

Application of Generative Artificial Intelligence in Specialized Chinese Teaching: A Case Study of Chinese Medicine Antonym and Synonym Teaching

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Abstract: *Against the backdrop of the convergence between the global “Chinese language fever” and “Traditional Chinese Medicine (TCM) fever,” teaching Chinese for Specific Purposes (CSP) is presented with a developmental opportunity. TCM antonym terms, characterized primarily by binary opposition relationships, centrally embody the dialectical thinking of TCM. However, due to their metaphorical and abstract nature, learners face difficulties in comprehension. Generative Artificial Intelligence (GenAI) technology offers a new pathway for teaching. Based on the metaphorical cognitive mechanism and binary opposition structure of TCM language, this paper categorizes these terms into spatial, attributive, and functional antonymous pairs. It explores the auxiliary role of GenAI in vocabulary teaching, including concept establishment, comparative explanation, scenario simulation, and the generation of differentiated exercises. The paper also proposes new pedagogical reflections, such as developing school-based curricula with regional cultural characteristics, promoting the transformation of teachers’ roles, and establishing intelligent assessment and learning progress tracking systems. In the future, generative artificial intelligence is expected to provide more precise support for TCM Chinese teaching, driving CSP toward a new stage of intelligence and personalization.*

Keywords: Generative Artificial Intelligence, Teaching of TCM Antonym Terms, Chinese for Specific Purposes.

1. Introduction

Traditional Chinese Medicine (TCM), with its deep humanistic spirit and cultural characteristics, stands out uniquely in the world medical system. It vividly interprets the connotations and mode of thinking of China’s excellent traditional culture, serving as a treasure of the traditional culture of the Chinese nation. In recent years, the role of TCM in national foreign exchanges and cooperation has become increasingly prominent, and it has now been elevated to the highest national strategic level. The TCM major has become one of the most popular majors among international students in China, second only to Chinese Language and Literature, with the number of students in this major increasing year by year. Similarly, as an important branch of artificial intelligence (AI), generative artificial intelligence (GenAI) technology has developed rapidly in recent years. GenAI typically uses neural network-based models to learn and understand patterns and features from large amounts of training data, generating new content such as images and texts to provide information support and learning assistance [1]. Against the backdrop of the convergence of the “Chinese language fever,” “TCM fever,” and “AI fever,” this paper takes the teaching of TCM antonyms as an entry point to consider how to use Chinese as a medium to disseminate TCM culture externally, utilize “generative artificial intelligence” to improve teaching efficiency, and help international students majoring in TCM understand TCM culture, establish TCM thinking, and learn TCM professional vocabulary. As an important teaching content in Chinese for Specific Purposes, it should be distinguished from vocabulary teaching in general Chinese.

2. Characteristics of TCM Language and Classification of TCM Antonyms

2.1 Unique Metaphorical Cognitive Mechanism

The renowned cognitive linguist Lakoff emphasizes in his work *Metaphors We Live By* that metaphor is not only widespread in our language but also deeply embedded in our ways of thinking and behavior. It is an essential component of the human cognitive system, profoundly reflecting the fundamental mode of thinking through which we understand the world. The language of Traditional Chinese Medicine (TCM) is no exception; it is not merely a tool for symbolic communication but a carrier of the unique thinking and cognitive patterns of the Chinese nation. This is not simply a rhetorical device but a fundamental cognitive approach. When people’s current cognitive abilities are unable to comprehend and explain unfamiliar, abstract concepts, they must rely on metaphor to project these onto familiar, concrete things. As the ancient Chinese saying goes, “far draws from objects, near draws from the self,” which reflects the insights of ancient Chinese thinkers into this cognitive method.

2.2 Characteristics of Binary Opposition Structure

In the expression of TCM language, opposing aspects often appear simultaneously. The so-called “characteristic of binary opposition structure” is a common formal expression and reflection of the thinking mode in TCM antonymous terms, such as “cold and heat”, “deficiency and excess”, “exterior and interior”, “ascending and descending”, and “dispersing and contracting”. These paired terms do not represent static or absolute states but rather dynamic, mutually transformable unities of opposites [2]. They reflect changes in the human body’s condition and the fluid state of diseases. Such terms embody the core “semantics” of TCM discourse, and their meanings can only be defined within interdependent relationships. This linguistic characteristic requires learners, during the acquisition process, to connect isolated vocabulary into semantic networks, thereby mastering the language rules

and dialectical logic.

2.3 Classification of TCM Antonymous Terms

Traditional Chinese philosophy and culture have nurtured antonymous terms, which vividly characterize the TCM approach to understanding the human body, diseases, and the treatment process of prescribing according to syndrome differentiation. Based on our study, and inspired by the different meanings that word senses express in the TCM treatment process as well as the theory of metaphor, we have classified them into “spatial antonymous terms,” “attributive antonymous terms,” and “functional antonymous terms.”

2.3.1 Spatial Antonymous Terms

People initially perceive their relationship with the external world based on their own position in space. TCM language applies this sense of space to the treatment process. Spatial antonymous terms are used to describe the spatial relationship in TCM regarding the internal spatial structure of the human body and the depth of disease location, transforming abstract disease locations and pathological trends into perceptible spatial relationships. The most representative example is “exterior and interior”, which blurs the boundary between the skin and internal organs in Western medical concepts and is used to describe the depth of pathogenic invasion. “Exterior” refers to the superficial, peripheral, and defensive interface, while “interior” points to the core systems within the human body. “Up and down” regards the movement of qi in the human body as a vertical direction, as in “the upper burner is like mist, the middle burner like fermentation, and the lower burner like drainage.” It can also describe the positional relationships between organs, such as “the heart and lungs are above, the liver and kidneys are below.” The teaching challenge of these terms lies in the need for learners to fundamentally understand the connotations of TCM language, viewing the human body as a whole with dynamically interconnected internal operations, and distinguishing this from the anatomical concepts of Western medicine.

2.3.2 Attributive Antonymous Terms

Spatial antonymous terms are primarily used for disease localization, while attributive antonymous terms are used to describe physiological and pathological states, closely related to diagnosis and the subsequent determination of treatment principles. By abstracting the attributes of natural phenomena or life activities in the human body, they describe the state of energy levels in the human body. Representative terms of this category include “cold and heat” and “deficiency and excess”. “Cold and heat” is a comprehensive summary of the body’s overall state and sensations during illness, while “deficiency and excess” depicts the dynamic contrast between healthy qi and pathogenic factors. “Deficiency” refers to the insufficiency of substances such as essence, qi, blood, and body fluids or the hypofunction of physiological activities, while “excess” refers to the accumulation of pathological products such as phlegm, retained fluid, blood stasis, or food stagnation, or the exuberance of pathogenic factors within the body. These terms are more abstract, describing bodily states and relationships that cannot be expressed with specific numerical values. For learners, the greatest difficulty lies in

departing from concrete data and accurately identifying attributes such as cold, heat, deficiency, or excess based on the patient’s specific symptoms.

2.3.3 Functional Antonymous Terms

Functional antonymous terms dynamically depict the direction of movement and interaction patterns of qi and the functional activities of the zang-fu organs in the human body, reflecting the dynamic balance in TCM theory. The main characteristic of these terms is not the attribute or location of a lesion, but rather the trends and processes of life activities in a diseased state. “Ascending and descending” describe the functional movement of qi. For example, the spleen governs the ascent of the clear, while the stomach governs the descent of the turbid; liver qi governs ascending and spreading, while lung qi governs depuration and descending. Only when ascending and descending are orderly can the human body function normally. “Entering and exiting” describe the movement of substance and energy exchange between the body and the external environment, such as the discharge of sweat and the intake of food and drink. “Free-flowing and obstructed” represent the smooth flow or blockage of qi and blood in the meridians. Functional antonymous terms need to appear in pairs to explain the interactions between qi movement and the zang-fu organs. The difficulty encountered in teaching lies in helping learners switch between static and dynamic thinking while understanding how abstract qi movement affects the organs of the human body.

3. Strategies for the Application of Generative Artificial Intelligence in Teaching TCM Antonymous Terms

3.1 Vocabulary Teaching

The teaching of TCM antonymous terms typically targets international students majoring in TCM, who possess intermediate to advanced language proficiency. According to the requirements of the *International Chinese Language Education Chinese Proficiency Standards*, learners at this stage should already have a certain ability in listening, speaking, reading, and writing, as well as general translation skills. They are expected to have mastered a basic knowledge of 1,800 or more Chinese characters and over 5,000 words, and be able to appropriately complete dialogues and communicative tasks with rich content. Learners at this stage are more concerned with how to complete learning tasks efficiently, making the two major functions of generative artificial intelligence—content generation and scenario simulation—crucially important.

3.1.1 Establishment of Concepts

TCM antonymous terms are vocabulary with distinct and pronounced characteristics, primarily defined by two features: stability and extensibility. From a diachronic perspective, the combination and expression of TCM antonymous terms are highly stable, with two-character pairings of opposite meanings that rarely change in form. Extensibility, on the other hand, refers to the fact that while the combined forms of antonymous terms are stable, the meanings they express can vary and differ across different contexts. Therefore, when

learners first encounter TCM antonymous terms, it is essential to establish an overall conceptual awareness of them, laying a solid foundation for subsequent systematic learning. During the teaching process, instructors can prioritize the use of generative artificial intelligence to organize the necessary materials based on the lesson's theme, thereby forming an overarching concept. International Chinese language teachers can begin by explaining the basic concepts of "deficiency and excess", then encourage students to express in Chinese any related vocabulary or concepts they can think of. The teacher can then supplement and organize these, helping students aggregate related terms and establish the fundamental concept of TCM antonymous terms.

3.1.2 Comparative Explanation

The composition and meanings of TCM antonymous terms mostly present opposite states. Therefore, during instruction, teachers can direct artificial intelligence to analyze the co-occurrence relationships of these terms in classical medical cases or theories, generating visual knowledge graphs and images of a certain scale. By combining the TCM knowledge and theories within these graphs, teachers can conduct

semantic comparisons to aid learners' further understanding and memorization. Certain disease patterns manifest in tongue and pulse presentations. Teachers can instruct it to generate images of tongue manifestations for the same disease at different stages. For example, from the tongue manifestation of "deficiency with excess complication" in spleen deficiency with dampness exuberance, where the tongue body is usually enlarged with tooth marks on the edges, to the tongue manifestation of "true excess with false deficiency signs" in severe excess presenting as weakness, where the tongue substance appears aged and the tongue coating is thick and greasy. Generative artificial intelligence can present the key nodes in this continuous spectrum through parallel descriptions of symptoms and presentations of tongue and pulse features. In teaching, instructors should focus on the different meanings represented by antonymous terms in various contexts. For instance, "supplementing and draining" can refer to acupuncture needle techniques or medicinal properties; "counterflow and following" can pertain to pathology or treatment methods. Therefore, using generative artificial intelligence can assist teachers in organizing the different meanings these words represent in various application scenarios for use in teaching. (Table 1)

Table 1: The co-occurrence relationship of artificial intelligence analysis terms in classic medical cases or theories

Application Scenarios and AI Tasks	AI-Generated Content / Presentation Format	Teaching Focus
Tongue Manifestation Pattern Differentiation Teaching: Instruct AI to generate images of tongue manifestations for the same disease at different stages.	A continuous spectrum of tongue manifestations from "deficiency with excess complication" (spleen deficiency with dampness exuberance) to "true excess with false deficiency signs" (severe excess presenting as weakness): Spleen deficiency with dampness exuberance: Tongue body enlarged, tooth marks on the edges. Severe excess presenting as weakness: Tongue substance appears aged, tongue coating thick and greasy.	By presenting symptom descriptions and tongue/pulse features in parallel, help students understand the dynamic transformation and continuous spectrum of antonymous terms like "deficiency and excess."
Polysensuous Word Context Discrimination: AI organizes the meanings of the same term in different contexts.	"Supplementing and draining": Acupuncture needle techniques / Medicinal property theory. "Counterflow and following": Description of pathological state / Principles of treatment methods.	Focus on the semantic differences of antonymous terms in various application scenarios to avoid mechanical understanding.

3.1.3 Scenario-based Teaching

For international TCM students studying in China, the ultimate goal of learning TCM antonymous terms is to truly understand the underlying principles of TCM and flexibly apply this way of thinking in real clinical settings. Given the limitations of the current single-mode classroom teaching, the author hopes that generative artificial intelligence can be integrated into instruction, generating simulated diagnosis and treatment scenarios for learners based on different diseases. Students can engage in multi-turn conversations with the AI-simulated consultation. Following TCM treatment logic, the AI can dynamically generate responses that align with the "patient's condition," even intentionally presenting certain contradictory or ambiguous information to guide students in actively applying the learned antonymous terms for sorting, weighing, and making judgments. In this process, students also practice the antonymous terms they have learned, forming their own unique connection with TCM culture. The knowledge acquired is no longer merely terminology to be memorized. After extensive training with generative AI, learners develop the ability to extract information, thereby enhancing their adaptability in real clinical situations.

In the after-class stage, students can reconnect with the generative AI based on their performance in the simulated consultation, independently completing follow-up knowledge consolidation work.

3.2 Cultural Teaching

The fundamental task of teaching Chinese as a foreign language is to cultivate learners' communicative competence in Chinese [2]. Its essence is language teaching, and other teaching objectives such as cultural instruction should serve this fundamental goal. Character and vocabulary teaching revolves around language learning, while cultural teaching should be based on this foundation. It requires teachers to distill the profound connotations and essence of culture and also places demands on students' learning abilities and cultural receptivity. Although students have transitioned from general Chinese to learning TCM Chinese, they may still encounter difficulties in understanding the meanings within TCM Chinese. During instruction, teachers can employ methods such as appropriate cultural introduction and cultural comparison to alleviate pre-learning anxiety and enhance students' learning efficiency.

3.2.1 Cultural Introduction

Given that Chinese is an ideographic language, where symbols directly express the meaning of characters, in the context of TCM Chinese, the meanings of some characters may be narrowed or restricted, which can easily lead to misunderstandings for learners. In the teaching of antonymous terms, instructors can utilize generative artificial intelligence to collect and summarize relevant knowledge,

organizing it from the perspectives of the evolution of character forms, original meanings, common meanings, and meanings in the specific context of TCM terminology [3]. This can assist learners in memorizing character meanings and forms through cultural features and introduce culture based on the characteristics of vocabulary formation. For example, when explaining the term “yin and yang”, instruction should begin with the origin and structural features of the term. This not only covers basic knowledge but also guides students to understand the thinking behind TCM.

Yin and Yang: Initially derived from natural phenomena, these concepts were gradually formed by ancient people through summarizing various opposing natural phenomena experienced in their productive practices [4]. Later, The Inner Canon mapped the concept of yin and yang onto human health. For instance, “The human body has form, inseparable from yin and yang” (Su Wen·Baoming Quanxing Lun), indicating that the balance of yin and yang is fundamental to existence.

The character “yang” first appeared in oracle bone inscriptions. Its form is composed of “阜” (阜, representing hills) and “昃.” The upper part of “昃” is “sun”, and the lower part resembles sunlight shining, collectively depicting the scene of the sun rising and sunlight illuminating the hillside. Its original meaning is “the south-facing slope of a hill that receives light” [5].

The character “yin” first appeared in bronze inscriptions. Its form is composed of “阜” and “侁.” “侁” consists of “今” and “云,” depicting a scene where clouds obscure the northern side of a hill, resulting in dark and overcast skies. Its original meaning is “the north-facing slope of a hill that is shaded from the sun.”

In the teaching process, one can begin by explaining the evolution of the forms of the characters “yin” and “yang,” allowing students to gain a corresponding understanding of their basic meanings. This can then be abstracted and organized within the field of TCM. The concept of “yin and yang” as mutually constraining and balanced is the most fundamental concept distinguishing TCM from Western medicine. It is applied to the understanding of natural entities, human body structures, and medicinal substances. At this point, teachers can use generative artificial intelligence to collect and organize vocabulary, extracting and categorizing it for explanation in class based on the current teaching theme.

陰 (阴) yīn 影组, 侵部, 影组, 侵韵, 于金切。

𠄎¹ 𠄎² 陰³ 陰⁴ 𠄎⁵ 陰⁶ 陰 阴
 西周 春秋 战国《说文》小篆 秦 汉 楷书 楷书

3.2.2 Cultural Comparison

Cultural differences often hinder second language acquisition, while cultural similarities can help learners more readily accept the target language, thereby promoting learning effectiveness. Although significant differences exist between Chinese and foreign cultures, in practical teaching, instructors can choose topics of concern to most students to bridge the psychological distance between teachers and learners. The heterogeneity of cultural content can be guided toward health issues of common concern. This method can be applied in teaching TCM Chinese antonymous terms. For example, when teaching the term “supplementing and draining”, a comparison can be made between TCM dietary therapy and supplementation and Western dietary structures to find a suitable entry point (Table 2).

Table 2: Comparison between Traditional Chinese Medicine Dietary Therapy and Western Dietary Structure

Comparison Dimension	TCM Dietary Therapy Perspective	Characteristics of the Mediterranean Dietary Structure
Core Concept	Based on pattern differentiation of “deficiency and excess” to prescribe food: deficiency is treated with supplementation, excess with drainage, aiming to restore the balance of yin and yang in the human body.	Focuses on the rational combination of various nutrients to promote overall health.
Tonifying Methods (Supplementation Category)	Foods mostly possess warm, sweet, and moistening properties, categorized into four types: qi-tonifying, yang-tonifying, yin-tonifying, and blood-tonifying.	Emphasizes the intake of foods rich in unsaturated fatty acids, such as fish protein, legumes, and olive oil.
Purging Methods (Pathogen-Expelling Category)	Foods mostly exhibit cold, bitter, and pungent characteristics, categorized into four types: heat-clearing and fire-purging, diuresis and dampness-percolating, digestion-promoting and stagnation-resolving, and pungent-warm exterior-releasing.	No directly corresponding concept, but maintains metabolic balance through combinations like low-fat and high-fiber foods.
Typical Food Examples	Qi-tonifying foods (Chinese yam, jujube), yang-tonifying foods (mutton), yin-tonifying foods (lily bulb), blood-tonifying foods (longan); draining foods (bitter melon, coix seed, hawthorn, ginger).	Olive oil, deep-sea fish, legumes, nuts, whole grains, fresh vegetables and fruits.

Supplementing and Draining: This is a pair of TCM antonymous terms. In TCM, it often refers to using dietary supplementation methods to conform to the innate nature of the zang-fu organs, expel excess pathogenic factors from the body or mind, and restore their normal functions.

During the teaching process, instructors can adjust the content based on different teaching themes. For instance, when explaining health preservation and dietary supplementation, the content related to this term can be expanded to include the nature and functions of foods, as well as the principles that supplementation and draining should follow. The Yellow Emperor’s Inner Canon states, “When pathogenic qi is exuberant, there is excess; when essential qi is depleted, there

is deficiency.” Therefore, before selecting foods for consumption, a detailed understanding of the patient’s “deficiency and excess” is necessary. Thus, the learning content evolves from isolated knowledge points into a knowledge network. For deficiency patterns, supplementation methods should be used to boost the body’s healthy qi, enhance its ability to resist disease, and eliminate deficiency symptoms. Conversely, for excess patterns, draining methods should be applied to disperse and discharge pathogenic factors, treating patterns of pathogenic exuberance.

TCM’s proposed dietary therapy coincides with the Western emphasis on the combination of food nutrients. TCM believes that most foods possess the function of harmonizing the

body's qi and promoting smooth flow. Foods that can play a "supplementing" role typically have warm, sweet, and moistening properties, mainly categorized into qi-tonifying, yang-tonifying, yin-tonifying, and blood-tonifying types. On the other hand, "draining" foods usually have cold, bitter, and pungent characteristics, serving to clear excess heat-toxins, dampness, and food stagnation from the body. They are primarily divided into four categories: heat-clearing and fire-purging, diuresis and dampness-percolating, digestion-promoting and stagnation-resolving, and pungent-warm exterior-releasing. In the "Mediterranean dietary structure," one of the world's three major dietary patterns, the focus is on the combination of various nutrients, emphasizing the intake of ample fish protein, legumes, and olive oil. Teachers can use generative artificial intelligence to classify and summarize the roles of foods in different dietary structure systems, guiding students to appreciate the similarities and differences between the two dietary cultures. In class, they can provide seasonal dietary therapy recipes and plans, helping students lower their guard against TCM culture and gradually accept TCM's way of thinking during the learning process.

4. New Reflections on Teaching Methods for TCM Antonymous Terms

As the global status of Traditional Chinese Medicine becomes increasingly important, domestic and international experts and scholars have expressed support and affirmation for its therapeutic effects. The scale of international students coming to China to study TCM is also showing a growing trend, rising to the second place among international students in China [6]. During their studies, international students are exposed to a significant amount of culture. Only on the basis of systematically learning TCM culture can they understand the theoretical system of their major and accelerate their mastery of TCM skills. In related research on international Chinese language education, cultural teaching has always been a key focus for scholars. As an important symbol of Chinese culture, TCM culture appears in both general Chinese language textbooks and specialized TCM Chinese textbooks. However, issues such as the ambiguous balance between the scientific and nature of textbook content and weak practicality remain to be resolved. Teaching methods should be adjusted according to actual conditions to improve teaching efficiency.

1) Develop experiential school-based curricula with regional cultural characteristics. International students in China are distributed across different regions, and the teaching materials and resources used in instruction should incorporate regional culture. For example, Shaanxi Province is an area with an extremely rich cultural heritage in Traditional Chinese Medicine, renowned for the "King of Medicine" Sun Simiao and the essence of his philosophy. Universities can use specialized Chinese language textbooks as a foundation, integrating institutional characteristics to form high-quality school-based courses and establish TCM culture practice bases. After completing the corresponding TCM Chinese language learning, students can then engage in relevant practical experiences at these bases. This helps international students deepen their understanding of the knowledge they have acquired during the practical process.

2) Actively adapt to the role transformation of teachers in the

tide of AI. The wave of generative artificial intelligence is propelling teachers to shift from being mere knowledge transmitters to becoming instructional designers. Teachers must develop an innovative capability that is based on AI-generated content and restructured under their guidance. After using AI to quickly construct knowledge graphs, teachers can tailor differentiated texts for learners of different language proficiency levels and design deep-learning tasks that integrate real-world problems and cross-cultural value conflicts. Teachers should regard each instance of human-computer collaboration as an opportunity for teaching reflection and professional growth [7]. The development of teachers' instructional skills also relies on the discussion activities in various teaching workshops provided by schools. Schools need to strengthen the cultivation of teachers' professional knowledge and technical expertise, continuously improving their technical literacy in artificial intelligence. This will enable them to accurately instruct the generation of necessary teaching resources and materials, assisting teachers in completing related teaching tasks, thereby allowing AI to play its supportive role in TCM terminology instruction.

3) Establish an intelligent assessment and learning progress tracking system. At the current stage, teaching commonly exhibits a tendency to "emphasize knowledge memorization over the application of thinking." Relying solely on teachers' records of teaching situations is far from sufficient. Therefore, it is necessary for both teachers and schools to jointly utilize AI to establish a framework for intelligent assessment of student learning capabilities and a learning progress tracking system. By continuously recording the accuracy, logical coherence, and comprehensiveness of pattern differentiation in students' use of antonymous terms during simulated diagnosis and treatment dialogues, a dynamic learning profile can be formed. Particularly when students independently engage in consultation practice after class, AI can collect materials from multiple practice sessions, recording the context, accuracy, logical coherence, and alignment with pattern differentiation conclusions in the students' use of antonymous terms. This can assist teachers in judging the students' mastery of what has been learned and subsequently determining how to structure follow-up courses.

5. Conclusion

In summary, Traditional Chinese Medicine, with its unique knowledge structure and cultural connotations, is attracting an increasing number of international students to China—a natural outcome of the inherent appeal of Chinese culture itself. However, in the process of teaching practice, its effectiveness can be influenced by factors such as the professional expertise of the instructors, the learners' own abilities, and the impacts and challenges brought by the era of artificial intelligence. The essence of teaching TCM antonymous terms is to guide learners from the surface level of language into the dialectical thinking-centered TCM system and to form correct thinking patterns. By empowering teaching with generative artificial intelligence, with teachers serving as instructional designers and curators of vast teaching resources, students can receive precise, personalized support. Only in this way can the best outcomes and greatest impact be achieved in international Chinese language education.

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