Occupation and Professional Education Vol. 2 No. 10, 2025

AI-Enabled English for Vocational Undergraduate Education from the Perspective of Multimodal Cognitive Adaptation Exploration of Personalized Learning Path

Jing Lin
Guangdong University of Business and Technology, Institute of Applied Translation, Zhaoqing, Guangdong, China

Abstract: This study employs the framework of multimodal cognitive adaptation theory to investigate personalized learning phenomena in AI-enhanced English classrooms at vocational undergraduate institutions. The theoretical analysis begins with a detailed exploration of the concept's core principles, followed by an examination of the theoretical foundations supporting AI-integrated teaching environments. Current practices reveal both distinctive features and limitations of personalized learning approaches. These findings establish crucial empirical groundwork for future research. Notably, the multimodal cognitive adaptation-oriented learning pathway design principles developed from these insights demonstrate significant theoretical value. Practical implementation strategies for constructing personalized learning pathways have been validated in vocational English education. The study provides dual benefits: it offers theoretical references for integrating AI into classroom teaching reforms, while also contributing to improving foreign language instruction quality and fostering learners' individualized language development in vocational colleges.

Keywords: Multimodal Cognitive Adaptation; AI-Enhanced English Classroom; Personalized Learning; Pathway Construction; Vocational Undergraduate English Teaching

1. Introduction

In the context of advancing globalization, English proficiency has become a core competency in vocational education [1]. Vocational undergraduate programs aim to cultivate applied and skilled professionals, where students 'English capabilities directly influence their career development and international competitiveness. With AI technology developing at an unprecedented pace in recent years, it is profoundly reshaping educational paradigms. AI-powered teaching models have emerged as a key driver of educational reform [2]. Against this backdrop, integrating AI technology with advanced pedagogical concepts to develop personalized English learning pathways tailored to vocational undergraduates' characteristics has become a critical issue requiring urgent attention in current educational reforms [3,4].

Multimodal cognitive adaptation represents an innovative educational paradigm that delivers learning content through multisensory channels (visual, auditory, tactile), precisely aligning with learners 'cognitive patterns and individual needs. When applied to AI-enhanced vocational undergraduate English instruction, this approach effectively overcomes the limitations of traditional single-mode teaching [5]. The conventional "one-size-fits-all" methodology in English classrooms often fails to accommodate diverse learners' foundational levels and learning styles, resulting in diminished motivation and suboptimal outcomes for some students. The integration of multimodal cognitive adaptation with AI technology provides a groundbreaking solution to this pedagogical challenge [6,7].

AI technology has enriched English teaching with abundant resources and robust tool support. Intelligent teaching systems can automatically generate customized learning plans and relevant content based on students 'learning data and cognitive characteristics. Virtual learning assistants can provide real-time responses to students' questions and offer targeted one-on-one tutoring services. The multimodal presentation approach makes the learning process more engaging by utilizing various formats such as videos, audio, and images to demonstrate

English knowledge. This not only stimulates students' interest in learning but also enhances their focus and classroom participation, transforming learning from a tedious text memorization into an interactive experience [8].

The application of multimodal cognitive adaptation in AI-enhanced vocational undergraduate English classrooms remains in the exploratory phase. Achieving full integration of technology and pedagogical concepts to create effective personalized learning pathways continues to pose challenges in practical implementation. This study focuses on thoroughly exploring the application value of multimodal cognitive adaptation, establishing a scientifically sound and comprehensive personalized learning system. This provides robust theoretical and practical support for improving vocational undergraduate English teaching quality, driving the high-quality development of vocational undergraduate English education [9,10].

2. Theoretical Foundation of Multimodal Cognitive Adaptation in AI-Enabled Vocational Undergraduate English Classrooms

2.1 Analysis of the Connotation of Multimodal Cognitive Adaptation

As educational informatization advances, the core value of multimodal cognition adaptation in AI-enabled vocational undergraduate English classrooms is becoming increasingly evident. To drive innovation in such classrooms, a precise understanding of its essence is crucial [11].

Multimodal cognitive adaptation is an educational philosophy that integrates diverse cognitive approaches and information delivery methods. By synthesizing multiple sensory channels—including visual, auditory, and tactile elements—it effectively accommodates the varied cognitive preferences of learners. In vocational undergraduate English classes, students exhibit distinct learning styles: some prefer visual methods like watching English films or reading picture books, while others favor auditory approaches such as listening to English broadcasts or singing songs. This approach tailors diverse learning resources and methods to these differences, enabling each student to discover their optimal learning rhythm. From the perspective of information presentation formats, it encompasses diverse modal types including text, images, audio, and video. In AI-powered classroom environments, these multimodal elements can be organically and effectively integrated through appropriate technical means. When teaching grammar knowledge, beyond traditional text-based explanations, vivid animated demonstrations can be employed to illustrate grammatical application scenarios, complemented by clear audio commentary. This multi-dimensional approach not only enriches learning content but also effectively enhances students' interest and engagement during the learning process.

Multimodal cognitive adaptation transcends mere random combination of learning modalities. This approach strategically integrates diverse instructional formats based on three key factors: learning objectives, content complexity, and learners 'cognitive readiness. By leveraging AI-powered analytics, educators can monitor students' cognitive progress and learning trajectories in real-time, enabling dynamic adjustments to teaching resources and strategies. When students encounter comprehension barriers, educators can promptly supplement with relevant visual aids like images or videos to facilitate breakthroughs in understanding.

Multimodal cognitive adaptation also emphasizes synergy with the teaching environment. The AI-enhanced English classroom environment encompasses hardware devices, software platforms, and teacher-student interaction dynamics—all of which significantly impact instructional outcomes. Educators must develop well-planned multimodal teaching strategies based on the school's actual network infrastructure and multimedia equipment capabilities, ensuring effective implementation of teaching resources.

In essence, multimodal cognitive adaptation represents a comprehensive educational philosophy. It integrates diverse cognitive approaches and multiple information modalities, dynamically adapting to students' cognitive characteristics and actual teaching environments. This methodology provides a scientifically grounded and highly effective framework for implementing AI-enhanced English instruction in vocational undergraduate programs.

2.2 Theoretical Support System of AI-Enabled English Classroom

AI-enhanced English classrooms represent an innovative teaching model. The development

and implementation of this approach require robust theoretical foundations, which provide crucial guidance for optimizing classroom practices [12].

Constructivist learning theory serves as a cornerstone of this framework. It posits that knowledge is not passively transmitted by teachers, but rather actively constructed by learners within specific socio-cultural contexts. Through support from educators and peers, and with the aid of learning materials, students actively build their understanding. In AI-powered English classrooms, students can engage in knowledge construction through virtual communication scenarios and intelligent tutoring systems. AI technology tailors content and feedback to individual learning progress and performance, helping students deepen comprehension and advance their meaning construction process.

The theory of multiple intelligences holds significant reference value for personalized classroom design. It clearly demonstrates that human intelligence exhibits diverse characteristics, with individuals possessing various types such as linguistic, logical-mathematical, and spatial intelligences. Traditional English teaching methods, however, often lack diversity and fail to meet the varied needs of students with different cognitive profiles. AI-powered classrooms, leveraging technological advantages, can provide diversified learning approaches: students with strong linguistic intelligence can benefit from increased reading and writing exercises, while those with enhanced bodily-kinesthetic intelligence may engage in specially designed English practical activities or interactive games. This ensures every student can fully utilize their unique strengths.

Cognitive load theory provides scientific guidance for optimizing classroom content. It posits that human cognitive resources are finite, and poorly designed learning materials can increase cognitive load, thereby impairing learning outcomes. AI-enhanced classrooms leverage technology to optimize content delivery: AI filters and integrates learning materials, removes redundant information, and highlights key concepts. By adapting content difficulty to students' cognitive abilities, it prevents learning fatigue caused by excessive or insufficient challenges, making the learning process more efficient.

Adaptive learning theory provides crucial support for personalized education. This theory dynamically adjusts learning content, methods, and pacing based on individual differences and learners 'current states. AI-enhanced classrooms possess robust data analysis capabilities, enabling real-time monitoring of students' learning behaviors and performance. By analyzing their learning characteristics and needs, the system generates personalized learning plans. When students struggle with a particular concept, the system automatically supplements relevant explanations and exercises. Once students demonstrate solid mastery of a topic, the system escalates to more challenging content, ensuring the learning path consistently aligns with their actual needs.

These theories mutually reinforce each other, forming a theoretical framework for AI-enhanced English classrooms, thereby providing a scientific basis for addressing students' personalized needs and improving teaching quality [13,14].

3. Analysis of the Current Status of Personalized Learning in AI-Enabled Vocational Undergraduate English Classrooms

3.1 The Prominent Advantages of Personalized Learning

In vocational undergraduate English classes, personalized learning models offer significant advantages, driving positive changes in English education [15].

Personalized learning precisely addresses the diverse needs of students. Vocational undergraduate students exhibit significant variations in English proficiency, learning capabilities, and interests, making traditional uniform teaching methods inadequate for accommodating all needs. This approach customizes educational plans based on individual circumstances: students with weaker foundations receive more foundational knowledge instruction and targeted practice opportunities, while those interested in Business English gain access to relevant case studies and specialized materials. This highly targeted pedagogy effectively resolves issues of insufficient depth and difficulty levels, enabling each student to achieve steady progress according to their current proficiency.

Personalized learning effectively boosts students'

motivation. When learners can adapt their studies to their own pace and interests, their willingness to participate actively increases. AI technology provides diverse learning resources, such as English films, songs, and interactive games, making the learning process engaging and less monotonous. Students have the freedom to choose their own learning content and methods, which strengthens their sense of responsibility and achievement. By managing their study time independently and selecting preferred tasks, students gain a sense of accomplishment that naturally fuels their motivation to continue learning.

Personalized learning can significantly enhance educational outcomes. Powered by AI technology, the system monitors students' progress in real time, accurately tracking their learning pace, knowledge mastery, and weak areas while dynamically adjusting learning strategies. When students encounter difficulties with specific concepts, the system automatically provides targeted exercises and detailed explanations to reinforce and deepen their understanding. Resources are tailored to individual learning styles—for example, offering more visual aids like images and videos for visual learners, and prioritizing audio materials for auditory learners—thereby optimizing knowledge retention efficiency.

Personalized learning cultivates students 'self-directed learning capabilities. Through this process, learners independently develop study plans, curate resources, and evaluate outcomes. This approach naturally fosters habits of independent thinking and self-motivated learning. With sustained practice, students' academic management skills progressively improve, laying a solid foundation for lifelong learning.

These advantages make personalized learning inject new vitality into the teaching of English in vocational college and promote the continuous improvement of teaching quality.

3.2 The Real Problems of Personalized Learning

While AI-enhanced personalized learning in vocational undergraduate English courses offers significant advantages, its practical implementation still faces multiple challenges that hinder further improvements in teaching quality [16].

Significant limitations persist in technology application. AI integration in English classrooms remains underdeveloped, with some intelligent teaching tools exhibiting functional deficiencies. When students pronounce English with regional accents, speech recognition systems show marked accuracy drops, failing to properly interpret their speech and consequently compromising instructional feedback. Certain AI translation tools frequently produce errors when processing complex grammar and contextual nuances, potentially misleading learners. Moreover, technical stability requires enhancement, as recurring issues like network latency and system crashes disrupt classroom flow and negatively impact students' learning experiences.

Teachers 'digital teaching competencies require enhancement. While some educators recognize the significance of AI technology, they lack professional operational skills and advanced pedagogical concepts. When using smart teaching devices and software, they can only perform basic operations, failing to fully leverage their personalized teaching potential. Many teachers remain unclear about how to utilize data analytics from intelligent platforms to understand students' learning needs and develop targeted teaching plans. Additionally, some educators remain entrenched in traditional teaching models, showing low acceptance of AI-powered teaching methods and reluctance to adopt new approaches. This resistance significantly hinders the progress of personalized learning development.

Most vocational college students demonstrate insufficient self-directed learning capabilities. Significant disparities exist in English proficiency and study habits among students, with some lacking the awareness and skills for independent learning. In AI-enhanced classrooms equipped with diverse resources and personalized learning pathways, many students still over-rely on teachers' supervision. They fail to proactively plan their learning schedules or select suitable materials. Faced with an overwhelming array of learning resources, numerous students easily become disoriented, struggling to effectively utilize them, which ultimately leads to reduced learning efficiency.

The personalized learning evaluation system has inherent limitations. Current English assessment primarily relies on traditional exam scores, lacking comprehensive evaluation of students 'learning processes and individualized

achievements. This singular evaluation approach fails to accurately reflect students' learning status and progress in AI-enhanced classrooms, while also failing to meet the demands of personalized learning. The evaluation metrics lack diversity, failing to adequately consider factors such as students' learning interests, attitudes, and collaborative skills. This inadequacy hinders the motivation of students and stifles their creativity. These challenges require ongoing exploration of solutions in future practice, ensuring AI-powered personalized learning delivers tangible results.

4. Construction of Personalized Learning Path Based on Multimodal Cognitive Adaptation

4.1 Principles for Designing Learning Paths

In AI-enhanced vocational undergraduate English classrooms, the construction of personalized learning paths based on multimodal cognitive adaptation must adhere to scientific principles, ensuring these pathways effectively enhance students' English proficiency while fostering their individualized growth.

The student-centered principle is central to this approach. Vocational undergraduate students exhibit diverse characteristics in English proficiency, learning styles, and career requirements. When designing learning pathways, it is essential to fully respect these individual differences. By leveraging AI technology to conduct precise analysis of students' learning data, educators can comprehensively understand their English proficiency, interests, and learning habits. For visual learners, provide rich multimodal resources such as images and videos. For kinesthetic learners, design interactive practical activities that allow students to autonomously choose learning content and methods, enabling them to customize study plans according to their needs and enhance learning initiative.

The principle of multimodal integration serves as the cornerstone. Multimodal cognitive adaptation emphasizes the synergistic effects of diverse information modalities. When designing learning pathways, it is essential to integrate multiple resources including text, images, audio, video, and animations. By employing multisensory stimulation, students can achieve a more comprehensive and profound understanding of knowledge. For English grammar instruction, combining textual analysis, animated demonstrations, and audio explanations allows for multidimensional information delivery, thereby enhancing learning outcomes. Special attention should be paid to the conversion and complementarity between modalities, with the sequence and presentation methods of different modalities strategically arranged based on specific learning content and individual student characteristics.

The dynamic adjustment principle constitutes a vital safeguard. As students 'learning processes undergo continuous evolution, their English proficiency and academic needs dynamically adapt over time. This necessitates learning pathways with adaptive capabilities. AI technology enables real-time monitoring of learning progress and outcomes, allowing timely optimization of content and difficulty levels based on student performance. When encountering comprehension barriers in specific knowledge points, the system automatically provides supplementary resources or modifies learning approaches. Conversely, when students demonstrate satisfactory mastery of a concept, the system accelerates learning pace and assigns more challenging tasks, ensuring the learning pathway remains closely aligned with students' actual needs.

The career-oriented principle is central to vocational undergraduate education. Designed to cultivate applied professionals who meet industry demands, the program requires English learning pathways to be closely aligned with students' majors and career trajectories. Tailored curricula and practical projects should be developed based on specific English requirements across disciplines. For instance, business majors should receive specialized courses in Business English and Negotiation, while tourism students should study Travel English and Tour Guide English. This approach enables students to enhance their language proficiency while strengthening career-relevant skills, ensuring comprehensive preparation for future employment.

Only by following these principles can we build a scientific and efficient personalized learning path, and then promote the teaching quality and learning effect at the same time.

4.2 Implementation Strategy of Personalized Learning Path

In vocational undergraduate English classes, AI-

powered tools and multimodal cognitive adaptation are crucial for creating and implementing personalized learning pathways, which is a key element in achieving individualized teaching objectives. The following sections will outline specific strategies from four distinct dimensions.

Strategies for Integrating Multimodal Resources. Educators should fully integrate diverse learning materials including text, images, audio, and video to diversify instructional content delivery. When teaching reading comprehension, educators may incorporate theme-related visuals and videos to help students intuitively grasp textual content. For listening practice, beyond conventional audio materials, educators can introduce English films and songs to create varied language environments, thereby enhancing students 'listening comprehension skills. AI technology should be utilized to intelligently filter and recommend these resources, delivering personalized content tailored to students' learning progress, interests, and cognitive levels to meet individualized needs.

Designing personalized learning strategies. Tailor diverse learning activities to students 'distinct cognitive styles and learning capacities. For visual learners, organize tasks like picture description and poster creation; for auditory learners, implement activities such as English speeches and debates. By leveraging AI's intelligent analysis capabilities, educators can accurately identify students 'strengths and weaknesses in learning, thereby creating customized activities that align with their characteristics. For students with weaker oral skills, specialized speaking training programs should be designed. AI's speech recognition and error-correction features provide real-time feedback and targeted guidance, effectively enhancing their oral proficiency.

A strategy that integrates collaboration with self-directed learning. By leveraging AI technology to create collaborative learning platforms, students are grouped appropriately based on their cognitive characteristics and learning levels, enabling activities like group discussions and project-based cooperation. Through this collaborative process, students learn from and inspire each other, thereby developing teamwork and communication skills. Students should be encouraged to engage in self-directed learning, utilizing smart learning software and online platforms to achieve the goal of learning anytime, anywhere. They can autonomously select learning content and methods according to their own pace and needs, thereby achieving personalized growth.

Diversified evaluation and feedback strategies. To move beyond the traditional single-dimensional assessment model, we should establish a multifaceted learning evaluation system that not only evaluates academic performance but also considers the learning process and attitude. By leveraging AI technology to comprehensively analyze students' learning data—including study time, progress, and homework completion—we can generate precise evaluation reports, providing timely and personalized feedback. Teachers can then dynamically adjust teaching strategies and learning paths based on these evaluations, offering targeted guidance to help students optimize their learning methods and enhance academic outcomes.

By implementing these strategies, we can effectively promote AI-enabled personalized learning in vocational undergraduate English classrooms based on multimodal cognitive adaptation, thereby comprehensively enhancing students' English proficiency and overall competencies.

5. Conclusion

This study focuses on the personalized learning paths empowered by AI in vocational undergraduate English classrooms from the perspective of multimodal cognitive adaptation. Through meticulous analysis and thorough discussion, it yields research outcomes with practical value.

Theoretically, this study provides a meticulous analysis of the significance of multimodal cognitive adaptation and systematically organizes the theoretical framework for AI-enhanced English instruction, establishing a solid foundation for future research. The introduction of multimodal cognitive adaptation offers a multifaceted perspective on understanding students' cognitive characteristics in English learning. The associated theories further provide scientific guidance for teaching practices, enriching the theoretical system of vocational undergraduate English education.

Current analysis reveals that AI-powered personalized learning offers distinct advantages by precisely addressing individual differences

among students, thereby enhancing their learning autonomy. However, challenges persist, including inadequate technology implementation, teachers 'skill development needs, students' limited self-directed learning capabilities, and an underdeveloped evaluation system. These issues provide clear guidance for future development pathways.

Through theoretical analysis and practical assessment, this study establishes a personalized learning pathway grounded in multimodal cognitive adaptation. The development process clearly defines four core design principles: student-centeredness, multimodal integration, dynamic adjustment, and career orientation. Corresponding strategies include resource integration, activity design, collaborative-autonomous learning synergy, and diversified evaluation feedback. These components collectively provide actionable frameworks for implementing personalized teaching practices.

The innovation of this study lies in deeply integrating multimodal cognitive adaptation with AI-enhanced vocational undergraduate English teaching, establishing a comprehensive and systematic personalized learning pathway that provides new solutions to current pedagogical challenges.

Looking ahead, there are numerous directions worthy of in-depth exploration. For instance, we should further optimize models and related methods for multimodal cognitive adaptation to enhance their application in teaching. With the continuous advancement of AI technology, it is essential to explore deeper integration pathways with English teaching, thereby driving the intelligent upgrading of educational practices. More empirical research is needed to validate and refine the learning pathways proposed in this study, providing richer practical evidence for vocational undergraduate English teaching reform. Through sustained research and practice, we aim to continuously improve the quality of vocational undergraduate English education and cultivate more high-quality applied talents with strong English proficiency.

References

[1] Cheng Zhenan. Research on New Pathways of Personalized Services in AI-Enabling Smart Cities. Mobile Information, 2025,47(1):207-209.

[2] Liu Yong. Research on Point Cloud Completion Based on Deep Learning: From Single-Modal to Multi-Modal. Guangxi: Guangxi University, 2024.

[3] Wu Qian, Liu Li. Optimization Path of Online Deep Learning from the Perspective of Embodied Cognition. Changjiang Series, 2025(3):82-84.

[4] Zhang Xianheng. Research on Personalized Federated Learning Algorithms Based on Deep Learning. Qilu University of Technology, 2024.

[5] The Connotation and Practice of AI Empowered Personalized Learning. Hubei Education, 2025(2):5.

[6] Ma Mingyu. Research and Application of Knowledge Tracking Learning Process Modeling for Online Personalized Learning. Jiangxi: Jiangxi Normal University, 2024.

[7] Chen Xianghui. AI-assisted personalized learning in fine arts. Hubei Education, 2025(2):16-17.

[8] Liu Tianxiang. Research on Deep Learning Algorithms for Single-Modality and Dual-Modality Mirror Inspection. Anhui: Anhui University, 2024.

[9] Li Yuqing. AI Empowered Personalized Learning Process Management. Hubei Education, 2025(2):14-15.

[10] Luo Jiahui. Research on the Practical Path of Interdisciplinary Thematic Learning for Primary Schools Oriented towards Deep Learning. Guizhou: Guizhou Normal University, 2024.

[11] Jiang Jiajun, Ma Shijia, Liu Haohui, et al. Body, Cognition, and Context: Defining the Logic, Valuing the Implications, and Charting the Course for Interdisciplinary Thematic Learning in Physical Education and Health. Journal of Physical Education, 2024,40(4):1-9.

[12] Hu Hang, Yang Lin. AI-enabled personalized collaborative learning model construction and application. Hubei Education, 2025(2):9-11.

[13] Liu Jiaqi. Innovative Approaches to Personalized Interpretation Learning: An Action Research on Blended Teaching Models. Journal of Teacher Education, 2024(18):103-105.

[14] Xu Shisheng, Luo Caitian. Implementation Path and Case Analysis of Video Teaching in Junior High School English Classrooms. English Learning, 2024(6):37-43.

[15] Zhong Shaochun, Yang Lan, Fan Jiarong. Data-driven personalized learning: actual

issues, ideal logic, and implementation pathways. Research on Electro-education, 2025,46(1):13-19,33.
[16]Zhou Yingchun. AI+Personalized Teaching: Empowerment Pathways, Practical Challenges, and Future Prospects. Innovative Talent Education, 2024(4):62-66.