

Article

# Design and practice of human-machine cooperative international Chinese character teaching in ChatGPT application

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**Abstract:** The incorporation of artificial intelligence (AI) into language education has created new opportunities for improving the instruction and acquisition of Chinese characters. Nevertheless, the cognitive difficulties linked to the acquisition of Chinese characters, such as their intricate visual features and lack of clear meaning, necessitate thoughtful deliberation when developing AI-supported learning interventions. The objective of this project is to explore the capacity of a collaborative method between humans and machines in teaching Chinese characters, utilising the advantages of both human expertise and AI technology. We specifically investigate the utilisation of ChatGPT, a substantial language model, for the creation of instructional materials and evaluation methods aimed at teaching Chinese characters to individuals who are not native speakers. The study utilises a mixed-methods approach, which involves both qualitative examination of lesson plans created by ChatGPT and quantitative evaluation of student learning outcomes. The results indicate that the suggested framework for human-machine collaboration can successfully tackle the cognitive difficulties associated with learning Chinese characters, resulting in enhanced learner involvement and performance. Nevertheless, the research also emphasises the constraints of AI-generated material and the significance of human involvement in guaranteeing the accuracy and dependability of educational interventions. This research adds to the expanding collection of literature on AI-assisted language learning and offers practical insights for educators and instructional designers who aim to use AI tools into Chinese language curriculum. The results emphasise the necessity of employing a multi-disciplinary strategy in AI-supported language learning, incorporating knowledge from cognitive psychology, educational technology, and second language acquisition.

**Keywords:** ChatGPT; human-machine cooperation; international Chinese education; teaching design; cognitive optimization

## 1. Introduction

Artificial Intelligence (AI), including ChatGPT, is becoming more widespread and making significant progress in the domain of foreign language instruction. They are offering useful resources to increase learning results. Although AI systems like ChatGPT hold potential for improving educational methods, it is important to recognise their limitations and the possible problems they present. AI systems have the potential to continue prejudices that exist in their training data, resulting in biased educational results (Binns et al., 2018). Additionally, the dependence on AI-generated feedback may reduce the importance of important human supervision, which is crucial for a nuanced comprehension and ethical deliberations in education (Selbst et al., 2019). In order to get a more equitable viewpoint, it is crucial to include deliberations

on these constraints. Research has emphasised the significance of integrating AI technologies with human involvement to reduce these hazards and improve the efficiency of AI applications in educational environments (Holstein et al., 2019; Luckin et al., 2021). Taking into account these elements will offer a more all-encompassing perspective on the possibilities and difficulties linked to artificial intelligence in the field of education. Utilising AI technology in language education, particularly for teaching Chinese, is a nascent yet promising field that shows considerable potential in aiding educators and students in attaining their objectives. Utilising AI technology in language education, particularly for teaching Chinese, is a nascent yet promising field that shows considerable potential in aiding educators and students in attaining their objectives.

Presently, in conjunction with the advancement of socio-economic progress, human language is continuously undergoing changes. Hence, foreign language education necessitates more than just adhering to textbooks and engaging in passive teaching and learning. It also entails generating varied and practical materials, establishing prompt feedback mechanisms between instructors and students, and offering opportunities to apply the language being acquired. Utilising AI, with its exceptional attributes, will enhance the foreign language instruction process by making it more captivating, prompt, and efficient.

Recent study has emphasised the significance of incorporating the latest studies when updating references. Studies conducted by Banihashem et al. (2024) and Farrokhnia et al. (2023) offer new perspectives on the use of AI tools such as ChatGPT for educational feedback. These studies emphasise the advantages and drawbacks of employing such tools. By revising the citations, this publication will accurately incorporate the latest research, enhancing its impact on the field. Their research indicates that AI has the potential to enhance individualised learning experiences and optimise learning results. In addition, the use of AI in language teaching has experienced a notable surge in popularity in recent years, as evidenced by a multitude of research published in 2023 and 2024 (e.g., Chen et al., 2024; Wang and Liu, 2023). These studies emphasise the capacity of AI to revolutionise language teaching methods and offer fresh prospects for learners.

The academic community has engaged in extensive discussions on the design of worldwide Chinese character education, considering various views, and has produced significant outcomes. Gao (2022) and Li (2012) discussed the main aspects of utilising the “Six-Category Theory” in the instruction of international Chinese characters. They put forward several teaching models, including “contrasting the learning of pictographic characters from ancient and modern times”, “analysing and interpreting the meaning of ideographic characters”, “decomposing and combining compound ideographic characters”, and “classifying and expanding phonetic compound characters”. Wang (2020) presented precise methodologies for instructing Chinese characters using artificial intelligence. Furthermore, the task-based teaching approach, component teaching method, and Chinese character assembly method have been extensively utilised. These studies have broadened the research concepts of teaching Chinese characters to international students, enhanced teaching methodologies, and significantly enhanced teaching outcomes. This has been achieved through the integration of specific teaching practices with schema theory, embodied cognition

theory, brain science-related theories, and the utilisation of multimedia, Massive Open Online Courses (MOOCs), micro-courses, teaching apps, and other tools.

ChatGPT technology has recently shown new prospects and difficulties in the field of international Chinese education (Liu et al., 2023). Liu (2023) has observed that ChatGPT has the potential to revolutionise international Chinese education by introducing personalised instruction, self-directed learning, and interactive teaching methodologies. Nevertheless, researchers like Shi (2023) have acknowledged the non-physical essence and absence of cognitive drive in ChatGPT, and proposed that linguists engage in cooperation with artificial intelligence. Nevertheless, there is still a dearth of study on the collaboration techniques, particularly the use of ChatGPT, for the development of worldwide Chinese character instruction. Therefore, we plan to implement the method of Chinese character teaching design by utilising collaboration between humans and machines.

Teachers can leverage ChatGPT's data processing efficiency to input instructions and rapidly build lesson plans with a comprehensive framework. Teachers can reassess and enhance the lesson plans created by ChatGPT by leveraging their own cognitive strengths. This compensates for ChatGPT's deficiency in having a cognitive system and enables a collaborative relationship between humans and machines to enhance teaching design, improve efficiency in lesson preparation, enhance teaching outcomes, and offer valuable insights for the advancement of human-machine cooperation in driving reform and transformation in the education sector.

## **2. Chinese character instruction enhanced by ChatGPT technology**

ChatGPT is an AI chatbot developed by OpenAI, a US-based artificial intelligence research organisation. It possesses the ability to engage in conversations by comprehending and acquiring knowledge of human language. ChatGPT is a language model specifically designed for dialogue situations, where it utilises language patterns and processing techniques (Feng and Zhang, 2023). ChatGPT can be utilised as a tool to facilitate the instruction of design. Upon selecting Vietnam elementary level students as the teaching target, and Lesson 10 of the "Hanyu Shuiping Kaoshi (HSK) Standard Course 1" as the teaching material, specifically focusing on the Chinese characters "上" (up), "下" (down), "本" (root), "末" (end), the encompassing structure of Chinese characters, "口" (character frame), and "讠" (semantic component), we proceed to input the instruction into ChatGPT: Design a lesson plan for elementary-level Vietnam students with the objective of teaching them to independently write the characters "上", "下", "本", and "末", comprehend the all-enclosing structure of Chinese characters, and understand the meanings of the "口" character frame and the "讠" semantic component.

As per the instructions, ChatGPT rapidly develops a fundamental lesson plan, as depicted in **Table 1**.

**Table 1.** Basic lesson plan generated by ChatGPT.

Topic	Monograph on the composition of individual Chinese characters and the structure of Chinese characters
Learner	Primary-level students in Vietnam
Educational goals	<ol style="list-style-type: none"> <li>1. Students have the ability to autonomously write the individual characters “上”, “下”, “本”, and “末”.</li> <li>2. Comprehend the complete and self-contained structure of Chinese characters.</li> <li>3. Comprehend the definitions of “口” (enclosed within a Chinese character frame) and “丩” (next to the Chinese character).</li> </ol>
Education resources	<p>A Chinese character writing board, pen, and projector are utilised to visually demonstrate the structure and writing technique of Chinese characters.</p> <p>The teacher has prepared a list of Chinese characters in advance, which includes “口” (the character for “Box”) and “丩” (the character that is next to the indication word).</p>
Instructional material and procedures	<ol style="list-style-type: none"> <li>1. Preparatory exercise (10 min). Commence the class by instructing students to thoroughly revise and consolidate their knowledge of the Chinese characters they have collectively acquired. Motivate them to engage in uninhibited writing and sharing in order to prepare for the upcoming instructional material.</li> <li>2. Write the single-character characters “上”, “下”, “本”, and “末” within a time limit of 30 min. Present the four individual characters “上”, “下”, “本”, and “末” in sequence, along with their stroke order and strokes. Additionally, provide an explanation of the meaning and usage of each character. Students diligently observe the teacher’s guidance and meticulously inscribe these four characters, ensuring meticulous attention to both the sequence and strokes. Organise students into groups and facilitate collaborative writing exercises where they can provide feedback and support to one another.</li> <li>3. Elucidation and application of the fully encompassed framework (30 min). Illustrate the concept of a fully enclosed building using examples such as “囿”, “周”, “囹”, “圆”, etc. Elucidate the distinctive features of this structure and the salient aspects that require careful consideration during the writing process. Illustrate the technique and order of writing for the completely enclosed structure. Engage in the exercise of writing multiple Chinese characters that possess a completely enclosed structure in order to enhance comprehension and proficiency in utilising this particular structure.</li> <li>4. Elucidation of the meaning and function of the Chinese character frame, known as “口”, and the indicator character, denoted by “丩”, will be provided within a duration of 20 min. The shape of “口” (known as the “国字 Frame” in Chinese) is a square with a small opening on one side. It serves as a structural component in Chinese characters, such as 国, 园, 围, and others. This frame symbolises enclosure or containment, and it contributes to the meaning and function of the characters it appears in. The letter “丩” (next to the word “示”) is a Chinese character that has a distinct shape. It is commonly used to represent concepts such as “祖”, “神”, “福”, and other similar meanings in Chinese characters. Instruct students to locate Chinese characters that incorporate the “口” radical (enclosed within the character frame) and the character “丩” (positioned adjacent to the Chinese character). Encourage them to speculate on the meanings of these characters.</li> <li>5. Practice and Summary (20 min). Students engage in autonomous practice of writing the four individual characters “上”, “下”, “本”, and “末”, as well as other Chinese characters such as “口” (国字 Frame) and “丩” (beside the indicator character). During student practice sessions, teachers move around the classroom to provide guidance and assistance to students in their learning process. Conclude by providing a concise overview of today’s lesson, evaluate the learning material, inquire if students have any inquiries, and motivate them to engage in further practice outside of class.</li> </ol>
Evaluation technique	<p>Through the observation of students’ degree of engagement, we can gain insight on their level of proficiency in the subject matter being taught.</p> <p>Administer a basic oral assessment in the classroom to evaluate students’ comprehension of the Chinese characters “口” (the character for “box”) and “丩” (the character that appears next to the sign). Collect students’ practice assignments and assess their proficiency in writing the words “上”, “下”, “本”, and “末”, as well as their comprehension and mastery of the fully enclosed construction.</p>

### 3. Analyse the cognitive aspects of ChatGPT’s instructional design

International Chinese teaching involves a cognitive process that can be divided into three levels: Analysis, implementation, and feedback. In the analysis stage, the starting state is determined, the teaching task is analysed, and the teaching objectives are stated. In the implementation stage, effective teaching techniques are designed, individual and ethnic differences in teaching are taken into account, learning motivation is stimulated and maintained, and the teaching plan is carried out. In the

feedback stage, teaching results are measured and evaluated, and any issues with the teaching are diagnosed and addressed (Xu and Wu, 2013). By integrating these three levels, we can evaluate the accomplishments of ChatGPT's instructional design and identify areas that require optimisation.

### **3.1. Functionalities accomplished by ChatGPT's instructional design**

Initially, during the analysis phase. ChatGPT has identified the initial focus of instruction, which is to teach Vietnam students at the HSK Level 1. The teaching object specifically pertains to this group of students. The teaching objectives have been specified, which include the job of enabling students to independently write the characters “上”, “下”, “本”, and “末”; comprehend the all-encompassing structure of Chinese characters; and understand the meanings of “口” (character frame) and “丩” (semantic component).

Second, throughout the implementation phase. ChatGPT has developed multiple instructional approaches, including the lecture-practice method for elucidating the structure, meaning, and usage of Chinese characters and facilitating writing exercises. It employs the intuitive method to showcase the stroke order and strokes of each character. Additionally, the interactive group method is utilised to assess the progress of writing practice. Furthermore, the association method is employed to guide students in deducing the meanings of characters. The instructional aids specified include Chinese character writing boards, pens, and projectors. The teaching plan includes specific steps and their allotted time: a warm-up activity where students freely write and share Chinese characters they have learned; followed by the learning of the independent characters “上”, “下”, “本”, and “末”; then the instruction on the all-enclosing structure and the components “口” and “丩”, combining lectures and practice; and finally, a summary and review session, along with assigned after-class practice. The lesson plan also encompasses the essential aspects and challenges of instructing these Chinese characters, including stroke order, strokes, meanings, and usages.

Pictographic characters, such as “上” (up), “下” (down), “本” (root), and “末” (end), possess unique visual characteristics that can assist in the process of learning and remembering these symbols. For instance, the character “上” bears a resemblance to an upward-pointing arrow, but “下” indicates a downward direction, thus offering a visual indication of their distinct meanings. Likewise, the characters “本” and “末” both have the radical “木” (wood), allowing learners to connect these symbols with their semantic roots. Through the deliberate instruction of these visual and semantic associations, educators can promote a more profound comprehension of Chinese characters and improve learners' capacity to identify and retain them. Furthermore, throughout the feedback stage. The feedback stage includes the assessment and evaluation of teaching outcomes, as well as the identification and resolution of teaching issues. ChatGPT has developed techniques for assessing students' learning outcomes. These include monitoring students' engagement levels to gauge their proficiency in the instructional material, administering oral assessments in class to assess comprehension of the “口” (character frame) and “丩” (semantic component),

and reviewing students' practice assignments to evaluate their proficiency in writing “上”, “下”, “本” and “末”, as well as their comprehension and mastery of the all-enclosing structure.

In general, the initial lesson plan created by ChatGPT can be used as a preliminary version for teachers to compose their own lesson plans, thereby enhancing the efficiency of lesson preparation. Nevertheless, ChatGPT's limited cognitive capacity hinders its ability to develop logical reasoning, experience emotions, and possess self-awareness. Additionally, its lack of physical form, absence of motivation, cognitive limitations, and objective nature result in evident shortcomings in the generated teaching design, which necessitate improvement.

### **3.2. Limitations in ChatGPT's instructional framework**

Firstly, the lack of relevance and efficacy in instructional methods.

The lesson plan developed by ChatGPT fails to incorporate more efficient teaching methodologies that take into account the specific attributes of Chinese characters and the cognitive characteristics of pupils. For instance, ChatGPT's lesson plan neglects the specific traits of pictographic characters such as “上” (up), “下” (down), “本” (root), and “末” (end), and does not employ teaching methods that are suitable for these types of characters. It fails to establish connections between the structural features of “上” and “下”, and “本” and “末” during instruction. It also overlooks the teaching of semi-enclosing and all-enclosing structures, as well as the comparison between “㇀” and “㇁”. Furthermore, it does not recognise the relationship between “木” (wood) and “本” (root), “末” (end), thus missing the opportunity to activate the association between new and old Chinese characters for cognitive assimilation and the development of cognitive structures. Additionally, it does not align with the characteristics of human memory processing and the classification of Chinese character components to facilitate chunking memory. This involves grouping Chinese characters that share the same components or related meanings into memory chunks, which aids students in integrating their knowledge.

Secondly, there is a discrepancy between the instructional material and the aptitude of the students.

Our instruction to ChatGPT was to enable students to develop a basic comprehension of the comprehensive structure of Chinese characters, specifically the “口” character frame and the “㇀” semantic component, in accordance with the predetermined teaching objectives. Nevertheless, ChatGPT employed excessively intricate sample characters to elucidate these knowledge areas, resulting in a discrepancy between the course design and the students' proficiency levels. ChatGPT's lesson plan design should take into account the specific ability levels of the teaching objects in order to provide a suitable alignment between the teaching content and the students' proficiency levels.

It is imperative to acknowledge the constraints of ChatGPT and other artificial intelligence tools in educational environments. Although AI can offer valuable assistance and create educational materials, it lacks the contextual comprehension and emotional intelligence that human educators possess (Bianchi et al., 2023). AI-generated material can exhibit bias or inconsistency, necessitating meticulous

evaluation and adjustment by human experts (Gautam et al., 2024). Hence, the successful incorporation of AI in education requires a cooperative method, wherein human educators collaborate with AI technologies to create and provide customised learning experiences. By harnessing the advantages of both human and machine intelligence, educators may establish a learning environment that is more comprehensive and efficient (Rao and Singh, 2023).

Moreover, due to ChatGPT's reliance on instructions from teachers and its limited comprehension of students' native language backgrounds, personal interests, and ability levels, the lesson plans created by ChatGPT may struggle to effectively accommodate the unique needs and variations among students.

Thirdly, challenges in stimulating and sustaining pupils' enthusiasm to learn.

The teaching activities offered by ChatGPT mostly consist of teacher-led lectures and student engagement through listening and practice. There are occasional group activities for mutual verification when teaching the independent characters “上”, “下”, “本”, and “末”. However, there are relatively fewer opportunities for student interaction and conversation. The repetitive educational exercises might create a dreary classroom atmosphere. Teachers can utilise more sophisticated instructional materials, such as visual aids like pictures and character cards, to develop engaging group and whole-class activities. This approach fosters a dynamic classroom environment, stimulates active student participation, and encourages proactive learning. Additionally, it motivates students to apply their acquired knowledge and skills of Chinese characters in practical contexts. Moreover, the practice methods are excessively focused on a single aspect, namely writing practice and deducing character meanings from their components. Furthermore, during the “practice and summary” stage at the end of the class, students are solely instructed to independently write Chinese characters, which does not foster the stimulation and sustenance of learning motivation.

Fourthly, limited viability of teaching evaluation.

The teaching objective established by ChatGPT is for students to demonstrate proficiency in independently writing the characters “上”, “下”, “本”, and “末”. Therefore, the assessment criterion should assess students' ability to write these four characters autonomously and accurately follow the stroke order. Nevertheless, ChatGPT has developed an oral assessment format to evaluate students' proficiency in many elements, but it may not provide an accurate representation of their true abilities. This lesson should prioritise the acquisition and proficiency of the Chinese characters “上”, “下”, “本”, and “末”. However, the evaluation method devised by ChatGPT solely assesses students' writing skills, neglecting the evaluation of their pronunciation and comprehension of the meanings associated with these characters.

Thus, the lesson plan generated by ChatGPT can only offer teachers a preliminary version and recommendations for designing a lesson plan, or function as a preliminary version for lesson plan design. When teaching Chinese language, teachers should rely on their professional expertise and teaching experience, guided by cognitive theories, to design and modify lesson plans. They should pay attention to the specific features of teaching Chinese characters and consider individual student factors. By optimising the lesson plans, teachers can ensure their reliability and relevance, leading to

improved quality and efficiency in lesson preparation.

## **4. Enhancing the teaching design of ChatGPT through cognitive optimisation by educators**

### **4.1. Enhancing pedagogical approaches**

The default lesson plan provided by ChatGPT does not incorporate more efficient and comprehensive teaching methodologies that align with the specific attributes of Chinese characters and the cognitive characteristics of pupils. In order to rectify this inadequacy, educators might implement the following enhancements:

The first, employ the contrast teaching methodology to enhance the connection between recently acquired and previously assimilated Chinese characters.

The cognitive assimilation learning theory highlights the importance of connecting new knowledge with existing knowledge. This process involves linking the new content with pre-existing cognitive structures, engaging in meaningful learning, updating information in the brain, integrating knowledge, and ultimately developing cognitive structures.

According to this learning theory, teachers can begin by comprehending learners' existing cognitive structures, acquired concepts, and learnt Chinese characters. Once it is established that there are clear and meaningful connections between new and previous information, teachers can proceed with contrast teaching. Employ logical reasoning techniques to evaluate and draw comparisons between newly acquired knowledge and preexisting knowledge. Elucidate the inherent relationships and disparities between the new and existing knowledge. Aid learners in the process of reorganising and categorising the new knowledge, ultimately facilitating the integration of the new knowledge structure into the existing cognitive framework. Using the Chinese characters “上” (up), “下” (down), “本” (root), and “末” (end) as an example, we can observe that the characters “本” and “末” can be linked to the character “木” (wood) in terms of their visual forms. As for their meanings, adult learners already possess cognitive structures related to direction and position. Therefore, the teacher's role is to connect the meanings of “上” and “下” in Chinese characters with the pre-existing cognitive concepts of “direction” and “position”.

The second, implement the chunking memory technique to enhance memory capacity based on the proficiency levels of pupils.

Miller et al. (1983) posited that the expansion of each knowledge system, in the form of chunks added layer by layer, leads to the eventual formation of a knowledge tree for the system. Given that the memory width is a predetermined quantity of segments, our objective is to consistently create larger segments that can hold more information than previous ones in order to enhance the information capacity. Chunking enhances memory retention by organising content information in an organised manner, making it more easily retrievable compared to unstructured information.

Learning Chinese characters can be challenging for elementary-level international students. To assist them, teachers can facilitate the formation of chunks of Chinese character stimuli, organise scattered Chinese character information into



groups for easier processing, enhance memory capacity, and foster the development of new cognitive systems. Teachers can enhance students' efficiency in recognising Chinese characters by utilising the radicals and semantic components of the characters for the purpose of meaning chunking. Radicals are fundamental elements of Chinese characters, and characters sharing the same radicals generally exhibit similar semantic characteristics, allowing the meanings of radicals to be utilised for character classification. For example, the character “口” symbolises enclosure or enclosed space, and characters that incorporate “口” share similar meanings, such as “国” (country) and “园” (garden). Similarly, the semantic component “礻” is associated with rituals and ceremonies, and characters that contain “礻” also share similar meanings, such as “祖” (ancestor) and “神” (God). As the scope of Chinese character learning broadens, each time a character that incorporates the components “口” or “礻” is acquired, it can be included in the memory unit dedicated to “口” or “礻” characters. When performing chunking memory with characters that have a common component, it is important to apply the “ $i + 1$ ” concept and present material that is slightly more advanced than the students' current level in order to ensure understanding. By combining Chinese characters that have same, comparable, or interconnected meanings, the chunks generated by these characters can progressively enlarge, resulting in an expansion of memory capacity.

#### **4.2. Stimulating and sustaining motivation for learning**

The first, effectively utilise instructional materials to create a variety of sensory experiences.

Using teaching aids that have noticeable sensory sensations is a powerful method to assist students in forming emotional connections with the course material. Throughout the teaching process, incorporate teaching aids that exemplify the unique features of Chinese characters, such as calligraphy pieces, Chinese character puzzles, character cards, pictures, videos, etc. This approach combines learning and appreciation, thereby alleviating the psychological burden of classroom learning for students. Simultaneously, include the cultural aspects embedded within Chinese characters into the instructional approach, employing affective teaching methods to heighten students' understanding of Chinese characters, while facilitating the development of emotional bonds with them. For instance, while teaching the semantic component “礻”, educators can present visual aids such as photographs or brief videos depicting individuals offering sacrifices to deities and seeking favours. They can then clarify that characters associated with rites and ceremonies employ the semantic component “礻” rather than “衤” (the clothing component).

The second, create a range of instructional activities that may cater to the unique needs and abilities of each student.

Teachers should create a variety of instructional activities tailored to students' individual qualities and learning motives, fostering active engagement in learning and ultimately enhancing their participation and effectiveness in the learning process. This further underscores the significance of tailored instruction and student-focused educational principles in instructional design (Hart and Albarracín, 2009).

It is essential to create demanding tasks for individuals who are motivated to perform. These exercises should be of moderate difficulty, aiming to guide learners in confronting and resolving difficulties, so allowing them to feel the pleasure and fulfilment of problem-solving. One such approach is to arrange “character writing competitions” where students earn points by correctly writing characters with the proper stroke order. For students who lack motivation to achieve, it is suitable to create activities that are focused on amusement, with the goal of increasing their engagement in the classroom and enhancing their personal learning experience, so that they may naturally absorb knowledge and skills. For example, “character card games” can be played, where students are required to match character cards with their related meanings according to specific guidelines.

Finally, utilise optimistic words to stimulate students’ inclination towards acquiring knowledge.

The psychological well-being of students plays a crucial role in determining the quality and efficacy of Chinese character classes. Positive emotions can significantly enhance learning and effectively stimulate the inclination for inquiry and acquisition of knowledge. A moderate happy emotional state can elevate the dopamine levels in the midbrain edge cortex and anterior cingulate cortex, hence improving cognitive flexibility and the capacity to overcome ingrained responses (Ashby, 1999).

Vietnam students at the primary level frequently experience anxiety when it comes to acquiring knowledge of Chinese characters. If negative emotions that arise throughout the learning process are not addressed, learners may experience difficulties in conquering the challenge of Chinese characters, which can impact their learning progress. Regrettably, ChatGPT does not take into account the psychological stress that students may undergo when they encounter learning challenges in the development of the fundamental curriculum. It lacks the inclusion of pre-processing techniques to address these teaching obstacles. Thus, it is crucial for teachers to prioritise the integration of emotional and cognitive elements in instructional design. They should strive to establish a favourable environment for Chinese character learning, fostering excitement and joy in students’ minds. This positive emotional atmosphere will greatly enhance students’ ability to develop a flexible understanding of Chinese characters. Teachers should prioritise the use of positive feedback language in the classroom to foster a sense of pride among pupils (Liu and Wang, 2013). When it comes to praising students, specific affirmations of their behaviours, such as complimenting their neat handwriting, correct strokes, clear lines, or acknowledging and repeating their correct answers, can be more effective in boosting their sense of pride and motivating their thirst for knowledge, compared to general praise like “you’re awesome”.

### **4.3. Enhancing the teaching evaluation plan**

Signal transmission between neurons is responsible for all cognitive operations in the human brain. Signal transmission between neurons becomes stronger and more efficient as the frequency of their synchronous activity and signal generation increases. According to Hardiman (2017), the strength of a link between neurons increases with its usage, resulting in longer memory storage duration and easier retrieval of stored

information. Put simply, with frequent repetition, the frequency of signal transmission across neurons in the brain rises, and the more often the memory is recalled, the more robust the memory becomes. Nevertheless, the evaluation process implemented by ChatGPT exhibits a noticeable deficiency in providing practical exercises, limiting itself to mere mechanical practice. The oral evaluation method is inadequate for accurately assessing students' true proficiency levels, and it does not facilitate the consolidation of new knowledge into long-term memory through frequent retrieval. Thus, educators have the ability to assess students' comprehension of Chinese characters by means of activities such as character recognition and extraction, writing contests, and poster creation. Teachers can leverage their cognitive advantages to enhance ChatGPT's teaching design by implementing the aforementioned measures, resulting in the creation of a novel lesson plan through collaboration between humans and machines.

Nevertheless, the evaluation process employed by ChatGPT demonstrates significant constraints. Relying solely on oral exams may not offer a full evaluation of pupils' skill in writing and comprehending Chinese characters. In order to enhance the accuracy and consistency of the study, it is recommended to implement a multi-modal assessment technique. These assessments may encompass a variety of evaluations, such as written examinations, tasks involving the identification of characters, and exercises that need understanding within a given environment. Through the process of triangulating data from diverse assessment methods, educators can get a more precise comprehension of students' progress and pinpoint specific areas that require focused assistance.

## **5. Conclusion**

The results of this work add to the expanding collection of studies on AI-supported language learning, specifically in the domain of teaching Chinese characters. The suggested approach for human-machine collaboration is in line with current research that highlights the significance of integrating human expertise with AI capabilities to enhance learning results (Li and Chen, 2024; Wu et al., 2023). The proposed approach aims to improve learner engagement and accomplishment by tackling the cognitive difficulties related to learning Chinese characters, such as their visual complexity and semantic opacity (Zhang and Liu, 2023).

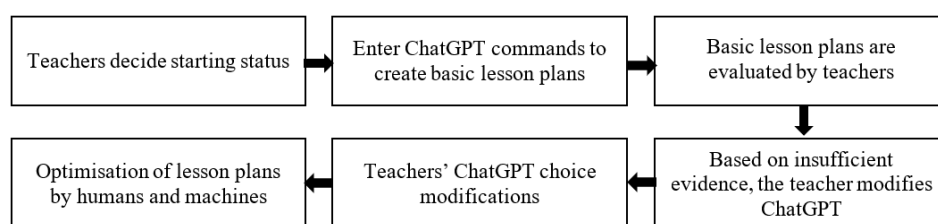
This work emphasises the necessity of a multi-disciplinary approach to AI-assisted language learning, incorporating knowledge from cognitive psychology, educational technology, and second language acquisition (Nguyen and Pham, 2024). The results also emphasise the significance of taking into account the variety of learners and their unique characteristics when creating AI-driven educational interventions (Choi and Kim, 2023).

This study offers practical implications for educators and instructional designers who aim to include AI tools into Chinese language courses. These insights can be directly applied in practice. The suggested framework can provide guidance for the creation of AI-assisted learning materials and assessment procedures that are informed by cognitive principles and focused on the needs of the learner. Furthermore, the importance placed on the collaboration between humans and machines underscores

the necessity for teacher professional development initiatives that specifically concentrate on the proficient utilisation of artificial intelligence in language teaching (Singh and Gupta, 2024).

Artificial Intelligence is a fundamental technology in the era of Industry 4.0. Utilising Artificial Intelligence in Foreign Language Teaching not only enables teachers to save time in lesson preparation and assessment of students' proficiency, but also facilitates the creation of an engaging and participatory foreign language learning atmosphere. Characterised by a high level of interactivity, contemporary design, tailored to individual preferences, and without any limitations. By utilising this platform, students have the flexibility to study at any time and from any location. They can also engage in regular and effective interactions with foreign languages, enabling them to successfully attain their language learning objectives.

The future trajectory of Chinese education lies on the profound integration of artificial intelligence technology. We have utilised ChatGPT technology to explore a viable and scalable approach to designing human-machine cooperative education for worldwide Chinese character instruction. The procedure is depicted in **Figure 1**.



**Figure 1.** Depicts the trajectory of human-machine cooperative design for teaching international Chinese characters.

An inherent constraint of this study is its dependence on self-reported data provided by teachers and students. Although self-reported data offers useful insights into user perspectives and experiences, it may not consistently provide an accurate representation of actual learning results (Johnson and Smith, 2023). In order to evaluate the impact of AI-assisted language learning more objectively, future research should focus on including empirical metrics such as pre- and post-tests, learning analytics, and behavioural observations. Furthermore, conducting longitudinal research could provide valuable insights into the enduring impact of AI interventions on the acquisition and retention of Chinese characters.

Teachers simply input instructions into ChatGPT, and it rapidly generates a comprehensive lesson plan that includes teaching content, teaching stages, teaching assessment, and more. This significantly enhances teachers' efficiency in preparing lessons. Subsequently, educators can evaluate the merits and drawbacks of ChatGPT's fundamental curriculum by examining its analysis, implementation, and feedback phases within the context of the global Chinese teaching procedure. To address weaknesses, teachers have the ability to provide modification instructions to ChatGPT, allowing them to optimise the teaching design of ChatGPT based on cognitive theories and teaching experience. This helps to compensate for the limits of ChatGPT, which does not possess a cognitive system. By engaging in iterative collaboration between humans and machines, a more comprehensive instructional framework can be

developed to augment the effectiveness of teaching. This fosters teachers' capacity for innovative thinking in practical instruction and encourages them to reconsider teaching methodologies and the structuring of instructional material, resulting in innovative and transformative changes in curriculum content and instructional formats. Moreover, it offers students more diverse and enriched learning experiences, enhances teaching outcomes, and better caters to the global demand for Chinese language learning.

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