Research on the Construction of Personalized Teaching Pathways for Generative AI-Driven Intelligent Auditing Curriculum

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Abstract: *With the rapid advancement of generative artificial intelligence technology, its capabilities for dynamic content generation and contextualized interaction offer new technological pathways to transcend traditional educational paradigms. This study focuses on auditing courses, aiming to explore the construction of a personalized teaching pathway for intelligent courses driven by generative AI. The research begins by explicating the theoretical foundation for the deep integration of generative AI and personalized instruction, drawing upon pedagogical theory, cognitive science, and the specific characteristics of auditing as a discipline. Subsequently, it systematically constructs a framework for generating teaching pathways, centered on dynamic learner modeling, auditing knowledge graphs, and personalized content adaptation, and designs a dynamic pathway planning algorithm based on multi-objective optimization. Finally, an implementation and optimization system is proposed, encompassing multidimensional efficacy evaluation, feedback- based refinement mechanisms, and a sustainable evolution logic, to form an intelligent teaching system capable of adapting to learners' cognitive development and evolving in tandem with the discipline and technology. This provides theoretical reference and technical implementation insights for the reform of teaching in disciplines oriented toward higher- order competencies, such as auditing.*

Keywords: *generative artificial intelligence; auditing; smart courses; personalized teaching pathway; cognitive modeling; knowledge graph*

Introduction

Auditing as a discipline, which emphasizes the cultivation of higher-order competencies such as professional judgment, systematic thinking, and complex decision-making, has long faced teaching challenges including its complex knowledge structure, strong context dependency, and significant individual cognitive differences. Traditional standardized teaching models often struggle to effectively support the development of students' critical auditing thinking and differentiated professional judgment capabilities. Therefore, exploring intelligent teaching pathways capable of precisely accommodating individual cognitive characteristics and developmental needs bears urgent theoretical and practical necessity. The emergence of generative artificial intelligence technology, with its capabilities for deep content generation, multimodal interaction, and contextual awareness, provides unprecedented technical potential for constructing highly personalized, flexible, and self-adaptive learning environments. This study aims to systematically explore the theoretical and methodological construction of personalized teaching pathways for smart auditing courses driven by generative AI. By integrating learning science, cognitive science, and artificial intelligence technology, it designs and elucidates a comprehensive theoretical framework and technical system-encompassing dynamic cognitive modeling of learners, structured representation of domain knowledge, and dynamic generation and continuous optimization of pathways-with the goal of propelling auditing education toward greater precision, intelligence, and sustainability.

1. Theoretical Foundation for Integrating Generative AI with Personalized Auditing Instruction

1.1 The Educational Application Potential of Generative AI and Its Pedagogical Significance

Generative artificial intelligence offers the potential to transcend traditional knowledge-transfer paradigms in education, owing to its architecture based on large-scale pre-trained models and its emergent capacity for deep content generation. Its core potential lies in its ability to dynamically parse unstructured, complex learning needs and, accordingly, generate highly contextualized, interactive, and diversified instructional content and cognitive scaffolding. This includes, but is not limited to, automatically generating explanatory texts tailored to specific knowledge points, analytical case studies, evaluative question chains, and simulated dialogic scenarios, thereby transforming static knowledge repositories into adaptive resources for cognitive development.

From the perspective of pedagogy, the introduction of generative AI essentially provides a technological medium for realizing the personalized and contextualized learning advocated by constructivism and sociocultural theory. It enables the teaching system to transcend linear curriculum arrangements by offering immediate cognitive conflict or cognitive support based on the learner's real-time cognitive state and knowledge gaps. This process reshapes the traditional mechanisms of content delivery and feedback, transforming the teaching process from a unidirectional transmission into a dynamic generation and adaptation process centered on the learner's cognitive trajectory. This lays a technological-philosophical foundation for constructing a highly adaptive intelligent learning environment[1].

1.2 Analysis of the Knowledge Structure and Competency Cultivation Characteristics of Auditing Courses

The knowledge system of auditing courses exhibits a multi-layered composite structure. Its core lies not only in the mastery of declarative knowledge, such as accounting standards and audit procedures, but more crucially, in the development of higher-order cognitive abilities including risk-oriented professional judgment, systematic thinking, and evidence-based logical reasoning. The knowledge of this discipline is highly context-dependent, requiring learners to identify key audit matters, assess control risks, and design appropriate response procedures within intricate simulated or real-world business scenarios, which constitutes the complexity and comprehensiveness of its competency cultivation.

This characteristic of competency cultivation imposes specific requirements on the design of teaching pathways. Traditional homogeneous models of content delivery are inadequate for effectively supporting the differentiated development of critical auditing thinking and professional judgment capabilities. Learners need to engage with core conceptual frameworks before progressing to differentiated scenarios of varying complexity and risk characteristics for continuous analysis and decision-making practice. Consequently, the inherent demand of an intelligent auditing course is to provide a flexible teaching framework capable of simulating the uncertainties of auditing practice and offering precise interventions tailored to individual thinking patterns and decision-making shortcomings. This requirement creates a point of structural alignment perfectly suited for the integration of generative AI.

1.3 The Core Theoretical Basis for Constructing Personalized Teaching Pathways

The construction of personalized teaching pathways is not merely a product of technological convenience; its deeper theoretical foundation is rooted in relevant theories from cognitive science and learning science. Cognitive load theory posits that instruction must effectively manage a learner's intrinsic, extraneous, and germane cognitive loads. Personalized pathways aim to optimize the allocation of cognitive resources during the learning process by adapting the complexity and sequence of content presentation. Meanwhile, metacognition theory emphasizes the learner's monitoring and regulation of their own cognitive processes. A well-designed personalized pathway should provide external scaffolding and opportunities for reflection that foster metacognitive development, guiding learners from passive reception toward active, self-guided learning.

From a systemic construction perspective, the personalization of teaching pathways is a process of continuous interaction and dynamic equilibrium between the learning environment and the individual's cognitive system. In this process, generative AI serves as an intelligent regulator. Based on its multidimensional analysis of the learner's interactive behaviors, it dynamically infers their potential knowledge network structure and zone of cognitive development, thereby generating the next optimal learning sequence to promote knowledge integration and transfer. This construction logic elevates the learning pathway from a predetermined, fixed script to a growth-oriented structure that is driven by real-time data and undergoes continuous evolution. Its goal is the optimized expansion and deepening of each learner's unique cognitive map[2].

2. Construction of Core Elements for the Teaching Pathway in Generative AI-Driven Intelligent Auditing Courses

2.1 Dynamic Modeling of Learner Cognitive Characteristics and Knowledge States Based on Generative AI

The prerequisite for effectively constructing a personalized teaching pathway lies in achieving continuous and precise characterization of the learner's internal cognitive state. Generative AI can transcend the single-score representation of traditional assessments by parsing the multimodal interaction data of learners within the intelligent course environment-including the semantic logic of problem-solving, reasoning trajectories in case discussions, and time-series data alongside choice preferences in simulated decision-making. This process allows for the extraction of implicit cognitive feature dimensions. These dimensions encompass domain-specific depth of conceptual understanding, thinking patterns in audit risk judgment, logical rigor in evidence evaluation, and decision-making styles when confronting uncertainty, collectively forming a dynamically evolving learner cognitive profile.

Building upon these multidimensional cognitive characteristics, generative AI can further quantify the learner's knowledge state through modeling. This model is not a static checklist of mastered knowledge points, but rather a dynamic probabilistic representation that captures the strength of connections between various auditing concept nodes, the capacity for knowledge transfer, and potential areas of misunderstanding. Through sequence prediction and pattern recognition, the generative model can infer the consolidated areas, weak links, and potential "zones of proximal development" within the learner's knowledge structure. It also performs correlational mapping between the knowledge state and cognitive characteristics, thereby providing a temporally sensitive and interpretable data foundation for subsequent content adaptation and pathway planning.

2.2 Construction of the Auditing Knowledge Graph and the Personalized Content Adaptation Mechanism

The implementation of an intelligent auditing course requires a structured representation of domain knowledge to serve as its core framework. The construction of an auditing knowledge graph necessitates a systematic deconstruction of the disciplinary system. This involves entityizing core concepts such as audit objectives, risk assessment procedures, internal control components, types of audit evidence, and key accounting standards, and precisely defining the semantic relationships, logical sequences, and cognitive dependencies among them. This knowledge graph should encompass not only nodes of declarative knowledge but also embed "competency-oriented" nodes representing contexts of varying complexity and risk. This process forms a multidimensional semantic network integrating conceptual hierarchies with competency mappings, thus providing a framework for annotating and organizing teaching resources[3].

The personalized content adaptation mechanism operates between the aforementioned knowledge graph and the learner's dynamic model. Based on the real-time learning state, generative AI performs heuristic search and path planning within the knowledge graph to identify the target knowledge cluster or competency node that best aligns with the current cognitive development needs. Subsequently, the mechanism activates a context-aware content generation engine built upon pre-trained large models. This engine extracts elements from a base material repository to synthesize or reorganize, in real-time, micro-instructional content that matches the target node and is appropriate for the learner's existing cognitive level. These content forms include customized explanatory narratives, targeted analytical exercises, progressively complex case segments, or guided reflective questions, thereby achieving precise alignment between learning provision and individual needs.

2.3 A Dynamic Generation and Adaptive Adjustment Framework for Learning Pathway Algorithms

The generation of learning pathways constitutes a sequential decision-making problem based on multi-objective optimization. The core algorithmic framework takes the learner's dynamic model as its input, utilizes the auditing knowledge graph as the state space, and aims to maximize long-term learning gains and cognitive efficiency as its optimization objective. This framework typically employs paradigms such as reinforcement learning or evolutionary computation to simulate and generate multiple potential sequences of instructional actions (e.g., recommending specific learning resources, initiating a particular interactive task). It then estimates the anticipated impact of each sequence on the evolution of the learner's knowledge state and cognitive characteristics, subsequently selecting the path with the highest evaluated utility as the short-term recommended plan.

This algorithmic framework possesses inherent adaptive adjustment capabilities. The teaching pathway is not fixed upon initial generation but rather functions as a rolling, optimized provisional plan. With each new interaction between the learner and the course, their model is updated in real time, and the pathway generation algorithm immediately re-evaluates the suitability of subsequent sequences. The system is able to detect learner difficulties in comprehension, shifts in interest, or unexpected rapid progress, subsequently triggering either local re-planning or global adjustment of the pathway. This elasticity ensures the teaching pathway continuously synchronizes with the nonlinear, emergent nature of the learner's cognitive development, maintaining the timeliness and relevance of instructional interventions. This thereby constitutes the core of an intelligent teaching system featuring a sensing-response feedback loop[4].

3. Implementation Efficacy and Optimization Dimensions of the Personalized Teaching Pathway

3.1 A Multidimensional Efficacy Evaluation Framework for Learning Pathways Supported by Generative AI

Evaluating the implementation efficacy of personalized teaching pathways requires moving beyond singular measures of learning outcomes to construct a multidimensional assessment framework that integrates process-oriented and developmental indicators. This framework must first encompass the dimension of cognitive gain, quantifying a learner's progress in areas such as the integration of auditing concept networks, the complexity of reasoning chains, and judgment accuracy by comparing structural changes in their dynamic knowledge model before and after pathway intervention. The second dimension is pathway efficiency, which assesses the effectiveness of pathway planning in optimizing learning resource allocation by analyzing the cognitive investment and time cost required to achieve specific competency goals. Additionally, learning engagement and adaptive experience serve as process-oriented dimensions. These indirectly reflect the degree of alignment between the pathway and an individual's cognitive pace and interest preferences by analyzing the depth of learner interaction with generated content, its duration, and the frequency of self-regulatory behaviors.

Generative AI serves not only as the core driver for pathway construction but also provides crucial technical support for the aforementioned multidimensional evaluation. It can automatically generate formative assessment questions and contextualized tasks covering different cognitive levels, continuously collecting fine-grained learning performance data. Simultaneously, through natural language processing and pattern recognition technologies, the AI can perform semantic analysis and deconstruct the logical structure of learners' textual answers and discussion records, thereby transforming unstructured learning outputs into quantifiable evidence of efficacy[5]. This capability for data acquisition and analysis enables the efficacy evaluation to shift from a static endpoint assessment to a dynamic, multidimensional observation and diagnostic system that operates throughout the entire learning process.

3.2 The Feedback Loop and Adaptive Adjustment Mechanism for Pathway Iterative Optimization

The vitality of a personalized teaching pathway stems from a sophisticated, closed-loop, data-driven feedback system. This system takes the continuous data stream generated by the multidimensional efficacy evaluation framework as its input, establishing a complete feedback cycle from "pathway execution" to "effect perception" and finally to "strategy optimization." Temporally, this cycle manifests as the coordination of multi-level feedback mechanisms. Immediate feedback acts on the micro-level instructional pacing, dynamically adjusting the explicitness of subsequent prompts or providing instant cognitive scaffolding based on the learner's real-time performance on a current task (e.g., hesitation duration, error types). Periodic feedback operates at the meso-level of pathway segments; upon completing a knowledge unit or competency module, it comprehensively evaluates the overall efficacy of that segment, and the learner model parameters are recalibrated to update the estimation of their knowledge state and cognitive characteristics. Long-term feedback focuses on the macro-level pathway structure. By analyzing learning sequence data across chapters and topics, it assesses the long-term effectiveness of the overall pathway structure in promoting knowledge integration and transfer, and this information is used to optimize the macro-level strategies of the pathway generation algorithm.

Building upon this multi-level feedback, the system's internal adaptive adjustment mechanism is activated, driving the continuous iteration of the pathway. The core of this mechanism is an adaptive controller equipped with meta-learning capabilities, which encodes feedback signals into dynamic adjustments to the parameters of the pathway generation strategy. For instance, when data indicates that a specific type of exercise, such as "deriving audit procedures from case studies of misstatements," proves highly effective for learners with a visual-spatial cognitive style, the mechanism increases the weight of this teaching strategy within pathways designed for learners matching that cognitive profile. Conversely, for combinations of strategies that demonstrate low efficacy or cause high learner frustration, an automatic attenuation or replacement procedure is triggered. This process not only achieves fully individualized pathway optimization but also, while ensuring data privacy through privacy-enhancing computation technologies such as federated learning, facilitates the aggregation and analysis of anonymized group data. From this, more universally applicable and effective pedagogical patterns can be abstracted, subsequently feeding back into and enriching the system's overall teaching strategy repository. This creates a synergistic evolutionary dynamic where "individual optimization experience" and the "accumulation of collective wisdom" mutually reinforce each other[6].

3.3 The Logic of Sustainable Evolution for Teaching Pathways within the Intelligent Course Ecosystem

From the perspective of a complete intelligent course ecosystem, the construction and optimization of personalized teaching pathways is not a one-time project. Instead, it is an ongoing evolutionary process embedded within a dynamic, complex system co-constituted by technology, the discipline, and learners. Its sustainability is rooted in three core endogenous driving forces within the system: the content-driven force of disciplinary knowledge, the data-driven force of the learner population, and the technology-driven force of generative AI models. The dynamically maintained auditing knowledge graph, serving as the disciplinary ontology, evolves continuously alongside updates to auditing standards and shifts in business models. It consistently incorporates new nodes and relationships, such as novel risk types and audit techniques (e.g., continuous auditing, data analytics), thereby providing an ever-current "growth substrate" for teaching pathways. The continuous stream of learner interaction behaviors constitutes a massive flow of feedback data, offering a perpetual source of "empirical fuel" for validating and optimizing pathway efficacy. Concurrently, the iterative upgrades of the generative AI models themselves-such as improvements in comprehension and generation capabilities and optimizations in computational efficiency-provide a powerful "propulsive engine force" for delivering more precise and seamless personalized services.

This evolution follows a spiral-shaped, complex adaptive logic of "design-emergence-verification-crystallization-redesign." Initially, seed pathways co-designed by domain experts and learning scientists, when deployed at scale, generate a massive number of variants through the real-time adaptation performed by generative AI. Through continuous multidimensional evaluation, the system can not only verify the effectiveness of existing design hypotheses but, more importantly, allow for the "emergence" of highly effective instructional sequence patterns or content organization strategies from the vast number of successful pathway instances that were never pre-defined. These emergent best practices can be formally identified, extracted, and validated, ultimately becoming "crystallized" as new pathway generation rules or content templates, which are then integrated into the system's core knowledge base. Consequently, the teaching pathway transforms from a static "expert-designed product" into a dynamic "system-grown product." It acquires an inherent capacity to update in sync with disciplinary advancements, co-evolve with technological tools, and adapt in concert with learner diversity. This ensures that the intelligent course ecosystem can function as an intelligent entity capable of learning, adapting, and evolving, thereby maintaining its pedagogical efficacy and vitality at the forefront over the long term.

Conclusion

This study systematically constructs a theoretical framework and technical system for a personalized teaching pathway within generative AI-driven intelligent auditing courses. It demonstrates the logic of deep integration between generative AI and personalized auditing instruction at the theoretical level, clarifies the core element construction method based on dynamic cognitive modeling and auditing knowledge graphs, and proposes a pathway optimization and sustainable evolution mechanism supported by multidimensional efficacy evaluation and feedback loops. This framework transforms the teaching pathway from a predetermined, fixed sequence into a growth-oriented structure that is driven by real-time data and co-evolves with learners' cognitive development, providing a novel solution for achieving scalable, individualized teaching. Future research could focus on the empirical validation and refined measurement of pathway generation algorithms, the automated discovery and representation of complex teaching strategies, and the interconnection and transfer of cross-disciplinary knowledge graphs. Concurrently, sustained attention must be given to deeper issues in the educational application of generative AI, such as the management of cognitive load, ethical boundaries, and trustworthy interaction, in order to propel intelligent educational systems toward a more responsible, effective, and human-centric direction of development.

Fund Projects

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References

[1] Zhu Zhuoyue. The Design and Practice of an Intelligent Classroom for the "Tax Fundamentals" Course in Secondary Vocational Education Under the Personalized Teaching Context. 2025. Guizhou Normal University, MA thesis.

[2] Peng Xinyuan. "Research on the Development and Teaching Practice of Intelligent Auditing Courses Empowered by Generative Artificial Intelligence." China Chief Financial Officer .10(2025):100-103.

[3] Zhang Mei. "Research on the Reform Path of Auditing Courses Under the Background of Intelligent Auditing." Science, Education and Culture Journal .21(2024):132-135.

[4] Li Xin, Yang Zhaohui, and Li Haiying. "Research on the Construction of Intelligent Classrooms Based on Online High-Quality Open Courses." Public Relations World .01(2025):130-132.

[5] Zhou Yan. "Research on the Implementation Strategy of Differentiated Teaching in Higher Vocational Colleges Under the Background of Smart Education-Taking the Financial Accounting Course as an Example." Modern Vocational Education .23(2021):50-51.

[6] Liu Shasha, and Li Wenjing. "Exploration of the Personalized Teaching Model for Applied Undergraduate Accounting Majors in the Intelligent Classroom Environment." China Management Informatization 24.07(2021):210-211.