, to generate an optimization report for each group: for example, to address the issue of slow response speed, the program algorithm was optimized, reducing the data processing time from the original 3 seconds to 1.8 seconds. Each group made a secondary adjustment to the system based on the report, and DeepSeek R1 provided technical support throughout the process, until the system met the goals, forming a "practice-reflection-optimization" closed-loop learning path to ensure the effect of the practical operation.

4.4 Migrating Applications and Innovative Expansion: Empowering Capability Migration with Large Models

The core of this stage is to achieve the transfer of knowledge and abilities, cultivating students' innovative thinking and engineering application capabilities. Coze leads scenario migration, and DeepSeek V3 is responsible for innovation support.

The teacher proposes a transfer task: transfer the design ideas of the intelligent lighting system in a simple scene to a complex scene, where the illumination intensity threshold needs be different at different positions in the same scene, combined with complex environmental characteristics such as high humidity and large temperature difference, etc., how to select equipment components, etc. Use large model for scheme innovation.

Each group conducted innovative design based on the transfer task, DeepSeek V3 provided cross-domain knowledge support: how to solve the problem of high corroding hardware? How to design an algorithm for automatically adjusting the light intensity? And so on. After each group completed the innovative scheme, the scheme demonstration animation and feasibility analysis report generated through Coze, and the whole class conducted an innovation scheme competition. The teacher combined the technical feasibility evaluation provided by the model to comment from three dimensions: innovation, practical, and technical rationality. Finally, the teacher can push extended learning resources, such as energy-saving standards, certification norms related to smart lighting, and guide students to carry out-depth learning after class.

5 Teaching Effectiveness and Conclusion

Practice has shown that empowering classroom teaching with large model technology has increased students' participation in class, and teaching quality and efficiency have also improved significantly, providing a feasible path for classroom teaching reform in the intelligent era. The interactive learning mode constructed by large models fully mobilizes students' initiative in learning. Students who originally had lower classroom participation can also actively engage in the learning process under the guidance of personalized tasks and the incentive of real-time feedback. At the same time, large models, through intelligent screening, reorganization, and adaptation of teaching content, organically integrate abstract and dull theoretical knowledge with concrete practical cases. Based on students' cognitive levels, they dynamically adjust knowledge structures and presentation difficulties, enabling students of different levels to receive appropriate learning support. This has enhanced the accuracy and systematicness of students' understanding of knowledge, with the overall correct rate of knowledge mastery among class students increasing by about 20% compared to traditional teaching. In addition, large models undertake a large amount of repetitive teaching tasks, such as answering questions about basic knowledge points and guiding practical operation steps.

The real-time response of large models effectively solves the inefficiency of queuing for answers in traditional classrooms, greatly saving teaching time. A project that would take 6 class hours to complete in a traditional classroom can be efficiently completed in 3-4 class hours under the support of large model technology, according to the actual situation of different classes.

The revolution of classroom teaching supported by large models is essentially a restructuring of the educational ecology that aims to empower education through technology and focuses on improving the of talent training. This transformation breaks the traditional boundaries of time and space, subject, and content in teaching, achieving a fundamental shift from “knowledge transmission” to “ability cultivation” from “unified teaching” to “individualized learning”. Schools, teachers, and students should all actively embrace this change, not only to fully leverage the advantages of large models the process of human-machine collaborative teaching and learning but also to rationally address risks such as technology dependency and academic integrity. Through measures such as optimizing teaching design, enhancing teacher capabilities and establishing a system of institutions, it is necessary to ensure that technology serves the goal of talent training.

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