Research on the Reform of the Operating System Teaching Mode Based on Artificial Intelligence

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Abstract: ***Aiming at the pain points of the teaching reform of the operating system course, this paper proposes a reform plan based on artificial intelligence technology. By constructing an intelligent teaching resource library, applying knowledge graph technology, creating an intelligent training system for postgraduate entrance examination, and establishing an AI-driven teaching iteration mechanism, etc., the difficulty of course learning is systematically reduced, and the teaching efficiency and the pertinence of postgraduate entrance examination review are improved. The reform is guided by the cultivation of compound talents, strengthens the cultivation of theoretical depth and practical innovation ability, and aims to cultivate applied talents with solid professional foundation and innovative practical ability.***

Keywords: Artificial Intelligence; Operating System; Teaching Reform; Knowledge Graph; Postgraduate Entrance Examination Training.

1. INTRODUCTION

The operating system occupies a core position in computer professional education. Its knowledge system is complex and abstract, with numerous algorithms that are easily confused, making it difficult for students to learn. At the same time, as a popular subject in postgraduate entrance examinations, students urgently need targeted training. The traditional teaching mode seems powerless in dealing with these challenges. With the booming development of artificial intelligence technology, introducing it into the field of education and teaching has become a trend This study aims to meet the needs of the times and explore the curriculum reform of "artificial intelligence + operating system" in order to innovate the teaching mode and improve the teaching quality and students' learning experience. Peng et al. [1] proposed a lifelong domain adaptive framework to tackle performance degradation across changing environments (Peng et al., 2026), while Zheng et al. [2] introduced DiffMesh, a motion-aware diffusion framework for recovering human mesh from videos (Zheng et al., 2025). Beyond pure vision tasks, multimodal personalization has been explored for consumer applications, as Shan et al. [3] rethought wine tasting for Chinese consumers using a service design approach (Shan et al., 2025), and Xia et al. [4] developed KOA-Monitor, a digital intervention system for knee osteoarthritis patients (Xia et al., 2025). In the field of sarcasm detection, Deng et al. [5] proposed LLM-MVR, an LLM-guided multi-view reasoning distillation framework (Deng et al., 2026). For person re-identification, Wang et al. [6] introduced QA-ReID, a quality-aware query-adaptive convolution method for clothes-changing scenarios (Wang et al., 2026). Video object segmentation has been advanced by Li et al. [7] through MFT, a memory-aware fine-tuning strategy for SAM2 enabling efficient long-sequence processing (Li et al., 2026). Wu et al. [8] presented Tiny-Critic RAG, which empowers agentic fallback using parameter-efficient small language models (Wu et al., 2026). For root-cause investigation, Yan et al. [9] designed PRISM, a pipeline leveraging specialized multi-agents (Yan et al., 2026), while Yuan et al. [10] introduced TA-Mem, a tool-augmented autonomous memory retrieval system for long-term conversational question answering (Yuan et al., 2026). In financial and trading systems, Yang et al. [11] developed a recursive multi-agent trading system for iterative portfolio optimization under geopolitical uncertainty (Yang et al., 2026). Industrial and marketing optimizations have also been addressed: Li et al. [12] researched cross-selling strategies for machinery equipment using historical behavior and product association rules (Li, Yang & Lu, 2025). Zhou [13] analyzed hierarchical needs in US automotive customer feedback and the sentiment–function nexus (Zhou, 2026). Wensi [14] explored AI-enabled data visualization marketing for automated production lines to build customer trust (Wensi, 2026). Yang, Zheng and Lu [15] constructed multi-dimensional credit-related transaction risk maps using graph neural networks (Yang, Zheng & Lu, 2025). Shen et al. [16] applied the whale optimization algorithm to financial payment fraud detection (Shen et al., 2025). In photonics, Tang et al. [17] designed and optimized a shallow-angle grating coupler for vertical emission from indium phosphide devices (Tang et al., 2020). Sun [18] proposed adaptive interfaces for personalized user experience using machine learning (Sun, 2025). For generative models, Dong and Li [19] developed a face generation model based on DCGAN (Dong & Li, 2025). Liu [20]

systematically evaluated deep learning architectural efficacy for plant image classification (Liu, 2025). Gao [21] researched intelligent supply chain collaboration for industrial electrical enterprises (Gao, 2025). In geomechanics, Gao et al. [22] conducted experimental study and modelling of hard and soft rock masses including fault zones (Gao et al., 2026). Jin [23] optimized order allocation algorithms for industrial internet platforms (Jin, 2025), and Miao [24] explored big data technologies for enhanced network security analysis (Miao, 2026).

2. ANALYSIS OF THE CURRENT SITUATION

2.1 Diagnosis of Teaching Pain Points

Cognitive overload: Abstract concepts such as process state transitions and virtual memory management rely on teachers' empirical explanations. Due to differences in students' spatial imagination abilities, the level of understanding varies.

Algorithm system confusion: There is a lack of dynamic comparison tools for scheduling algorithms such as FCFS, RR, and SJF in terms of time slice allocation and response time, leading students to fall into the dilemma of "knowing what it is but not knowing why".

Training system disconnection: The analysis of postgraduate entrance examination questions still mainly relies on static PPT presentations, unable to achieve the intelligent association of "knowledge points - questions - variants", and the attribution of wrong questions depends on manual experience.

2.2 Feasibility of Technology Empowerment

Use Unity3D and AI engines to build a dynamic process scheduling simulation system, and achieve a closed-loop of code-level policy configuration and visual feedback. Knowledge graph technology can analyze the course knowledge network, build an algorithm comparison matrix and a cognitive reinforcement path. The LSTM prediction model can achieve the dynamic evolution of postgraduate entrance examination questions and the self-optimization of recommendation strategies.

3. TEACHING REFORM OBJECTIVES

This project aims to achieve three major teaching reform objectives by introducing artificial intelligence technology.

1) Use AI technology to visualize and materialize abstract knowledge, lower the learning threshold [5-6], and significantly improve students' understanding and learning satisfaction of abstract content.

2) With the help of artificial intelligence-assisted teaching tools, effectively solve the problems of large course content and easily confused algorithms, and greatly improve learning efficiency.

3) Build an artificial intelligence personalized learning system, and comprehensively strengthen students' problem-solving skills and 应试能力 (examination-taking ability) according to the needs of postgraduate entrance examination.

Finally, form a "AI + Operating System" teaching model that can be promoted, and cultivate compound talents with both theoretical depth and intelligent practice ability. The goal setting is shown in Table 1.

Table 1: Set the "Artificial Intelligence +" curriculum reform objectives for the pain points of operating system teaching

Teaching pain points	Reform objectives	Final objectives
Abstract content, difficult to understand Large amount of content, algorithms prone to confusion Examination subject for postgraduate entrance, lack of pertinence	Utilize AI technology to lower the learning threshold, enhance the understanding of abstract content, and improve learning satisfaction. 借助人工智能辅助教学工具，解决课程内容量大、算法易混淆等问题，提升学习效率。 Through the AI personalized learning system, strengthen students' problem-solving skills and应试能力 for postgraduate entrance needs.	Form a promotable "AI + Operating System" teaching model to cultivate compound talents with both theoretical depth and intelligent practice ability.

4. IMPLEMENTATION OF THE REFORM PLAN

4.1 AI Resource Construction

Build an intelligent teaching resource library, develop an AI dynamic demonstration system and an intelligent simulation platform to achieve knowledge visualization. The process scheduling simulator can generate the CPU utilization curve in real time, and the memory allocation VR experiment can visually display the page frame allocation process.

1) AI Dynamic Demonstration System. Develop a process scheduling simulator based on a physics engine, support real-time adjustment of parameters such as time slice length and I/O request frequency, and generate dynamic curves such as CPU utilization and turnaround time. The memory allocation experiment uses VR panoramic display to visualize the page frame allocation process through a heat map.

2) Intelligent Simulation Platform. Build a virtual experimental environment covering core mechanisms such as deadlock detection and disk scheduling, and integrate functional modules such as magnetic head movement trajectory simulation and thread competition state capture.

3) Cognitive Optimization Driven by Knowledge Graph. Use AI technology to sort out the course knowledge network, generate an algorithm visualization correlation comparison graph, develop a model for identifying confusing points, push targeted teaching cases and cooperate with animations to achieve multi-dimensional cognitive reinforcement. The knowledge points of the algorithm visualization correlation comparison graph to be designed are shown in Table 2.

Table 2: Knowledge Points of the Algorithm Visualization Correlation Comparison Graph to be Designed

Comparison algorithm	Visual presentation method	Dynamic adjustment parameter	Performance evaluation index
Process scheduling algorithm			
FCFS RR SJF	Gantt chart + timing animation	Time slice length (RR), process arrival interval, I/O request frequency	Average turnaround time, response time variance, CPU utilization
Page replacement algorithm			
FIFO LRU OPT	Page frame heat map + page fault interruption statistics panel	Memory capacity Access string pattern Working set size	Page fault rate Jitter frequency Effective access time
Disk scheduling algorithm			
SSTF SCAN C-LOOK	Head movement trajectory simulation + cylinder distribution map	Request distribution density, head movement speed, request arrival rate	Average seek time Throughput Response latency
Synchronization mechanism			
Semaphore, monitor, message passing	Thread state transition diagram + resource competition animation	Number of threads Critical section size Competition intensity	Deadlock probability Throughput Waiting queue length

4) Algorithm comparison matrix. Use NLP technology to generate visualization components such as Gantt charts for scheduling algorithms and heat maps for page replacement, and establish an association model between dynamic adjustment parameters and performance indicators.

5) Intelligent diagnosis system. Develop a model for identifying easily confused points, design interactive cases for core concepts, and support an intelligent question engine to generate discrimination question banks; automatically push targeted teaching cases (such as comparison experiments of "process synchronization problems" and "deadlock avoidance"), and use text explanations and animations to achieve multi-dimensional cognitive reinforcement. The targeted teaching cases to be designed are shown in Table 3.

6) Intelligent training collaboration system for postgraduate entrance examination. Build a "test-evaluate-train" closed-loop system, create an AI course question bank and an AI empowerment auxiliary tool chain, and achieve dynamic evolution, precise recommendation and personalized training of the question bank.

Evolution of the AI question bank. Collect the real exam questions of nearly 10 years from 50 universities, build a three-dimensional label system, and calculate the question similarity and achieve dynamic recommendation through collaborative filtering algorithms.

Intelligent tool chain. Integrate multi-modal question answering assistants, three-dimensional test paper generation systems, and weak point targeted training modules.

Table 3: Targeted teaching cases to be designed

Confusing concept group	Visual design of core differences	Targeted teaching cases	Cognitive reinforcement strategies	AI interaction functions
Avoidance of process synchronization deadlocks	State machine comparison animation (showing differences between blocking/circular waiting)	Producer-consumer problem (synchronization), Banker's algorithm (deadlock avoidance)	1. Two-column comparison experiment report 2. Self-test question bank for confusing points	Real-time code risk detection (marking potential deadlock locations)
Paging storage, segmentation storage	Address translation AR demonstration (linear/two-dimensional space comparison)	Memory compression scenario (advantages of paging), shared library loading (advantages of segmentation)	1. Memory snapshot comparison tool 2. Performance test sandbox	Intelligent question engine (Automatically generate discrimination questions)
Threads, processes	Heat map of resource occupancy (CPU/memory/I/O comparison)	High-concurrency Web server (threads), multi-task scientific computing (processes)	1. Switching overhead measurement experiment 2. Fault injection test	Visualization of execution traces (Comparing context switches)
Virtual memory cache	Simulation of data flow paths (panoramic view of storage hierarchy)	Big data processing (virtual memory), real-time systems (cache optimization)	1. Access latency tester 2. Replacement policy analyzer	Intelligent parameter tuning assistant (Recommend optimization solutions)

4.2 Teaching Process

1) Before class: Identify problems.

Relying on the "three-dimensional integrated" intelligent teaching resource library, students independently explore and identify the key and difficult problems in learning, preparing for in-class learning. The knowledge graph navigation system constructs the knowledge network of the operating system discipline, annotates the core concepts such as process scheduling and memory management and their correlations, providing students with a visual interface to quickly identify knowledge weak points; the hierarchical question bank push module, based on students' historical learning performance, uses intelligent algorithms to accurately match personalized exercises and micro-course resources. For example, for students with insufficient mastery of the deadlock avoidance algorithm, it automatically recommends training content related to the banker's algorithm; the system also supports generating learning diagnostic reports, analyzing the results in combination with the degree of knowledge mastery, and pushing adapted preview materials and tools 定向推送适配的预习资料与工具, to help students strengthen knowledge blind spots targeted.

2) During class: Situational teaching.

① Create a situation. Use the AI simulation platform to simulate real operating system scenarios, support dynamic adjustment of key parameters and introduce the function of simulating random failures. Students can observe the changes in the system state in real time, use debugging tools for fault diagnosis and repair, and deeply understand the underlying operation mechanism and resource management logic through practical operations.

② Learn the principles. With the help of the AI dynamic demonstration system, transform abstract algorithms into interactive visual charts, allowing students to independently adjust parameters and observe the execution effects of algorithms in real time. The system automatically generates algorithm comparison conclusions through the AI interpretation module, and conducts correlation analysis in combination with theoretical pseudo-code and real system source code, strengthening students' dual understanding of algorithm principles and engineering practice.

③ Application practice. Based on the AI algorithm comparison tool, students can design and test custom algorithms in the simulation environment, and the system automatically generates a performance evaluation report and associates it with the industrial-level case library. Through modular code practice and function verification, students master the core capabilities of algorithm optimization and system-level development, realizing a closed-loop training from theory to engineering application.

3) After class: Intensive training.

① Personalized intelligent training. The postgraduate entrance examination intelligent training collaboration system, through a multi-modal intelligent Q&A assistant, integrates natural language processing technology, analyzes students' questions and correlates with the knowledge graph, and accurately identifies learning weak

points. The system dynamically generates personalized exercise sets according to students' historical learning data and the requirements of target universities, pushes special training content for high-frequency error-prone knowledge points, and provides step-by-step analysis and extended resources to achieve accurate knowledge consolidation.

② Three-dimensional test paper generation and simulation mock exam. The three-dimensional test paper generation system automatically generates simulation test papers suitable for different postgraduate entrance examination needs based on multi-dimensional rules such as knowledge point coverage, difficulty gradient, and question type distribution. The system supports dynamic adjustment of test paper parameters, simulates the real exam environment, and generates a multi-dimensional evaluation report, covering the degree of knowledge mastery and comprehensive ability ranking, helping students clarify the key points of review and improvement strategies.

③ Virtual collaboration and resource integration. The virtual learning community integrates an intelligent collaboration toolchain, supporting students to form teams and collaborate according to their learning progress and ability labels, sharing code libraries and project resources. Through AI-driven code review and performance testing tools, students can verify their practical results. At the same time, by accessing the integrated real exam questions bank for postgraduate entrance examination, academic literature and teaching resources in the system, a closed-loop learning system of "training - feedback - optimization" is formed.

5. CONCLUSION

This study uses artificial intelligence technology to solve the problems of "high abstraction, high confusion, and high competitiveness" in core computer courses. By constructing a reform closed-loop of "technology empowerment - data-driven - cognitive optimization", it has achieved a leap in teaching mode from "experience-driven" to "evidence-driven".

In the future, the integration dimension of AI and educational scenarios will be deepened, aiming to build a new teaching mode of "AI + operating system" and promote the equitable, personalized and high-quality development of education. Specifically, it includes three paths: expanding the boundaries of multimodal interaction to achieve intelligent perception of teaching scenarios; constructing a dual-graph mapping mechanism to promote the dynamic coupling of educational supply and industrial demand; exploring the metaverse experimental field to reshape the immersive educational operating system architecture.

FUND PROJECT:

Exploration and Practice of Cultivating Open Source Harmony Applied Innovation Talents from the Perspective of Industry-Education Integration — Taking "Comprehensive Training of Embedded Systems" as an Example, Yuejiao Gaohan [2024] No. 30, Serial Number: 1025; Reform and Practice of the Applied Teaching Mode of the "Computational Intelligence" Course Empowered by AI, Huiyuanfa [2024] No. 173, Serial Number: 32; Artificial Intelligence + "Computational Intelligence", Huiyuan Jiaowu [2025] No. 12, Serial Number: 10; Artificial Intelligence + Operating System, Huiyuan Jiaowu [2025] No. 12, Serial Number: 48; Comprehensive Training of Embedded Systems, Huiyuanfa [2023] No. 158, Serial Number: 154; OpenHarmony Innovation Laboratory, Yuejiao Gaohan [2024] No. 09, Serial Number: 51

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