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AI-Enabled Online Learning in New Business Education: Pathways and Mechanisms for Whole-Process Precision Support

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ABSTRACT

At present, online learning in new business education still faces several challenges, including ambiguous learning status diagnosis, coarse-grained resource matching, delayed instructional feedback, and insufficient coordination among different teaching stages. Focusing on whole-process precision support, this study constructs four operational mechanisms: a dynamic closed-loop mechanism, a human–AI collaborative mechanism, a learning motivation mechanism, and a continuous optimization mechanism. Based on these mechanisms, an implementation pathway of "pre-class precise diagnosis- in-class personalized support- post-class continuous improvement" is proposed. By leveraging AI-based learner profiling, intelligent resource recommendation, dynamic feedback, and human–AI collaborative tutoring, this study enhances the ability of online teaching to identify and respond to individual differences among students. It promotes the transformation of new business education from standardized resource delivery toward personalized and whole-process learning services, providing theoretical and practical references for improving talent cultivation quality and advancing the intelligent transformation of business education.

KEYWORDS

Artificial intelligence; New business education; Online learning; Whole-process support.

1. INTRODUCTION

With the rapid development of the digital economy, the cultivation of business talents can no longer be limited to the acquisition of basic theories and specialized knowledge; greater emphasis must be placed on developing students' data-driven thinking, business insight, comprehensive decision-making capabilities, and proficiency in solving complex problems. Online learning has become a vital modality for higher education, providing new business education programs with richer resources and more flexible learning approaches. However, as the availability of instructional resources continues to grow, a mismatch has gradually emerged between the supply of such resources and the actual needs of students. Within the same course, there are significant individual differences among students in terms of knowledge acquisition, cognitive abilities, learning pace, and learning aptitude; yet, most online courses still employ relatively uniform learning content, pacing, and evaluation criteria, making it difficult to accurately address the diverse learning needs of individual students. In light of this, leveraging artificial intelligence (AI) to enhance the capacity of online learning systems to identify and respond to these individual differences has become a critical challenge that new business

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education programs urgently need to address. This paper focuses on three structural dilemmas currently encountered in online business education: the ambiguity of student learning diagnostics, the crude nature of resource allocation, and the latency of instructional feedback. By analyzing the operational mechanisms and implementation pathways for AI-enabled, end-to-end precision support in online business education, this study aims to contribute to enhancing the targetedness and effectiveness of online teaching, as well as fostering deeper integration between artificial intelligence and the cultivation of new business talents.

2. PRACTICAL FOUNDATIONS AND CHALLENGES OF AI-ENABLED ONLINE LEARNING IN NEW BUSINESS EDUCATION

2.1 Realistic Foundations of AI-Enabled Online Learning in New Business Education

① Continuous Policy Support and Deeper Application of AI in Education

Driven by the advancement of educational digitalization strategies and the rapid development of artificial intelligence technologies, AI applications in higher education are accelerating and gradually expanding from single-function assistance to the entire teaching process. In recent years, China has continuously strengthened its policy framework for educational digitalization and AI-enabled education. The Education Powerhouse Development Plan Outline (2024-2035) proposes promoting artificial intelligence to support educational transformation, while the Opinions on Deeply Implementing the "Artificial Intelligence + " Initiative emphasizes integrating AI into all elements and processes of education and teaching. In 2026, five ministries and commissions, including the Ministry of Education, jointly issued the Action Plan for "Artificial Intelligence + Education", proposing key tasks such as promoting deep integration between AI and education and building an open ecosystem of "AI + Education"[1]. With the continuous improvement of policy systems, AI-enabled education has gradually shifted from strategic planning to practical applications such as intelligent learning assistants, learning analytics, learner profiles, and adaptive learning pathways, showing an increasingly prominent trend toward whole-process, scenario-based, and precision-oriented development.

② Expansion of Intelligent Teaching Scenarios and Accelerated University Applications

From the perspective of practical development in higher education institutions, the application scenarios of AI-enabled teaching are continuously expanding. Technologies such as knowledge graphs, AI teaching assistants, intelligent recommendation systems, smart courses, and educational intelligent agents are gradually becoming important components of online teaching. In 2025, the Ministry of Education included educational knowledge graphs, domain-specific educational models, educational intelligent agents, and digital intelligent practical teaching among the key directions in the third round of the collection of typical application scenarios for "Artificial Intelligence + Higher Education". At the university level, practical exploration and implementation are also accelerating. The Business School of Sichuan University has applied intelligent education platforms to teaching resource integration, classroom interaction, and learning analytics, while actively exploring intelligent lesson preparation, real-time classroom feedback, and personalized learning pathway design. The School of Business Administration at Shanghai Business School has developed knowledge graphs to associate teaching resources such as PowerPoint slides, videos, and exercises with specific knowledge points, enabling precise resource recommendation and further exploring functions such as intelligent assessment generation and personalized knowledge mapping. Overall, AI-enabled teaching in higher education is gradually evolving from single-function applications toward multi-scenario integration. Related technologies are being increasingly implemented in curriculum development, learning support, and teaching evaluation, providing stronger support for intelligent transformation of teaching processes.

③ Increasingly Abundant Digital Resources and Accelerated Integration of Intelligent Teaching

With the continuous advancement of educational digitalization in universities, digital courses, knowledge graphs, case-based resources, and online question banks have become increasingly abundant. Meanwhile, intelligent teaching platforms, large language models, and AI teaching assistants are gradually being integrated into new business education. In 2022, the National Higher Education Smart Education Platform established by the Ministry of Education incorporated 27,000 high-quality courses and 65,000 experimental and teaching research resources, covering a wide range of domestic and international learning resources[2]. At the same time, universities continue to expand AI applications in curriculum development, classroom teaching, and learning evaluation. The Business School of Sichuan University Jinjiang College has applied AI to knowledge graph construction, teaching material design, and classroom instruction in financial management courses. The Business School of Shantou University has developed the “Intelligence + Business” curriculum system, integrating smart teaching platforms and large language models into course teaching and evaluation. The construction of digital teaching resources and intelligent learning platforms for new business education is accelerating. AI applications are gradually shifting from supporting individual teaching tasks toward integration across multiple teaching stages, providing a solid foundation for personalized and whole-process online learning support.

2.2 Challenges of AI-Enabled Online Learning in New Business Education

① Ambiguous Learning Condition Diagnosis and Difficulty in Accurately Profiling Diverse Learners

Traditional online teaching usually evaluates students' learning conditions based on limited information such as examination scores, assignment performance, and online learning duration. Although these data can reflect certain learning outcomes, they cannot fully reveal students' knowledge understanding, cognitive engagement, and problem-solving abilities during the learning process, making it difficult to accurately determine whether deep learning has been achieved. For the same business analysis problem, different students may make identical mistakes for completely different underlying reasons. If judgments are made solely based on final scores, weaknesses in students' learning may be inaccurately identified, making targeted instructional interventions difficult. Furthermore, new business education places greater emphasis on data thinking, business insight, and decision-making capabilities, which are often reflected in students' thinking processes rather than only final outcomes. Therefore, learning condition diagnosis should not focus solely on results but should also consider learning behaviors, case analysis processes, task revisions, and decision-making processes in business simulations.

② Inefficient Resource Adaptation and Lack of Personalized Intelligent Recommendation Based on Cognitive Patterns

With the continuous development of online education, universities have accumulated large amounts of teaching resources, including course videos, electronic materials, cases, and exercises. However, the expansion of resource quantity does not necessarily lead to improved learning efficiency. When facing massive and diverse learning resources, students often need to independently select appropriate materials and determine learning sequences, which can be challenging, especially for students with weaker foundations. Although some online platforms provide recommendations based on historical browsing behaviors or resource popularity, they often fail to accurately identify students' current learning needs. Particularly in new business courses, resource requirements vary significantly across different learning stages. The foundational stage emphasizes conceptual understanding and basic training, whereas the competence-development stage focuses more on business cases, data analysis, and simulated decision-making. Therefore, achieving genuine resource adaptation based on students' cognitive characteristics and learning progress remains a key challenge in whole-process precision support.

③ Delayed Instructional Feedback and Lack of Real-Time, Deep Intelligent Interaction and Guidance

Online learning relies heavily on students' autonomous completion of learning tasks. However, due to limitations in teachers' time and energy, it is difficult to respond promptly to all students' learning problems. Although intelligent question-answering systems can improve feedback efficiency, if they merely provide direct answers, students may develop superficial understanding rather than deeply mastering knowledge. This issue is particularly significant in new business courses, where problems such as business case analysis, strategic choices, and operational decisions are highly open-ended and require students to consider multiple factors and compare different alternatives before forming judgments. When AI-generated answers differ from students' conclusions, students' judgments should not simply be regarded as incorrect. Instead, their reasoning processes should be further analyzed to identify underlying problems. Therefore, intelligent tutoring should move beyond a simple "question–answer" model and accurately identify students' knowledge gaps and reasoning deviations, providing targeted guidance, exercises, and case-based training to improve the effectiveness and depth of learning support.

3. OPERATIONAL MECHANISMS OF WHOLE-PROCESS PRECISION SUPPORT FOR AI-ENABLED ONLINE LEARNING IN NEW BUSINESS EDUCATION

3.1 Establishing a Data-Driven Dynamic Closed-Loop Mechanism

A data-driven dynamic closed-loop mechanism refers to connecting learning condition diagnosis, instructional support, and outcome feedback through the continuous collection and analysis of students' learning data, enabling teaching arrangements to be dynamically adjusted according to students' actual learning conditions. This mechanism provides a data foundation and operational basis for whole-process precision support in new business online learning. On the one hand, by comprehensively analyzing students' learning information, educators can more accurately identify students' learning needs at different stages, providing a basis for resource recommendation and instructional support arrangements, and reducing the mismatch between standardized teaching plans and students' actual requirements. On the other hand, through the continuous transmission of learning data across pre-class, in-class, and post-class stages, learning outcomes from previous stages can guide subsequent instructional arrangements, preventing fragmentation and disconnection among different teaching processes.

3.2 Establishing a Human–AI Collaborative Mechanism of "Routine AI Support and Key Teacher Intervention"

The human-AI collaborative mechanism emphasizes the rational allocation of responsibilities between AI and teachers according to the characteristics of teaching tasks. Under this mechanism, AI undertakes routine and repetitive learning support tasks, while teachers focus on complex problem guidance and the cultivation of students' higher-order abilities. This mechanism fully integrates AI's advantages in real-time response with teachers' professional judgment, providing more comprehensive support for whole-process precision support. On the one hand, AI can continuously provide knowledge explanations, learning resource recommendations, and basic question-answering services, responding promptly to students' routine learning needs at different stages and reducing delays in instructional support caused by limited teacher time and capacity. On the other hand, when students encounter complex business cases, open-ended decision-making problems, or persistent learning difficulties, teachers should intervene in a timely manner to compensate for AI's limitations in deep analysis, value judgment, and comprehensive ability development. Through the effective division of responsibilities and collaboration between AI and teachers, instructional support can

achieve a balance between broad routine assistance and in-depth personalized guidance, thereby improving the timeliness and coverage of online learning support in new business education.

3.3 Developing a Motivation Mechanism for Active Learner Participation

The motivation mechanism for active learner participation refers to stimulating students' willingness for autonomous learning and continuous improvement through learning goal guidance, learning process feedback, and learning outcome presentation. This mechanism changes students' traditional passive role in accepting instructional arrangements and enables them to become active participants in whole-process precision support. First, when AI recommends learning content, it should simultaneously explain the reasons behind the recommendations, allowing students to understand their knowledge weaknesses and directions for improvement. Second, by presenting information regarding learning progress, knowledge mastery, and capability development, students can clearly perceive their own growth and learning outcomes. Such transparent feedback helps students develop a more accurate understanding of their learning status. Through the establishment of learning motivation mechanisms, students can not only better recognize their own learning conditions but also actively adjust learning strategies and priorities based on AI-generated feedback. In this process, precision support evolves from a one-way system-driven delivery model into a two-way process involving active student participation and continuous feedback, providing additional data support for optimizing learner profiles.

3.4 Establishing a Feedback-Driven Continuous Optimization Mechanism

A feedback-driven continuous optimization mechanism refers to continuously improving resource recommendation and instructional support strategies by collecting and analyzing information such as students' learning outcomes, teacher and student feedback, and changes in course content. This mechanism enables intelligent support systems to continuously adjust themselves through accumulated data and ongoing feedback, rather than remaining as a fixed and static process. On the one hand, by evaluating the actual effectiveness of learning resources, institutions can identify problems such as inappropriate resource recommendations and unsuitable tutoring approaches in a timely manner, and accordingly adjust subsequent teaching arrangements. On the other hand, incorporating teachers' professional judgments and students' actual feedback into the optimization process can compensate for the limitations of relying solely on data analysis, making instructional support more aligned with real learning needs. Meanwhile, as new business course content continues to evolve, enterprise cases, data environments, and business models are also constantly changing. Therefore, resource databases and recommendation rules must be updated accordingly. Through continuous evaluation and adjustment, AI can more comprehensively identify students' needs, match appropriate learning resources, and optimize learning support strategies

4. IMPLEMENTATION PATHWAYS FOR WHOLE-PROCESS PRECISION SUPPORT IN AI-ENABLED ONLINE LEARNING OF NEW BUSINESS EDUCATION

4.1 Pre-Class Precise Diagnosis

First, it is necessary to establish and improve a data collection system for whole-process online learning in new business education. Taking courses as the basic unit, clear responsibilities should be assigned to teachers, platform administrators, and technical personnel. Unified data lists and recording standards should be developed to collect various types of learning data, including examination results, assignment performance, resource access, learning progress, case analysis, interactive discussions, and business simulations. Relying on existing online learning platforms,

learning data from course platforms, assignment systems, and practical teaching platforms should be integrated. Data cleaning, organization, and updating should be conducted in a unified manner, accompanied by data review and anomaly detection mechanisms to improve data completeness and accuracy. At the same time, access permissions and usage boundaries for learning data should be clearly defined, and student privacy protection should be strengthened to provide secure and continuous data sources for learning condition diagnosis, learner profiling, and personalized learning support[3].

Second, based on the characteristics of new business courses, talent cultivation objectives, and enterprise practice requirements, pre-class learning assessment indicators should be refined. Diagnostic content should be designed around students' foundational knowledge, data analysis abilities, case comprehension, business judgment, and comprehensive decision-making capabilities. Through preliminary knowledge assessments, case analyses, data-oriented tasks, and learning preference surveys, combined with students' previous academic performance and learning records, a comprehensive understanding of students' knowledge foundations and competency differences can be achieved. On this basis, intelligent learner profiling and growth trajectory tracking systems should be developed to visualize students' capability weaknesses and learning preferences. Students should then be classified according to different learning needs, such as foundational reinforcement, competency enhancement, and advanced training. For different types of learners, the system can recommend corresponding preparatory materials, basic exercises, case tasks, and extension resources, helping teachers understand students' learning conditions in advance and enabling students to clarify their learning priorities. This provides a foundation for in-class personalized instruction.

4.2 In-Class Personalized Support

Learning resources should be dynamically matched according to students' profiles and real-time learning performance. By continuously updating learner profiles through online learning platforms, teaching systems can capture students' learning behavior data during classes. Through big data analysis, students' personalized learning habits and knowledge preferences can be identified, thereby forming differentiated teaching strategies and achieving “precision teaching” driven by data. Meanwhile, considering the interdisciplinary and practice-oriented characteristics of new business education, classroom learning resources and application scenarios should be further enriched. Universities can integrate internal and external practical platforms, online and offline teaching resources, and invite practitioners in digital economy and digital management fields to participate in teaching, forming a multi-stakeholder collaborative practical teaching support system[4]. On this basis, technologies such as digital twins and business simulations can be applied to construct virtual learning environments. Real-world business scenarios, including enterprise operations, market decision-making, and financial analysis, can be transformed into online practical tasks. Through intelligent recommendation systems, students with different disciplinary backgrounds and learning stages can be matched with appropriate interdisciplinary resources and practical learning content. This approach improves the alignment between learning resources and students' actual needs while enhancing the practicality and personalization of new business online learning.

4.3 Post-Class Continuous Improvement

Strengthen activity-based learning and establish AI-assisted flipped classrooms to improve students' participation and knowledge consolidation after class. With the goal of consolidating knowledge and enhancing competencies after class, students can be encouraged to shift from “learners” to “instructors” by independently explaining key course concepts, analyzing cases, or discussing challenging problems. AI teaching assistants can take responsibility for questioning, follow-up inquiries, and classroom feedback, helping students examine their understanding, identify cognitive gaps, and further expand their thinking during the process of explanation and interaction. Through this approach, post-class tutoring is transformed from a one-way question-answer process into an

interactive learning process characterized by student-led explanation and continuous AI engagement. While stimulating students' initiative, this approach also strengthens the connection among pre-class preparation, in-class learning, and post-class consolidation, further enhancing AI's supporting role in post-class reinforcement and personalized tutoring for new business online learning[5].

5. CONCLUSION AND OUTLOOK

Currently, the application of AI in higher education continues to deepen; however, insufficient coordination remains among pre-class diagnosis, in-class support, and post-class tutoring. The key to AI-enabled online learning in new business education does not lie in simply adding intelligent tools, but rather in dynamically adjusting learning resources, learning tasks, and tutoring approaches according to students' actual performance at different stages. By accurately identifying learners, continuously tracking learning conditions, responding to instructional needs in a timely manner, and effectively transferring teaching feedback, the pre-class, in-class, and post-class stages can be organically connected to form a closed-loop support system covering the entire learning process. Furthermore, through human-AI collaboration, teaching effectiveness and the quality of talent cultivation can be further improved. In the future, AI-enabled whole-process precision support in new business online learning still requires further improvement through practical exploration. On the one hand, continuous evaluation of the actual educational effectiveness of whole-process precision support should be strengthened, with particular attention paid to the applicability of AI across different courses, student groups, and learning stages, avoiding standardized and homogeneous technology applications. On the other hand, further improvements are needed in regulations concerning learning data usage, algorithmic recommendation, privacy protection, and teacher intervention. Clear boundaries of responsibilities between AI and teachers in different teaching scenarios should be established, promoting the transformation of online education from tool-assisted teaching toward comprehensive whole-process precision support.

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