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The Auxiliary Role of Artificial Intelligence Applications in Mitigating the Linguistic, Psychological, and Educational Challenges of Teaching and Learning Chinese Language by non-Chinese Students

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See table of contents

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Article abstract

Learners might have several challenges while attempting to learn a second/foreign language. Learners of Chinese face linguistic, psychological, and educational challenges. The integration of technology, especially artificial intelligence (AI), into teaching foreign languages is a blessing for teachers and learners. This study delved into the auxiliary role of AI-powered applications in mitigating the linguistic, psychological, and educational challenges which non-Chinese learners face while learning Chinese/Mandarin language. Qualitative research was employed, and 20 teachers of Chinese language were selected through theoretical sampling. In-depth interviews were used for collecting data, and MAXQDA was used for thematic analysis. Findings revealed that AI-powered educational applications are useful for helping language learners overcome the commonly reported linguistic, psychological, and educational challenges which non-Chinese learners and teachers of Mandarin might encounter. Findings verify the effectiveness of AI-powered applications, such as ChatGPT, Poe, Brainly, and so forth, in helping teachers and learners of Chinese language learn grammar, structure, idioms, and cultural issues of Chinese language. Findings have implications for foreign language (Chinese) learners and teachers, educational technologists, as well as syllabus designers.

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The Auxiliary Role of Artificial Intelligence Applications in Mitigating the Linguistic, Psychological, and Educational Challenges of Teaching and Learning Chinese Language by non-Chinese Students

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Abstract

Learners might have several challenges while attempting to learn a second/foreign language. Learners of Chinese face linguistic, psychological, and educational challenges. The integration of technology, especially artificial intelligence (AI), into teaching foreign languages is a blessing for teachers and learners. This study delved into the auxiliary role of AI-powered applications in mitigating the linguistic, psychological, and educational challenges which non-Chinese learners face while learning Chinese/Mandarin language. Qualitative research was employed, and 20 teachers of Chinese language were selected through theoretical sampling. In-depth interviews were used for collecting data, and MAXQDA was used for thematic analysis. Findings revealed that AI-powered educational applications are useful for helping language learners overcome the commonly reported linguistic, psychological, and educational challenges which non-Chinese learners and teachers of Mandarin might encounter. Findings verify the effectiveness of AI-powered applications, such as ChatGPT, Poe, Brainly, and so forth, in helping teachers and learners of Chinese language learn grammar, structure, idioms, and cultural issues of Chinese language. Findings have implications for foreign language (Chinese) learners and teachers, educational technologists, as well as syllabus designers.

Keywords: AI-powered application, auxiliary role of AI, AI, Chinese language, challenges of learning, Chinese language learner, Chinese language teacher

Introduction

Over numerous years, the People's Republic of China (PRC) has exerted significant influence on the global political stage. This can be attributed primarily to its extensive military power, expansive territorial control, and its privileged position as a permanent member of the United Nations Security Council (Wang & Lemmer, 2015; Wu, 2017; Wu et al.,2022). Following significant internal political changes, China has taken on a role of great importance as a trade partner and a rapidly growing market for regions including the Middle East, the Western world, and Africa (Yalun, 2019). Chinese, being one of the official languages of the United Nations, holds a central position in international discussions.

AI is an expanding area of computer science that engenders intelligent machines capable of executing human activities. The implementation of AI technology is progressively more prevalent in the domains of healthcare, banking, and transportation. The potential of AI to revolutionize diverse industries lies in its efficacy, accuracy, and decision-making capabilities. AI acquires knowledge and enhances its performance through the use of machine-learning algorithms. These algorithms enable robots to assess extensive datasets, identify patterns, and uncover insights that are beyond the reach of human cognition. Consequently, this has propelled the advancement of natural language processing, computer vision, and speech recognition. Nevertheless, the advent of AI may engender job displacement and predispose biases in decision-making processes. Therefore, the ethical dimensions of AI research and development must be taken into account. While AI has the potential to enhance society and improve lives, its ethical use is imperative.

A few related studies (Wang, 2004, Ye, 2013; Yue, 2017) have argued that there is a clear tendency among youth in several Western countries to study Mandarin as a foreign language (MFL) or Chinese as a foreign language (CFL). The term Chinese Mandarin as a foreign language (CMFL) has also gained popularity in academic discourse (Wang & Lemmer, 2015). Increasing enrollment numbers demonstrate the growing interest in CFL, the need for more Chinese language teachers, and rising support for standardized tests of Chinese language proficiency in nations with MFL/CFL teaching institutions (Lu, et al., 2016; Orton, 2011, 2016; Pérez-Milans, 2015). The need for more instructors to be trained and recruited domestically in China and internationally to better support Chinese language learners has become urgent due to the rising interest in Chinese language acquisition and the increasing number of international students studying this language. China's efforts to enhance its global influence have led to increased investments in promoting Mandarin, often referred to interchangeably as Chinese. These initiatives also aim to elevate Mandarin's official language status in regions such as Taiwan and Singapore (Hartig, 2015). It's important to highlight that Chinese is one of the six official languages at the United Nations (Yalun, 2019). In English-speaking nations, diverse national initiatives have played a role in the expansion of CFL/MFL programs in educational institutions, both within China and globally, including countries such as Iran, Japan, the United Kingdom, the United States, South Africa, and Australia. Notably, in 2015, the US government reported that one million American students were engaged in studies in China, with ambitious plans to increase this number by 2020 (Everson, 2008; Wu & Itayi, 2022).

Teaching and learning Chinese, like other second/foreign languages such as English, French, and German, is associated with a set of linguistic, psychological, and educational problems, which can be solved through educational applications powered by AI. Therefore, educators in Chinese language teaching must critically

reevaluate traditional communication media and teaching methodologies through the lens of practical teaching experiences. This entails a paradigm shift in ideas and roles, the organization of disparate oral Chinese teaching resources, and the seamless integration of contemporary information technologies with traditional language teaching methods (Guo et al., 2019). Using network resources adeptly, educators should design the learning process and leverage the network to access individualized learning information for each student, thereby facilitating regulation of the learning process. Developing intelligent computer-assisted instruction systems involves the convergence of artistic intelligence, computer science, pedagogy, psychology, and behavioral science (Graham et al., 2019). This research aims to confer intelligence upon computer systems, allowing them to assume specific educational and instructional responsibilities and, consequently, partially substitute for teachers to achieve optimal teaching outcomes (Johnson et al., 2018). More specifically, it explores how AI-powered applications such as ChatGPT, Poe, and Brainly can be used to help Chinese language learners and teachers overcome linguistic, psychological, and educational problems. More specifically, the following questions were posed:

1. How can AI-powered educational applications help Chinese language learners overcome the linguistic problems of learning the Chinese language?

2. How can AI-powered educational applications help Chinese language learners overcome the psychological problems of learning Chinese?

3. How can AI-powered educational applications help Chinese language teachers overcome the educational problems of teaching Chinese?

Literature Review

One promising approach to resolving the complex issues faced by non-Chinese students learning Chinese is the integration of AI applications into language education (Guo et al., 2019). The theoretical underpinnings of this investigation are found at the nexus of linguistics, psychology, and education. The subtleties of learning Chinese are closely related to linguistics, which is a critical component. AI applications can help overcome language barriers by providing learners with a thorough and immersive linguistic experience by using advanced language processing capabilities. AI applications in the psychological field can be made to adjust to different learning styles and offer customized feedback, resulting in a positive and personalized learning environment. Finally, AI technologies have the potential to provide interactive and captivating learning environments, leading to better teaching and increased student involvement (Kang & Kang, 2023). The integration of these theoretical viewpoints offers a strong foundation for comprehending AI's auxiliary function in easing the difficulties non-Chinese learners encounter while learning the language.

The contemporary openness of network education undeniably broadens the learning space available for Chinese language instruction, with increasing interest in network learning and the continual emergence of network teaching platforms. However, the complexity and temporal-spatial separation within the network education environment poses challenges for managers and educators in acquiring dynamic learning information from online learners (Zhu et al., 2019). This often results in a simplistic reproduction of

textbook resource content and a unilateral pursuit of quantity and scale in the push mode of teaching resources (Yalun, 2019). Addressing this issue becomes crucial, given the diverse group of online learners and the need to determine effective ways of collecting reliable learning status information and providing personalized learning services (Derun et al., 2019).

The rapid development of multimedia and network technologies necessitates urgently establishing a novel Chinese language model that transcends traditional constraints of region and time (Chen et al., 2014). To enhance teaching efficiency and cultivate talents effectively, continuous exploration and experimentation with new technologies and methods for improving teaching and learning approaches are essential (Li, 2018). Simultaneously, there is a desire to tailor education to students' aptitudes and implement differentiated education based on individual learning foundations, abilities, and other characteristics (Miao et al., 2018). The proposal of an intelligent teaching system (ITS) makes it feasible to achieve these goals. By establishing an open teaching environment, Internet-based modern education surpasses traditional education's temporal and spatial limitations (Agarwal et al., 2021). Effectively leveraging the resource advantages of diverse existing education systems, rational resource allocation and educational development become possible, providing a practical solution to this challenge. Similarly, Kang and Wang (2022) proposed a model for an intelligent Chinese language network teaching system to address shortcomings in existing network teaching systems.

Intelligent teaching represents a pivotal direction in computer-aided teaching, characterized by an open interactive teaching approach that uses computers to simulate the teaching thought processes of experts (Jin, 2011). This approach centers on students as the focal point, with computers serving as the medium. In modern educational theory, intelligent teaching incorporates advancements from AI, psychology, and cognitive science into computer-aided teaching (Kang & Kang, 2023). It seeks to understand the mode of learning cognition by examining the characteristics and processes of human learning thinking, enabling students to acquire knowledge through personalized adaptive learning and achieving the goal of genuine individualized teaching (Peng, et al., 2019). Research on intelligent computer-assisted instruction systems in China commenced relatively late, but it can potentially play a positive role in advancing the country's education reform (Yi et al., 2020). By analyzing the substantial drawbacks related to adaptability and personalization in current online learning systems and drawing on critical technologies such as fuzzy evaluation algorithms and neural networks (NN) within the ITS, the paper discusses the extraction of parameters such as behavioral data and performance information from online learners (Xiao & Liu, 2017).

Educators in a networked environment, particularly those involved in language teaching, are urged to reevaluate conventional communication channels and instructional methodologies through the lens of practical teaching experience (Guo et al., 2019). This necessitates a shift in perspectives and roles and the systematic organization of disparate Chinese teaching resources. Graham et al., 2019 contributed a framework and design pattern capable of efficiently constructing a college English teaching system with a well-defined structure and dependable performance. This is achieved through research on the modeling of college English teaching systems using universal modeling language (UML).

According to research, the current network teaching platforms (Zhu et al., 2019) provide a wide range of educational resources; however, they frequently focus on enhancing particular student competencies rather than encouraging all-encompassing speaking, listening, reading, and writing skills. The literature (Li, 2018)

supports the seamless integration of contemporary IT with conventional language instruction techniques. Research has highlighted how crucial it is for teachers to skillfully use network resources to plan the learning process and gather personalized learning data for every student in order to successfully manage the learning journey (Makhambetova, et al., 2021)

The student model, which methodically depicts students' knowledge, cognitive abilities, learning motivations, learning styles, and prior learning patterns is crucial to ITS, as stated in Hirschmann et al., 2019. Yi et al., 2020 concluded that in order to solve urgent problems with the current Chinese language network teaching platform, it is imperative to develop a comprehensive, interactive, personalized, and feedback-oriented Chinese language teaching platform. According to Miao et al., 2018, the main goal of a network teaching platform is to showcase students' characteristics and attitudes, which serves as the basis for putting creative teaching objectives, resources, and methods into practice. Educational objectives ought to encompass motor skills, cognitive abilities, and emotions, as indicated by existing literature (Xiao & Liu, 2019).

Using UML, Kang and Kang (2023) explored the creation of network-based college. The framework and modeling diagram for an online college English teaching system are designed after extensive research. As per Johnson et al. (2018), the student model should be influenced by the responses and interactions that students have had with the system. This enables the system to apply personalized teaching, allowing for dynamic adjustments based on the learning circumstances of students.

To get around the drawbacks of current teaching systems, Xiao and Liu (2019) offered a model for a networked ITS. Their established a deep learning (DL)-based Chinese language teaching system model, building on earlier research and taking into account the state of Chinese language network teaching systems (Jiang et al., 2021). The model categorizes the learning characteristics of students and adjusts various teaching methods and materials based on these attributes. In order to achieve authentic individualized teaching, this model can dynamically create a personalized learning environment based on unique student traits.

Methodology

Sample and Procedure

For this study, we sought out a few teachers to serve as informants. The study's starting point did not specify a specific sample size. Given this, we first selected 20 teachers from various countries using a theoretical sampling technique. We conducted interviews until data saturation was achieved. After interviewing the fifteenth teacher, data saturation was reached. Thus, the final sample consisted of fifteen teachers. When choosing these instructors, special consideration was given to universities that offer Mandarin as a foreign language in the UK, Russia, and Australia. All of the instructors were non-native Mandarin speakers who started studying the language in their home countries or China after reaching puberty. After being fully informed about the purpose of the study, all participants signed the required paperwork to give their informed consent. The demographic information of the participating teachers is shown in Table 1.

Table 1

Demographic Information of Teacher Informants

Characteristic	*n*
Location of university	
UK	4
Russia	5
Australia	6
Gender	
Male	8
Female	7
Teaching experience	
1–5 years	5
> 5 years	10

Note. $N = 15$.

Research Method

We used a phenomenological research approach, which thoroughly explores the lived experiences of people affected by a particular phenomenon. Phenomenology is frequently used in studies with little prior knowledge (Cohen et al., 2018). Every participant received a thorough explanation of the study's procedures, and participation was voluntary (Bogdan & Biklen, 2007). We chose interviews, which comprised individual meetings, phone calls, and online exchanges, from among the different techniques for gathering data for qualitative research (Creswell, 2014). We conducted electronic interviews in two formats: online and offline (via email) because of the pandemic's effects and the participants' geographic distances from us. The option to respond in Mandarin or English was offered. Language, psychological, and educational barriers were among the main issues that participants were asked to address when discussing their experiences teaching or learning Mandarin. We listened to and carefully examined each online interview before transcribing it. After that, the recordings were played back to capture the exact words of the participants. The goal was to accurately capture colloquial expressions and phrases, considering the informal nature of the interviews. We transcribed the participants' comments daily following each interview session. Each interview was roughly 33 minutes, although discussions varied between 20 and 50 minutes. Generally, we carried out one or two interviews daily while allocating the rest of the time to transcription.

Data Analysis

Using MAXQDA software (Version 2022), data analysis was completed in accordance with Creswell's (2014) recommendations. The primary analytical unit was sentences, and the analysis's primary focus was manifest content as opposed to latent content. Every step of the qualitative data collection, analysis, and reporting process was done in English. Since this study was not based on theories or frameworks that already existed, an inductive method of content analysis was employed. To analyze qualitative data, we followed a five-step process based on the framework proposed by Gao and Zhang (2020). First, the data underwent a rigorous cleaning process to eliminate linguistic errors, ambiguities, and repetitions. Second, after reading the data multiple times, we generated open codes. Third, these open codes were used to develop axial codes and subthemes. Fourth, by organizing axial codes and subthemes, higher-order general

themes and selective codes were produced. To document each stage of the data analysis and interpretation procedure, a comprehensive report was written.

Results

Research Question 1

The first research question addressed the Chinese language teachers' perceptions of how AI-powered applications (ChatGPT and Poe) help Chinese language learners overcome linguistic problems. The interviews with experts were content analyzed, and the themes which emerged are presented in Table 2.

Table 2

AI-Powered Applications Usage in Addressing Learners' Linguistic Challenges

Theme	Frequency, ***n*** (%)
AI applications can solve pronunciation challenges.	20 (100)
AI applications can raise learners' awareness of tonal discrimination.	18(90)
AI applications can raise learners' awareness of tonal variation in dialects.	18 (90)
AI applications can help learners learn characters and writing.	14 (70)
AI applications can help learners learn grammar and sentence structure.	13 (65)
AI applications can help learners learn idiomatic expressions.	12 (60)
AI applications can help learners learn idiomatic usage.	12 (60)
AI applications can help learners learn cultural nuances.	12 (60)
AI applications can help learners learn proverbs and symbolism.	16 (80)
AI applications are useful for vocabulary acquisition and expansion.	17 (85)

All participants stated that speech recognition algorithms powered by AI can analyze learners' pronunciation, providing real-time feedback. AI can identify specific areas of difficulty, suggest corrections, and offer targeted exercises to improve pronunciation. About 90% of teachers argued that AI-driven language learning platforms can incorporate interactive exercises focusing on tonal discrimination. Speech synthesis technology can generate various tones, allowing learners to practice distinguishing between them in a controlled and supportive environment.

Moreover, 90% of participants stated that AI can expose diverse dialects through audio samples and interactive exercises. Speech recognition can assist learners in adapting to tonal variations, helping them understand and communicate effectively across different regional variations. Seventy per cent of the informants argued that AI-powered language learning apps often include handwriting recognition and character analysis tools. These tools can evaluate learners' writing skills, offer corrections, and provide character stroke order guidance to enhance writing proficiency.

Grammar and sentence structure were identified by 65% of participants as another thematic area in which AI-powered applications could help learners. Natural language processing (NLP) algorithms can analyze

written text to identify grammatical errors and suggest corrections. AI-driven chatbots or language tutors can engage learners in conversations, correct sentence structure, and reinforce proper grammar usage.

Among participants, 60% stated that language learning applications can integrate databases of idiomatic expressions. AI algorithms can provide explanations, examples, and context for using idioms. Interactive exercises and quizzes can reinforce understanding and application. The same number of informants stated that AI chatbots or virtual language partners can simulate real-life conversations, incorporating idiomatic expressions in context. Learners can engage in dialogue to practice the correct usage of idioms, receiving feedback from the AI system.

Participants (60%) also stated that AI can provide cultural context through multimedia content, including videos, articles, and interactive scenarios. Natural language understanding algorithms enable AI to explain cultural nuances, ensuring learners comprehend the broader context of language use. Furthermore, 80% of participants said that the contribution of language learning platforms can include modules focused on proverbs and symbolism. AI algorithms can break down the meaning of proverbs, explain cultural symbolism, and offer exercises to reinforce understanding and usage. Finally, 85% of informants stated that AI-driven apps employ spaced repetition algorithms to optimize vocabulary learning. These algorithms adapt to learners' proficiency levels, ensuring they review and practice words optimally for effective retention and expansion.

Research Question 2

The second research question addressed the Chinese language teachers' perceptions of how AI-powered applications (ChatGPT and Poe) help Chinese language learners overcome psychological problems. The interviews with experts were content analyzed, and the themes which emerged are presented in Table 3.

Table 3

AI-Powered Applications Usage in Addressing Learners' Linguistic Challenges

Theme	Frequency, *n* (%)
AI applications can solve interference from the learners' L1.	20 (100)
AI applications can reduce age-related challenges.	18(90)
AI applications can positively affect learners' motivation and attitude.	17 (85)
AI applications can affect students' preferences for other languages.	14 (70)
AI applications can affect parents' and learners' resilience to learn Mandarin.	13 (65)
AI applications can decrease learners' fear of making mistakes.	11 (55)
AI applications can reduce learners' anxiety in speaking and conversing.	11 (55)
AI applications can remedy the lack of personalized support.	11 (55)

Note. L1 = first language.

As seen in Table 3, the majority of participants stated that AI-driven language learning platforms can incorporate personalized modules that specifically target common challenges arising from learners' native language interference. Adaptive exercises, pronunciation analysis, and targeted lessons can address this interference. Similarly, participants argued that AI can tailor language learning content and methodologies

based on age. Interactive games, storytelling, and visually engaging content can be employed for younger learners. AI can customize lessons for adults to align with their cognitive abilities and learning preferences.

Furthermore, participants believe that AI-integrated applications can positively affect the learners' motivation and attitude. AI can employ motivational strategies, such as gamification, rewards, and personalized learning paths. Virtual language tutors powered by AI can adapt teaching styles based on individual preferences, fostering a positive attitude towards learning Mandarin. Participants also stated that AI can affect Chinese learners' preferences for other languages. They believed that AI could engage language learning by incorporating content related to students' interests. For instance, if a learner prefers a particular language or cultural context, AI can integrate relevant materials, making Mandarin learning more appealing and relevant.

The next theme was labeled parents' and learners' resilience to learn Mandarin, which is affected by AI-generated applications. Participants stated that AI-powered language learning platforms can provide continuous support and encouragement. Virtual tutors can offer positive reinforcement, progress tracking, and personalized feedback. Additionally, AI can facilitate community building, connecting learners with similar goals and fostering a supportive learning environment.

Participants also argued that AI-powered educational applications can reduce learners' anxiety and fear of making mistakes when speaking. The teachers believed that language learners often fear making mistakes, hindering their willingness to practice and engage actively in language learning activities. AI can create a non-judgmental learning environment. Virtual tutors can provide constructive feedback, emphasizing learning from mistakes. AI-powered language learning apps can offer safe spaces for trial and error, boosting learners' confidence.

Moreover, participants stated that learners may experience anxiety, particularly when it comes to speaking and holding conversations in the target language. However, AI can facilitate speaking practice through virtual interactions. AI-driven chatbots or virtual conversation partners can engage learners in realistic dialogues, providing a low-pressure environment to practice conversational skills.

The last psychologically related theme was the lack of personalized support for which AI-powered applications can be practical. For instance, some participants stated that in traditional classroom settings, teachers may need help to provide personalized attention to each learner's unique needs and challenges. AI can offer individualized learning experiences. Adaptive learning algorithms can identify areas of difficulty for each learner and tailor lessons accordingly. AI-powered virtual tutors can provide personalized guidance and support, addressing specific learning gaps.

Research Question 3

The third research question addressed Chinese language teachers' perceptions of how AI-powered applications (ChatGPT and Poe) help Chinese language learners overcome the educational problems of teaching the Chinese language to non-Chinese language learners. The interviews were content analyzed, and the themes which emerged are presented in Table 4.

Table 4

AI-Powered Applications Used in Solving Educational Problems

Theme	Frequency, *n* (%)
AI applications can help teachers develop course and curriculum.	18 (90)
AI applications can remedy the lack of resources and materials.	14 (70)
AI applications can help teachers know about pedagogical approaches and strategies.	13 (65)
AI applications can improve teachers' pedagogical knowledge.	12 (60)
AI applications can solve teacher training problems.	12 (60)
AI applications can be used for assessment and feedback.	12 (60)
AI applications can be used for individualized learning paths.	16 (80)
AI applications are useful for cultural understanding.	17 (85)

AI can play a crucial role in addressing various educational problems faced by learners of the Chinese language. The first type of educational problem AI can solve is thematically coded as course design and curriculum. Participants mentioned that this type of problem can be solved in three different ways. First, as suggested by most teachers, AI can personalize learning experiences by assessing individual student performance and tailoring course content accordingly. This adaptive learning approach ensures learners progress at their own pace, reinforcing concepts they find challenging while advancing quickly through familiar material. Second, AI-driven recommendation systems can suggest supplementary materials, practice exercises, and multimedia resources based on learners' proficiency levels, interests, and learning styles. This enhances the overall learning experience and provides a more comprehensive language understanding. Third, AI can analyze language trends, cultural changes, and real-time linguistic data to update and modify curriculum content. This ensures that learners are exposed to current and relevant language usage, keeping the curriculum dynamic and engaging.

The second theme that emerged from interviews is participants' view that AI can remedy the need for more resources and materials for teaching the Mandarin language. Participants stated that AI can assist in generating language learning materials, including interactive exercises, quizzes, and culturally relevant content. This addresses resource shortages by continuously supplying new and diverse learning materials. Participants also stated that AI-powered translation tools aid learners in understanding and translating complex Chinese texts. These tools can also offer multilingual support, helping learners of different native languages.

The teachers we interviewed also stated that AI-powered technology can raise Chinese language teachers' awareness of pedagogical approaches and strategies. Participants mentioned that intelligent teaching systems (ITS) can simulate one-on-one interactions with a teacher, providing instant feedback, guidance, and targeted support. This personalized learning experience helps students overcome specific language challenges and reinforces positive learning behaviors. Participants also mentioned that AI can facilitate gamified learning experiences, making language acquisition enjoyable and engaging. Interactive scenarios, role-playing, and language games enhance the learning process, making it more effective and enjoyable.

A fourth theme that emerged concerns how teachers can use AI applications to improve their pedagogical knowledge. AI can contribute to ongoing teacher training programs by offering individualized professional development modules. These modules can focus on emerging pedagogical techniques, incorporating the latest language education and technology advancements. Teachers also believe that AI-driven assessment tools can assist teachers in evaluating student performance efficiently. This allows educators to focus on providing targeted feedback and addressing specific learning needs.

The fifth theme we noted concerns participants' view that AI-powered applications can be used to address teacher training problems through virtual simulations and data-driven insights. Teachers stated that AI can create virtual classroom simulations where teachers can practice various instructional strategies, manage diverse student needs, and receive feedback. This virtual training environment helps teachers develop effective classroom management and teaching skills. Participants also stated that AI analytics can provide valuable insights into teachers' performance and areas that require improvement. This data-driven approach helps in tailoring professional development programs to address specific needs.

The sixth theme mentioned in the interviews concerns how AI-powered technology could be used for assessment and feedback purposes through automated grading systems. Teachers believe AI-powered grading systems can efficiently evaluate written assignments, essays, and language assessments. These systems save educators time and provide instant feedback to learners, helping them understand their mistakes and areas for improvement. Teachers also believe that speech recognition for pronunciation can be used for assessment purposes. Providing real-time feedback on intonation, accent, and fluency helps learners refine their spoken Chinese language skills.

The seventh extracted contribution of AI-powered applications to educational problems was thematically labeled as individualized learning paths. Informants stated that AI can analyze learners' interactions with educational content to identify individual strengths and weaknesses. This data-driven approach enables the creation of personalized learning paths, recommending specific exercises or activities tailored to each learner's needs. They also stated that AI tutors can adapt to learners' cognitive styles and preferences, providing customized learning experiences. By understanding individual learning patterns, AI can offer targeted support, ensuring that each student masters Chinese language concepts at their own pace.

Finally, participants believe that AI-powered applications can be used for cultural understanding. For instance, AI can enhance language learning by incorporating cultural context into lessons. Virtual cultural experiences, language immersion scenarios, and AI-generated content related to Chinese culture help learners better understand language nuances, idioms, and cultural references. Participants believe AI algorithms can monitor and analyze current events and trends in Chinese-speaking regions, providing learners with real-time cultural insights. This dynamic approach ensures that learners are linguistically proficient and culturally aware.

Discussion

Teaching and learning methodologies have been profoundly impacted by the incorporation of AI into a variety of educational fields. With regard to the first research question, it was found that AI applications offer comprehensive support for language learners, addressing pronunciation challenges and enhancing awareness of tonal discrimination and variation in dialects. These technologies aid in mastering characters, writing, grammar, sentence structure, and idiomatic expressions, including their usage. Furthermore, AI helps learners understand cultural nuances, proverbs, and symbolism, thereby providing a holistic approach to language acquisition. This finding is echoed in the study by Ajabshir (2013).

The study's conclusions demonstrate that AI can assist students in resolving linguistic-related issues when learning Chinese by drawing on insights from a variety of fields, including medical education, language learning, and the difficulties faced by Chinese language teachers.

As shown by Cheng et al. (2020), AI is being used in medical education. Its use goes beyond diagnosing and includes helping medical students understand complicated cases like hip fractures. These studies highlight how by offering sophisticated tools for interpretation and analysis, AI can improve medical education.

Findings also revealed that AI applications effectively address various challenges in language learning, such as interference from the learners' first language (L1) and age-related difficulties. They positively impact learners' motivation and attitudes, influence preferences for other languages, and enhance resilience in learning Mandarin. Additionally, AI reduces the fear of making mistakes and speaking anxiety, while also providing personalized support that is often lacking in traditional educational settings. Therefore, it can be strongly argued that AI-applications can be used to enhance personalized learning which was supported by a number of researchers (Alibakhshi, 2013). In constructing and validating self-assessment inventories and teaching motivation scales, Alibakhshi and Nezakatgoo (2019) emphasized the importance of personalized approaches in language education. These findings align with the broader theme of AI's role in tailoring language learning experiences based on individual needs.

The One Belt and One Road (OBOR) initiative's advantages and disadvantages are examined in relation to Chinese language instruction. The OBOR, also known as the Belt and Road Initiative (BRI), is a global development strategy adopted by the Chinese government in 2013. It aims to enhance regional connectivity and embrace a brighter economic future through building infrastructure and broadening trade links between Asia, Africa, and Europe. Furthermore, the research conducted by Kang and Kang (2023) highlights the importance of developing a deep learning based Chinese language teaching system model within the context of AI. These observations emphasize how the field of language education is changing and how AI has the potential to significantly influence teaching approaches and curriculum development. The results corroborate those of Gao and Zhang (2020), who investigated the beliefs of foreign language instructors regarding online instruction in difficult times, demonstrating the flexibility of AI-enabled teaching strategies. The enhancement of motivation and disposition, the mitigation of fear and anxiety by means of nonjudgmental surroundings, and the provision of ongoing assistance are consistent with the wider psychological motifs deliberated by educators. Cognitive difficulties in combining AI and deep learning for breast cancer screening (Derun et al., 2019) and the more general difficulties and possibilities in AI applications (Wang, 2021) draw attention to the necessity of ongoing study and modification. The

results highlight the significance of tackling obstacles and optimizing the advantages offered by AI, underscoring a well-rounded and knowledgeable strategy for execution. Generally speaking, this study illuminates the revolutionary potential of AI in resolving numerous educational obstacles faced by Chinese language learners. Through the integration of participant perspectives and pertinent scholarly works, this conversation clarifies the consistency and resilience of the recognized themes. In line with Gligorea et al. (2023), AI clearly emerges as a key component for customizing language instruction to each student's needs. The participants' focus on an approach to adaptive learning is in perfect alignment with the findings of Gligorea et al.'s (2023) demonstration of AI's revolutionary potential in enabling customized learning experiences that meet the needs of each individual student. The insights from the participants regarding AI producing a variety of educational resources and offering multilingual assistance are consistent with Kang and Kang's (2023) acknowledgment of AI's function in mitigating resource limitations in Mandarin language instruction.

Regarding innovative pedagogy and teacher assistance, the research finds resonance with Wang's (2021) and Cheng et al.'s (2020) work. Wang (2021) emphasized how AI can provide teachers with tailored professional development, and Cheng et al. (2020) emphasized the significance of personalized feedback powered by AI in medical education. Their results are consistent with the opinions of the participants regarding how AI can revolutionize education. As we move on to teacher training, Wu and Itayi's (2022) investigation of AI's function in offering virtual training environments for teachers is in line with integrating AI in virtual simulations and data-driven insights. This alignment highlights the potential of AI analytics to provide insightful information about teachers' performance and areas in need of development, thereby reinforcing participants' views on AI in teacher training. Regarding evaluation, the research is consistent with Agarwal et al. (2021), who used AI to classify diseases in medical imaging. The participants agreed with Gligorea et al. (2021) regarding the effectiveness of AI in assessing written assignments and language assessments. Regarding personalized learning paths, this research concurs with Kang and Kang (2023) who claimed that AI can analyze learner interactions and generate tailored learning paths. The focus on AI's capacity to assess how students engage with instructional materials aligns with participants' perceptions that AI can customize learning opportunities according to each student's unique strengths and shortcomings. Lastly, the participants' perceptions of AI's value in fostering cultural understanding are consistent with more general discourse about AI's potential to improve language acquisition. Yi et al.'s (2020) investigation into the application of deep learning and hyperspectral imaging technology in traditional Chinese medicine supports the participants' belief that AI can enhance language learning by incorporating cultural context.

Conclusions and Implications

In conclusion, this study highlights the transformative impact of AI on teaching and learning practices in second language acquisition. Drawing insights from the challenges faced by Chinese language teachers, the findings underscore AI's potential in addressing linguistic, psychological and education related issues for Chinese language learners. The study aligns with existing literature, showcasing AI's role in tailoring language learning experiences, mitigating resource shortages, reshaping pedagogy, and providing valuable insights into teaching and assessment.

The study focuses on AI's ability to customize language instruction to meet the needs of each learner, which is consistent with the literature's emphasis on personalized learning experiences. AI becomes a key factor in curriculum design and teaching approaches in the context of teaching Chinese, where opportunities and challenges are abundant because of programs such as One Belt and One Road. The study is consistent with earlier research, bolstering the notion that AI can produce a variety of learning resources and efficiently address resource constraints in language instruction. The study further supports the multifaceted impact of AI on the changing distance education landscape through pedagogical innovation, teacher support, training, assessment, and customized learning paths. The participants' perceptions of AI's role in enhancing cultural awareness are consistent with contemporary discourse about how AI can improve language learning experiences by incorporating cultural context, which represents a paradigm shift in how distance learning is perceived.

This study has several implications for educational practice and policy. The positive impact of AI on motivation, the reduction of anxiety, and adaptability in challenging teaching environments emphasize the need for continued exploration and integration of AI in education. Policymakers should consider fostering a supportive environment for AI integration in educational institutions, promoting research, and addressing challenges while maximizing opportunities. Continuous collaboration between educators, researchers, and AI developers is crucial to ensure a balanced and informed approach to AI implementation in education. The transformative potential of AI in addressing linguistic and cultural challenges positions it as a valuable ally in shaping the future of language education.

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