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RESEARCH ARTICLE

Research on Optimization of Teaching Resources for "Securities Investment" Course Based on Knowledge Graph-Integrated Hybrid Teaching Model

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ABSTRACT

The research and practice of the "knowledge graph + micro-lectures + flipped classroom" tri-model interactive teaching model impose higher requirements on teaching resources. Taking the "Securities Investment" course as an example, systematic digital upgrading and optimization strategies for teaching resources are proposed in this paper. Blockchain technology is adopted to construct a teaching resource chain during optimization practices. This method provides resource support mechanisms for the knowledge graph-integrated hybrid teaching model and explores new pathways for resource optimization, offering reference significance for course resource construction.

Keywords: Course resource construction, Knowledge graph-integrated hybrid teaching model, Resource optimization research, Teaching resource chain.

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1. Introduction

In the teaching reform system of undergraduate universities, course resource construction serves as a crucial component. Teaching resources not only provide advanced and diversified teaching tools for educators but also offer autonomous and personalized learning support for students. Given their reusable and time-sensitive attributes, teaching resources continuously generate new demands. Particularly under emerging hybrid teaching models, existing resources face challenges such as outdated traditional resources, insufficient digital resource integration, and underutilized research resources. This study proposes optimization solutions for the "Securities Investment" course based on a knowledge graph hybrid model to enhance resource efficiency and allocation quality (Xiaoyi, 2023).

2. Knowledge Graph-Integrated Hybrid Teaching for "Securities Investment"

As a comprehensive and applied interdisciplinary course spanning economics, finance, accounting, statistics, and psychology, "Securities Investment" requires students to master theoretical foundations, practical operations, and investment philosophies.

With the rapid advancement of information and network technologies and the strategic imperative to build an education-powered nation, the curriculum system, pedagogical methods, and teaching models are all confronting transformative challenges. The traditional teacher-centered instructional paradigm no longer meets the demands of new-generation students, urgently necessitating the exploration of innovative teaching models (Jiaxian, 2010).

2.1. Knowledge Graph-Integrated Hybrid Teaching Model

This model represents a multi-modal asynchronous teaching paradigm guided by course knowledge graphs (Fig. 1).

It synergizes knowledge graph pedagogy, micro-lectures, and flipped classrooms through online-offline integration, enhancing both teaching efficacy and learning outcomes via empowerment and collaboration mechanisms.

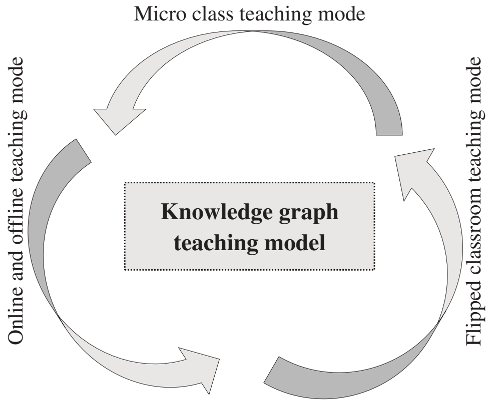

Fig. 1. Hybrid teaching model centered on course knowledge graph.

2.2. *Synergistic Empowerment of the Knowledge Graph-Integrated Hybrid Teaching Model*

The shift from the traditional "teacher-centered" instructional paradigm to a novel "learner-centered" hybrid teaching model—integrating Knowledge Graph, Micro-Lecture, and Flipped Classroom—lies in not only leveraging the enabling functions of individual modes but also activating their synergistic knowledge construction and comprehensive pedagogical efficacy (Zhijian *et al*., 2023).

In practice, the hybrid teaching model combines online and offline instructional activities. The knowledge graph mode primarily addresses the internalization of course knowledge and its interrelationships, the micro-lecture mode focuses on resolving key difficulties, common errors, and application points of the course content, while the flipped classroom mode emphasizes collaborative inquiry-based learning (Jingjing *et al*., 2018). However, in their application, these three modes are not isolated static entities but rather interact through mutual coordination, collaboration, and support, forming a dynamic configuration process of synergistic knowledge construction. Practitioners must prioritize the synergistic dynamics of the hybrid teaching model, including: the interactive coordination among hybrid modes, the complementary strengths of different modes, and the adaptive deployment of modes based on contextual needs. For instance, common learning challenges among students or issues in scaling personalized learning can be effectively addressed through flexible integration of these modes. By rationally and dynamically configuring hybrid modes in teaching practice, educators can maximize their comprehensive pedagogical efficacy, thereby efficiently enhancing students' ability to internalize knowledge and apply it in practical contexts (Gongwen *et al*., 2021).

3. Optimization of Teaching Resources in the Knowledge Graph-Based Hybrid Teaching Model

Curriculum teaching resource optimization encompasses multifaceted dimensions, including the enhancement of instructional resources, refinement of teaching materials, rationalization of physical resources, streamlining of information resources, as well as optimization of faculty capabilities and organizational coordination. This study narrows its focus to resource optimization within the knowledge graph-based hybrid teaching model, aiming to inform curriculum development with actionable insights.

3.1. *Strategies for Teaching Resource Optimization*

The research and implementation of the Knowledge Graph-Based Hybrid Teaching Model will trigger cascading transformations in traditional pedagogical ecosystems. The reform and optimization of related instructional elements must align with the operational requirements of this mode (Hongliang, 2019). Teaching resource optimization constitutes a systematic development project requiring multidimensional efforts to holistically enhance resource quality, efficacy, and utilization efficiency. Guided by principles of advancement and scientific rigor, this study proposes a resource optimization framework following seven strategies: resource planning, resource integration, resource enrichment, resource chain construction, resource allocation, resource evaluation, and resource sharing (Xianmin *et al*., 2024). Key implementation steps are outlined below:

1) Resource Planning: Develop standardized specifications and technical criteria for diverse resource types based on the pedagogical demands of the Knowledge Graph-Based Hybrid Teaching Model. Categorize resources for systematic integration, renovation, upgrading, and enrichment to build a reusable digital resource chain. Enhance resource quality and systemic coherence through reconstruction while improving utilization rates via rational deployment.

2) Resource Integration: Audit existing resources to identify supply categories, quantities, and quality levels. Streamline redundant resources, phase out obsolete materials, digitally upgrade standard resources, and prioritize digital development of scarce resources.

3) Resource Enrichment: Incorporate relevant research resources into course materials to expand their completeness and technological currency, ensuring alignment with the hybrid model's requirements while amplifying their enabling effects.

4) Resource Chain Construction: Optimize upstream, midstream, and downstream resource components through technological and managerial innovations. Systematically construct teaching resource chains using blockchain technology and database architectures (Zhigang & Hongliang, 2016).

5) Resource Allocation: Resource allocation operates through tiered strategies: static allocation aligns resources with predefined instructional objectives and schedules; dynamic allocation adapts resource deployment to evolving learner profiles; real-time allocation customizes distribution based on individualized learning analytics. This tiered approach ensures precision in matching resources to pedagogical demands across temporal and contextual dimensions.

6) Resource Evaluation: Implement full-process tracking and real-time monitoring via the resource chain platform. Conduct continuous assessments to identify issues, enabling prompt feedback and iterative improvements.

7) Resource Sharing: The model establishes intra- and inter-institutional sharing platforms with dual objectives: achieving resource complementarity and equitable distribution through cross-boundary collaboration, while systematically bridging disciplinary and geographical disparities. These platforms institutionalize mechanisms for sustainable resource circulation, leveraging interoperability standards to transcend institutional silos and amplify collaborative pedagogical innovation (Stahl, 2006).

3.2. Practices in Teaching Resource Optimization

In optimizing teaching resources for the Securities Investment course under the Knowledge Graph-Based Hybrid Teaching Model, research resources and digital resources serve as the core elements driving enhancement (Jiangyong *et al*., 2022). Traditional resources remain the primary targets for optimization, with their upgrade process focusing on digital transformation and systemic refinement. Through comprehensive optimization and restructuring of diverse pedagogical resources, this model provides holistic support for hybrid teaching.

3.2.1. Transformation of Research Resources

The Knowledge Graph-Based Hybrid Teaching Model not only introduces novel tools, technologies, methodologies, and dynamics to instruction but also establishes a reusable digital course resource repository.

Knowledge Graph Repository: The Securities Investment course's Knowledge Graph Repository comprises primary, secondary, and tertiary knowledge graphs, enabling students to explore visualized, networked representations of investment concepts and their interconnections.

Micro-Lecture Repository: The self-paced Micro-Lecture Repository aggregates critical, error-prone, and application-focused topics in securities investment, delivered via concise 10-minute videos. These micro-lectures prioritize engaging visuals, innovative content design, and audiovisual synchronization, with universal video formats ensuring cross-device accessibility.

Flipped Classroom Question Bank: This repository synthesizes core course concepts and recurring challenges identified across student cohorts, dynamically integrating new issues encountered by current learners. Functioning as an electronic compendium of traditional problem sets, it guides discussions, advanced tutoring, and collaborative knowledge construction in flipped classrooms. Pre-releasing questions in PDF format facilitates preparatory analysis and in-depth seminar engagement.

3.2.2. Utilization of Digital Resources

Digital resource optimization emphasizes functional refinement and strategic deployment.

Media Repository: Curated from high-quality, interactive multimedia content across online platforms, this repository organizes audiovisual materials on securities investment into taxonomically structured collections. Optimizing the Media Repository amplifies its pedagogical leverage through systematic categorization and accessibility enhancements.

Talent Repository: The database-driven Talent Repository archives institutional achievements in talent development, including alumni career trajectories, innovations, publications, and certifications (Gongwen *et al*., 2023). In the context of national educational advancement, its optimization involves continuous updates with performance metrics and industry credentials to strengthen career preparedness and employer alignment.

3.2.3. Modernization of Traditional Resources

Traditional resources—such as courseware, study guides, exercises, case studies, practical tools, assessments, and Q&A materials—undergo structural optimization through content enrichment, technological modernization, and presentational innovation.

Courseware Repository: Diverging from conventional supplementary materials, the digitally reconstructed Courseware Repository under the hybrid model serves as both content carrier and knowledge mapping tool, explicitly designed to scaffold self-directed learning in virtual environments.

Study Guidance Repository: As a critical scaffold for the hybrid model, this repository guides autonomous learning through three modules: learning tasks, methodological guidelines, and strategic recommendations. Educators deliver guidance via electronic templates or multimedia push notifications.

Assessment Repository: Centered on course competencies, this repository deploys progressive and summative assessments with diversified question types embedded in micro-lectures. Human-computer interaction mechanisms enhance learning outcomes through iterative testing cycles.

Case Study Repository: Augmented by AI-generated interactive digital cases, this repository provides authentic industry scenarios aligned with key course concepts. Incorporating exemplary student projects and real-world events under principles of authenticity and objectivity elevates case vividness and analytical depth.

Practical Training Repository: Given the Securities Investment course's applied rigor, this repository integrates virtual trading platforms, simulation software, and training bases, supplemented by curated online resources via hyperlinked references (Xinmin & Yao, 2024). Cross-platform resource aggregation addresses unmet practical needs while strengthening investment decision-making competencies.

3.3. Construction of a Teaching Resource Chain Based on Blockchain Technology

3.3.1. Composition of the Teaching Resource Chain

Through systematic integration and optimization of resource elements, a closed-loop digital resource chain compatible with the Knowledge Graph-Based Hybrid Teaching Model has been established, encompassing comprehensive upstream, midstream, and downstream resources. The structure consists of nine elements, including augmented academic research resources, digitally transformed resources, and optimized traditional resources (Fig. 2).

Scientific research resources, which have undergone rigorous review and endorsement by domain experts, are characterized by cutting-edge innovation and contextual applicability; digitally transformed resources, validated

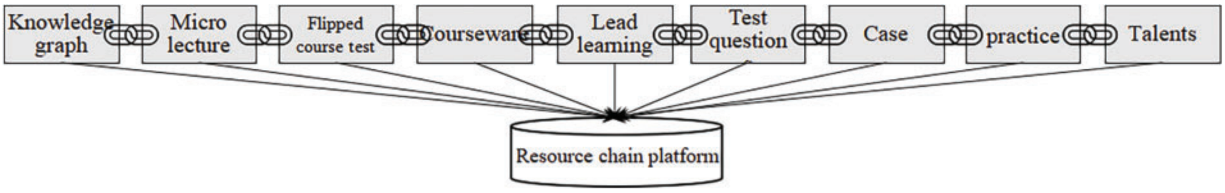

Fig. 2. Schematic diagram of the blockchain-based teaching resource chain.

through extensive practical implementation, demonstrate operational reliability; traditional resources, after undergoing systematic enhancements, exhibit digitally augmented adaptability and precision-targeted functionality (Zhiting *et al*., 2014). The rational allocation and synergistic integration of these resource elements collectively establish a fully functional resource support mechanism for the Knowledge Graph-Based Hybrid Teaching Model.

3.3.2. *Construction of the Teaching Resource Chain*

Construction Principles: The construction of the teaching resource chain must adhere to three principles: First, ensuring technical reliability, security, and innovation of resources. Second, evaluating collaborative applicability, dynamic updatability, scalability, and openness of resources. Third, balancing resource-sharing mechanisms and intelligent management capabilities (Gongwen *et al*., 2023).

Adopted Technologies: Blockchain technology represents a novel trust-based value network characterized by distributed storage, decentralization, traceability, high authenticity, smart contracts, and security. To address intra-campus and inter-campus resource-sharing demands, the teaching resource chain is built using consortium blockchain technology.

Technical Architecture: The blockchain-based teaching resource chain primarily consists of five architectural layers: the Storage Service Layer, Blockchain Service Layer, Gateway Service Layer, Interface Service Layer, and Application Service Layer. The Storage Service Layer is responsible for storing metadata and usage behavior data of all resource elements, leveraging blockchain's distributed storage and encryption algorithms to ensure tamper resistance and copyright protection. The Blockchain Service Layer employs consensus mechanisms and smart contract technology to enable transparent and automated verification of resource operations. The Gateway Service Layer manages secure cross-platform data interactions and access control, while the Interface Service Layer provides standardized APIs for third-party systems to support multi-device resource invocation. The Application Service Layer, serving as the real-time management platform, implements end-to-end governance of resource allocation, invocation, dynamic updates, and scalability through smart contracts, while also driving efficient resource-sharing collaboration via a decentralized architecture. A Resource Forum module can be integrated into the platform to iteratively enhance resource quality through user evaluations and feedback mechanisms, establishing a closed-loop improvement system.

3.3.3. *Functional Mechanisms of the Teaching Resource Chain*

The construction of the teaching resource chain provides high-reliability resource support for the Knowledge Graph-Based Hybrid Teaching Model. The primary functions of the resource chain include: enhancing resource utilization efficiency and allocation efficiency; elevating the value of resource sharing; enabling teachers to conduct collaborative lesson preparation via blockchain; offering on-chain support for students' self-directed learning; delivering personalized learning recommendations based on blockchain analytics; and facilitating course supervision to provide data-driven references for compliance inspections.

4. Continuous Improvement in Resource Optimization

Challenges encountered during resource optimization must be addressed through technological innovation and management innovation.

4.1. *Resource Quality Issues*

Key challenges include significant technical disparities among resources, such as inconsistent video resolutions and interoperability gaps. Addressing technical disparities requires strict adherence to unified technical standards and rigorous quality control protocols to ensure comprehensive technical excellence.

4.2. *Resource Co-Construction Issues*

Primary problems involve poor coordination and workflow disconnections during optimization. Resolving coordination inefficiencies and workflow disconnections is achieved through a hierarchical responsibility framework (Chief Supervisor Responsibility System + Sub-Resource Responsibility System), mobilizing faculty-student collaboration for systematic optimization.

4.3. *Resource Management Issues*

Implementing AI-driven automation (autonomous operation, maintenance, configuration, and invocation) alongside human-centric regulatory policies establishes a synergistic human-AI governance model for efficient problem resolution.

Conflict of Interest

The authors declare no conflict of interest.

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