

On How Artificial Intelligence Drives Innovation in International Chinese Language Education

Fanqi Meng^{a,*}

^aHeilongjiang Energy Vocational College, Shuangya, Heilongjiang 155100, China

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ABSTRACT

The rapid development of artificial intelligence (AI) technology is permeating all sectors of society with unprecedented depth and breadth. In the field of international Chinese language education, AI has evolved far beyond being a mere auxiliary tool like the "slide projector" or "tape recorder" of the past; instead, it has become a core driving force leading this field toward a profound paradigmatic revolution. This paper systematically elaborates on how AI technology promotes systematic innovation and upgrading in international Chinese language education from five core dimensions: the personalized reconstruction of teaching models, the intelligent generation of teaching resources, the full-process reform of teaching evaluation, the strategic transformation of teachers' roles, and the global integration of educational ecosystems. Meanwhile, the paper also takes a prudent look at challenges that may arise during the process of technology integration, such as algorithmic bias, lack of emotional interaction, the digital divide, and the alienation of the essence of education. Finally, it points out that the future development path must involve the in-depth integration of "artificial intelligence" and "humanistic guidance," aiming to build a new, human-machine collaborative, ecologically sound, and sustainable international Chinese language education system. This system will provide new possibilities and fundamental pathways for achieving more equitable, high-quality, and inclusive global Chinese language education.

1. Introduction: from "technological assistance" to "paradigmatic revolution"

As a crucial bridge for promoting people-to-people exchanges between China and foreign countries and advancing the building of a community with a shared future for mankind, international Chinese language education is currently in a critical period of strategic transformation — shifting from pursuing "scale expansion" to focusing on "quality improvement" and "model innovation"^[1]. To a large extent, the traditional teaching model relies on face-to-face classroom lectures, standardized textbook systems, and limited cultural experience activities. With the increasing diversification and in-depth development of global learning needs, this traditional paradigm is facing a series of severe challenges: there is a severe shortage of qualified teachers worldwide, and their distribution is uneven; the teaching model struggles to accommodate the individual differences and personalized needs of a large number of learners; teaching resources are monotonous in form and updated slowly, failing

to adapt to the learning habits of the digital native generation; more fundamentally, for the vast number of overseas learners, the lack of authentic Chinese language environments and cultural immersion scenarios leads to the widespread phenomena of "dumb Chinese" and "cultural barriers"^[2]. As a result, language learning can hardly evolve from mere knowledge memorization to the true acquisition of communicative competence and cultural understanding. Against this backdrop, the rise of AI technology — especially the breakthroughs in recent years in areas such as large language models, intelligent speech recognition and synthesis, computer vision, and virtual reality — has provided a key solution to break through these bottlenecks. The application of AI in international Chinese language education has already transcended the early stage of Computer-Assisted Instruction, where technology was used merely as a demonstration tool or practice carrier in a supporting role. AI is no longer just an "efficiency booster" in the educational process; it has become a "catalyst" and "engine" for the reconstruction of the educational paradigm. The core feature of this paradigmatic revolution is the shift from a teacher-centered knowledge-

* Corresponding author.

E-mail address: 503049866@qq.com.

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imparting system to a learner-centered system focused on personalized development and competence building. This means that the core elements of education—teaching, learning, assessment, and management—are all being systematically reshaped by AI technology. Going beyond the description of fragmented technological applications, this paper aims to systematically explain how AI drives in-depth innovation and leapfrog development in international Chinese language education from the above-mentioned five core dimensions, combining theoretical frameworks with practical approaches^[3]. It also conducts critical thinking and provides an outlook on the risks and future trends in this field.

2. Core innovation dimensions of AI-driven international Chinese language education

2.1. Innovation in teaching models: from "standardized indoctrination" to "personalized adaptation"

Restricted by the teacher-student ratio and unified teaching progress, traditional classrooms are essentially a "standardized" production model. The introduction of AI has made it possible, for the first time on a large scale, to realize the millennium-old educational ideal of "teaching students in accordance with their aptitude" (personalized teaching) even with a large number of learners.

2.1.1. Precise Learner Profiling and Dynamic Path Planning

By continuously collecting and analyzing multi-modal data of learners in the digital learning environment, AI systems can construct highly detailed "learner profiles^[4]." This data not only includes the accuracy rate of exercises and tests but also covers learners' behavioral trajectories: such as the duration of repeatedly watching teaching videos on a specific grammar point, the frequency of errors in a certain tone during oral practice, the preference for looking up new words in reading materials, and even the pace and order of completing tasks. Through in-depth mining of this data, AI can accurately diagnose each learner's knowledge gaps, cognitive preferences (whether they are visual or auditory learners), the strength of learning motivation, and emotional states (such as a sense of frustration or excitement). Based on this, adaptive learning systems can act like an experienced personal coach, dynamically planning and real-time adjusting a unique learning path for each learner. For example, for a learner who is weak in listening but strong in reading, the system will automatically push more listening-intensive materials and related oral dialogue exercises; for a learner who continuously makes mistakes in the usage of the particle , the system will intelligently generate micro-lecture videos, targeted exercises, and situational applications for this grammar point until the learner masters it. This "one plan per person" teaching model greatly enhances the pertinence and efficiency of learning.

2.1.2. Smart classrooms and immersive contextual experience

The combination of AI with virtual reality and augmented reality technologies provides a revolutionary solution to the problem of the lack of language environments for overseas learners^[5]. With VR/AR devices, learners can "instantly

teleport" into an ancient market scene like the one depicted in the famous painting "Along the River During the Qingming Festival," or into a modern Chinese city. In this highly simulated virtual environment, AI-generated non-player characters can engage in real-time, natural multi-turn conversations with learners. Learners can inquire about prices from virtual vendors, discuss the weather with virtual friends, or even order food in a virtual restaurant. The system can provide immediate feedback on the appropriateness of the learner's pronunciation, vocabulary, and grammar. This immersive learning that combines "contextualization and strong interaction" transforms language learning from boring textbook memorization and mechanical drills into the application of skills and problem-solving in real social and cultural scenarios. It not only trains the language itself but also cultivates learners' cross-cultural communicative competence and situational adaptability, realizing the in-depth integration of "learning by using and using by learning."

2.2. Innovation in teaching resources: from "pre-made resources" to "generative resources"

In the past, teaching resources mainly relied on "pre-production" by educational institutions and teacher teams. The production cycle was long, the cost was high, and it was difficult to meet the personalized and real-time needs of all learners. The maturity of AIGC (Artificial Intelligence Generated Content) technology is triggering a supply-side revolution in teaching resources.

2.2.1. Precise learner profiling and dynamic path planning

Based on large language models, AIGC technology can instantly generate a large amount of high-quality and diversified teaching content according to specific instructions input by teachers or learners^[6]. For example, a teacher can give an instruction: "Generate a short elementary Chinese reading passage about 'China's high-speed railways,' which must include the three core words 'convenient,' 'speed,' and 'environmental protection,' and design 5 reading comprehension questions." AI can complete this task within seconds. Learners can also request AI to generate a dialogue script about "Chinese tea culture" or a short argumentative essay imitating Lu Xun's style based on their own interests. This capability completely breaks the limitations and lag of traditional textbook content, transforming teaching resources from static, closed "products" into dynamic, open "services" that can be customized on demand. It greatly enriches the diversity and interest of teaching materials, enabling teaching content to closely align with the pulse of the times and the personal interests of learners.

2.2.2. realization of dynamically adaptive materials

AI can not only generate resources but also make them "dynamic" to achieve real-time adaptation. In an intelligent reading system, when AI detects that a learner is encountering difficulties in reading a certain article—through eye-tracking or analysis of answer data—it can intervene in real time and provide various scaffolding supports: automatically adding pinyin and annotations to new words, breaking down complex long sentences into simple short ones, inserting links to

relevant background knowledge, or even rephrasing the main idea of a paragraph using simpler vocabulary. Conversely, if the system determines that the material is too easy for the learner, it will automatically increase the difficulty of the text or raise more thought-provoking questions. This dynamic adjustment ensures that the learner's cognitive load is always within the "Zone of Proximal Development" proposed by Vygotsky — that is, between the learner's current level of ability and their potential level of development — thereby achieving the most effective learning.

2.3. Innovation in teaching evaluation: from "result-oriented judgment" to "process-oriented diagnosis"

Traditional teaching evaluation mainly relies on summative evaluations such as final exams and proficiency tests. The results are often "conclusive" but fail to reveal specific problems in the learning process. AI has made it common to conduct refined "formative evaluation" and "diagnostic evaluation" throughout the learning process.

2.3.1. Accurate and granular assessment of oral proficiency

Intelligent speech assessment technology based on deep learning can now conduct millisecond-level, multi-dimensional analysis of learners' oral performance. Instead of just giving a general score, it can provide real-time feedback from multiple dimensions, including clarity, fluency, and completeness. More advanced systems can act like an tireless pronunciation coach, accurately identifying which vowel has an incorrect mouth shape or which tone has an inaccurate pitch value. They then provide targeted pronunciation correction guidance through visual graphs and demonstration audio. This meticulous feedback is beyond the reach of human teachers in large-scale teaching scenarios^[7].

2.3.2. Intelligent and in-depth correction of writing proficiency

AI writing correction systems have long gone beyond simple spell-checking and grammar error correction. Current advanced technologies can conduct in-depth analysis of the coherence of the text, the structure of the article, the richness of vocabulary, and even the style of writing. The system can point out that "although this sentence is grammatically correct, using "thus" is more formal than "so" in this context," or "your argument is good, but it lacks specific examples—supplementing a case is recommended." Here, AI plays the role of a knowledgeable and patient "writing coach," guiding learners to independently improve their writing skills through specific revision suggestions time and time again.

2.3.3. Learning analytics empowering formative evaluation

AI systems can continuously record and analyze all of the learner's learning behavior data, such as login frequency, task completion time, video viewing completion rate, and participation in discussion forums. Through modeling and analysis of this process data, the system can not only evaluate what the student "has learned" but also predict their learning status. It also provides teachers with the most direct data support for timely teaching interventions and personalized tutoring. This shifts teaching evaluation from focusing on the static, summative question of "has the student learned?" to the

dynamic, developmental question of "how can the student learn effectively?"

2.4. Innovation in teachers' roles: from "knowledge imparters" to "learning designers"

Faced with the powerful capabilities of AI, a common concern is whether teachers will be replaced. The answer is no. The mission of AI is not to replace teachers but to free them from a large amount of repetitive and mechanical work, driving a strategic and more valuable transformation of their roles.

2.4.1. From "knowledge authorities" to "learning designers and facilitators"

When AI can take on the tasks of knowledge imparting, skill training, and basic assessment, the core responsibility of teachers will shift to a higher-level dimension. They will increasingly play the role of "learning designers," carefully planning and organizing human-machine collaborative blended teaching activities. For example, designing project-based learning tasks that guide students to conduct research in virtual scenarios and use AI tools for data organization and report writing; organizing online and offline seminars to conduct in-depth analysis and discussion on cultural topics generated by AI. Teachers' strengths lie in their critical thinking, creativity, and in-depth understanding of the laws of human learning—abilities that AI will find difficult to achieve in the foreseeable future. Teachers will focus more on stimulating students' interest in learning and intrinsic motivation, and cultivating their ability to screen information, conduct cross-cultural critical thinking, collaborate in teams, and solve complex problems.

2.4.2. Undertakers of emotional care and humanistic communication

Education is essentially an undertaking where "one soul awakens another soul." AI can simulate conversations, but it cannot generate genuine human emotional resonance, nor can it offer a look full of understanding and encouragement, or share personal and authentic cultural experiences and life stories. Therefore, teachers will become irreplaceable "emotional anchors" and "humanistic souls" in the educational process. They are responsible for creating a warm, safe, and supportive learning atmosphere, paying attention to students' emotional changes and mental health, and serving as the most warm connection bridge between students and the broad and profound Chinese culture. By sharing personal experiences, organizing in-depth cultural exchange activities, and guiding students to reflect on the philosophy and values behind the language, teachers address issues in the emotional, ideological, and spiritual dimensions that AI cannot reach.

2.5. Innovation in educational ecosystems: from "classrooms behind walls" to "borderless smart learning spaces"

AI technology is breaking down physical space and institutional barriers, building an open, interconnected, and intelligent global Chinese learning community.

2.5.1. Intelligent tutor systems and the promotion of educational equity

Intelligent tutor systems that integrate multiple AI capabilities can provide 24/7 professional Chinese tutoring to learners in any corner of the world and in any time zone. Whether it is students in remote areas or working professionals with irregular schedules, all can have equal access to high-quality educational resources. This greatly promotes the inclusiveness and equity of international Chinese language education, allowing the ideal of "education for all without discrimination" to be realized on a larger scale in the digital age.

2.5.2. Data-driven educational governance and scientific decision-making

When learning data from around the world (on the premise of anonymization and privacy protection) can be safely collected and analyzed, it forms a "smart brain" for international Chinese language education. Educational researchers and managers can use this big data to gain a macro-level insight into the development trends of global Chinese learning, regional learning difficulties, and the effectiveness comparison of teaching methods. These insights can provide an unprecedented scientific basis for optimizing curriculum systems, focusing on teacher training, allocating teaching resources, and formulating relevant national educational policies worldwide, thereby realizing refined and intelligent governance of the entire educational ecosystem.

3. Challenges and critical reflections

While enthusiastically embracing the dividends of technology, we must maintain a prudent and critical perspective and carefully address the challenges it brings.

3.1. Risks of algorithmic bias and cultural misinterpretation

The "intelligence" of AI models stems from their training data. If the training data itself contains unbalanced cultural representations or implicit value biases, AI may reproduce or even amplify these biases^[8]. For example, when introducing Chinese family values, a single data source may solidify a certain family model while ignoring its diversity. How to ensure that when AI disseminates Chinese culture, it can convey its rich, three-dimensional, dynamic, and contemporary features — rather than simplified and rigid stereotypes — is a crucial issue. This requires interdisciplinary cooperation among technology developers, educational experts, and cultural scholars to jointly build high-quality and diversified training corpora and design effective algorithmic bias correction mechanisms.

3.2. Concerns about the lack of emotional interaction and the "dehumanization" of education

Although AI has made rapid progress in simulating conversations, its essence is still pattern recognition and probability prediction, which cannot understand the

complexity of human emotions^[9]. Over-reliance on AI for teaching interactions may make the educational process mechanical and cold, weakening the precious interpersonal emotional connections between teachers and students, and among students. This is particularly detrimental to language subjects, which are highly dependent on emotional communication and social interaction. How to design the optimal "human-machine collaboration" model to ensure that technology empowers education without depriving it of its humanistic warmth is a balance that needs to be continuously explored in practice.

3.3. The widening digital divide and challenges of data ethics

Cutting-edge AI educational technology often entails high R&D costs and hardware requirements. This may allow countries and regions with abundant resources to benefit first, while underdeveloped regions are further marginalized—widening the "digital divide" in global Chinese language education. In addition, the massive amount of data generated during the learning process involves personal privacy. How to standardize the collection, storage, use, and analysis of this data and prevent data leakage and abuse are ethical and legal issues that must be taken seriously. The establishment of globally recognized data security standards and ethical norms is urgent.

3.4. The erosion of the essence of education by "instrumental rationality"

Perhaps the greatest concern comes from a philosophical perspective. When AI highly "datafies," "skillizes," and "pathizes" language learning, we need to be alert to the risk of education sliding into pure "instrumental rationality"—that is, over-pursuing learning efficiency and explicit outcomes while ignoring the essence of language as a humanistic discipline. Language is the carrier of thinking and the crystallization of culture. The process of learning Chinese should be more about cultivating critical thinking, enhancing aesthetic taste, and understanding the worldview of another civilization^[10]. If we are completely guided by AI's data indicators, we may overlook the educational values that are unquantifiable, tacit, and require in-depth contemplation—such as the perception of the artistic conception of a Tang dynasty poem, the critical thinking about a philosophical idea, and the understanding of a way of life.

4. Conclusions and outlook

In summary, AI is pushing international Chinese education toward a paradigm shift—from standardization to personalization and intelligence. True progress requires integrating technology with humanistic guidance. AI should handle standardized tasks like personalized practice, freeing teachers to inspire curiosity and guide cross-cultural understanding. This synergy will allow Chinese education to thrive in the digital age, fostering greater global understanding.

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