

The Integration of AI in Translation Pedagogy: Challenges and Innovations for Cultural Texts

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This paper examines ceramic-related cultural texts as a case study, systematically evaluating the capabilities and limitations of two popular large language models (LLMs) when processing culturally embedded content while simultaneously developing innovative methodological approaches for technology-enhanced translation classrooms. By conducting comparative analyses of artificial intelligence (AI)-generated translations, the study identifies key challenges in translating ceramic cultural texts, explores potential refinements for machine translation algorithms, and formulates evidence-based teaching strategies that leverage these insights to cultivate comprehensive translation skills. The findings indicate that while LLMs have demonstrated notable effectiveness in basic information transfer and literal semantic comprehension, they currently still need improvements to understand and process specialized jargon as well as metaphors. The findings also offer translation teachers a substantive framework for pedagogical transformation in the digital era, effectively bridging the theoretical divide between cultural translation studies and technological applications in translation education. AI should be leveraged to enhance ceramic culture translation, facilitating the advancement of cross-cultural communication and translation strategies.

Keywords: Chinese ceramic culture, artificial intelligence, translation teaching, DeepSeek-R1, ChatGPT-40

Introduction

Chinese ceramic culture, as an integral component of Chinese civilization, has historically served as a crucial medium for cultural exchange between China and other nations. As one of China's most distinguished cultural representations, ceramics have garnered worldwide acclaim not only for their exceptional craftsmanship and artistic value, but also for embodying unique Chinese philosophical thoughts and aesthetic sensibilities. From a long-term perspective, the international dissemination of Chinese ceramic culture possesses several advantages, primarily manifested in technical heritage, cultural depth, international recognition, and the global cultural exchange environment. These advantages not only reflect the competitiveness of Chinese ceramics in the international market, but also provide unique approaches and opportunities for promoting Chinese culture globally (Zhang & Shi, 2024).

However, compared to the profound historical accumulation of Chinese ceramic culture, its current breadth and depth of dissemination in modern international contexts remain insufficient. While modern Chinese ceramic publications are diverse—including interpretations of ancient ceramic texts, historical materials, translations of

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ancient ceramic classics, ceramic research monographs, personal collections, exhibition catalogues, pottery manuals, popular science readings, and textbooks (Zhang, 2024)—most are written in Chinese. The rich cultural connotations of Chinese ceramics, involving numerous technical terms, artistic expressions, and cultural metaphors, pose significant translating challenges. When translators are unfamiliar with Chinese ceramic culture, their English translations may contain errors or omissions, potentially leading to misunderstandings among foreign audiences rather than accurately conveying the original Chinese meaning.

Additionally, artificial intelligence (AI)'s multilingual support capabilities are widely applied in numerous fields, especially in scientific publication language translation and linguistic pattern innovation. Xiong (2020) suggested that current machine translation technology primarily relies on rule-based systems and corpus-based passive computation models, while artificial life technology achieves active environmental adaptation through biological system perception-feedback mechanisms, demonstrating high similarity to human cognitive processes. This indicates that with advancing artificial life research, machines may acquire aesthetic cognitive abilities and achieve breakthrough autonomous creation capabilities. Wang (2024) studied ChatGPT's understanding and translation of two Shakespearean sonnets, advocating for leveraging both human and machine advantages in the current "probability-based" new media era to achieve symbiotic development in modern translation. The advent of AI has precipitated profound transformations across numerous professional domains, with translation and language services experiencing particularly significant disruption. This technological evolution necessarily calls for a reassessment of traditional translation pedagogy. As globalization accelerates the exchange of culturally embedded texts across linguistic boundaries, translation educators face the dual challenge of incorporating AI tools into their teaching methodologies while ensuring students develop the critical cultural competencies that machines currently struggle to replicate.

Therefore, translation of texts related to Chinese ceramics represents an exemplary case study in this context. Such texts embody rich historical traditions, specialized terminology, and cultural connotations that often resist straightforward translation. This paper examines translating performances of the two popular AI models— ChatGPT-40 (hereafter ChatGPT) and DeepSeek-R1 (hereafter DeepSeek), investigating AI translation capabilities and both challenges and opportunities for future AI-based translation pedagogy. While rapid AI development provides new tools and methods for translating and disseminating Chinese ceramic culture, the complexity and profound cultural attributes of ceramic culture present significant challenges to AI accuracy and cultural adaptation. Thus, analyzing and optimizing pathways for foreign translation and publishing of ceramic culture under AI-enabled cultural communication not only holds academic value, but also provides practical insights for enhancing China's cultural soft power and promoting excellent Chinese culture.

Applying Large Language Models (LLMs) in Translating Ceramic Text

The original texts were extracted from a ceramic corpus. It includes the descriptive text data of ceramic collections at The Palace Museum in Beijing, China. This corpus was built by using #Lancsbox v.5.x (Brezina, Weill-Tessier, & McEnery, 2020), a corpus construction tool developed by Lancaster University. So far, the corpus contains 102,686 Chinese characters, including ceramics dating from the Western Jin Dynasty to the late Qing Dynasty (from AD 226 to AD 1912), extract data from the corpus, and employs two currently prevalent

LLMs, ChatGPT and DeepSeek, for Chinese-to-English translation comparison and analysis. Two examples will be presented in the following paragraphs.

Example(1) 白地酱彩花果纹盘,明弘治,高5.0厘米,口径26.0厘米,足径16.0厘米。清宫旧藏。盘内外施白 釉并以酱彩装饰。内底绘折枝花纹,内壁绘折枝花果纹。外壁绘折枝花纹。所有图案均先暗刻线条。内底、口沿及 足墙上均画有酱彩弦线。圈足内施白釉。外底署青花楷体"大明弘治年制"六字双行款,外围青花双线圈。此盘在 暗刻的花纹上施以酱彩,与洁白的釉色相互映衬,取得较好的装饰效果。其造型、纹饰等均延续宣德、成化白地酱 彩折枝花果纹盘。

ChatGPT version: Dish with Floral and Fruit Motifs in Overglaze Brown Enamel on a White Ground, Ming Dynasty, Hongzhi period. Height: 5.0 cm, rim diameter: 26.0 cm, foot diameter: 16.0 cm. Formerly in the Qing imperial collection. The dish is coated inside and out with a white glaze and decorated with overglaze brown enamel. The interior base features a design of flowering branches, while the inner wall is adorned with patterns of flowering and fruiting branches. The outer wall is decorated with flowering branch motifs. All patterns are first incised with fine lines. Brown enamel string patterns are painted on the interior base, rim, and foot wall. The recessed base is glazed in white. The underside bears a six-character, two-line mark in underglaze blue reading "Made in the Hongzhi Reign of the Great Ming Dynasty", encircled by a double-line border in underglaze blue. This dish achieves a striking decorative effect through the application of overglaze brown enamel on incised patterns, which contrasts elegantly with the pristine white glaze. Its form and motifs continue the tradition of similar dishes with flowering and fruiting branch designs in overglaze brown enamel on a white ground from the Xuande and Chenghua periods.

DeepSeek version: White-Ground Dish with Brownish-Glazed Floral and Fruit Motifs, Hongzhi period (1488-1505), Ming Dynasty. Height: 5.0 cm; mouth diameter: 26.0 cm; foot diameter: 16.0 cm. Formerly in the Qing palace collection. The dish is coated with white glaze inside and out, decorated with brownish glaze. The interior base features a painted floral spray, while the inner walls depict alternating floral and fruit sprays. The exterior walls are adorned with floral sprays. All motifs are first outlined with incised lines. Brownish-glazed bands frame the interior base, rim, and foot. The ring foot is glazed white. The exterior base bears an underglaze blue six-character mark in regular script, "大明弘治年制" (Made in the Hongzhi era of the Great Ming), arranged in two columns within a double-line blue border. The dish achieves striking decorative contrast by applying brownish glaze over incised motifs against the pure white glaze. Its form and motifs follow the tradition of Xuande (1426-1435) and Chenghua (1465-1487) period white-ground dishes with brownish-glazed floral and fruit sprays.

In previous ceramic translation studies, the accuracy of jargons and the conveyance of cultural connotations remain the core challenges. The source text contains numerous specialized ceramic jargons that require meticulous attention in the English translation process. Comparing the two translated versions reveals that while both translations share certain tendencies in handling specialized terminology, craft process descriptions, and aesthetic feature expressions, they demonstrate distinct approaches to technical precision and cultural interpretation, and several problems still exist.

Firstly, both translations misclassified the "Jiangcai (酱彩)" technique. The first translation ("overglaze brown enamel") makes an error by misclassifying this technique as it is an underglaze method, where pigment is applied before glazing, rather than an overglaze method. The Chinese term "彩" (enamel or color) can refer to various decorative techniques, applied either under or over the glaze. The English term "enamel" is often understood to mean "overglaze decoration", which can lead to unintentional inaccuracies if the process is not carefully researched. Due to this potential language ambiguity, AI may default to "overglaze" without appropriate context. The second translation ("brownish glaze") avoids the overglaze error but remains vague.

According to A Dictionary of Chinese Ceramics (Wang, 2002), "Jiang-se you (酱色釉)" is named as "caramel glaze", based on the similarity of colors between the glaze and caramel. It is defined as

a lime glaze with iron as the coloring agent. Its shades and tones vary according to the degree of iron content and firing atmosphere. The glaze first appeared on the proto-porcelain wares in the Western Zhou Dynasty and became widespread in the Eastern Han. (2002, p. 217)

However, "Jiangcai" (酱彩) in this example is distinct from caramel glaze. Caramel glaze refers specifically to a smooth, uniform brownish glaze color that covers the entire surface of an object. It is often semi-transparent or translucent, with a glossy finish resembling caramel or soy sauce. Instead of referring to a full glaze, "Jiangcai" refers to decorative patterns or motifs painted (or incised and filled with pigment) onto the ceramic body. These decorations are brown in color and are typically added before the glaze is applied. The brown pigment is then fired together with the glaze, creating the distinctive look of brown decoration beneath a clear transparent or white glaze. Unlike caramel glaze, which refers to the glaze being the main visual feature, "Jiangcai" combines decorative motifs and a base glaze, often white. Therefore, the term "underglaze brown" is the most accurate translation for Jiangcai, as it captures both the technical process and artistic intent of the decoration. Collections with similar technique in The British Museum also apply this term, like the Cizhou-type jar with underglaze brown.

Moreover, the term "Zhe-zhi-hua (折枝花)" literally means "a flower-bearing stem or branch is depicted". In mandarin, "zhe-zhi" means "a branch which has been cut from a plant, which generally includes sprays of plum, lotus, peony or other flowers and fruit" (Wang, 2002, p. 250). "Zhe-zhi-hua" also metaphorically implies the flower's beauty lives even when detached, mirroring the Royal family's desire to maintain seamless cultural transmission from earlier dynasties. ChatGPT simplifies "Zhe-zhi-hua's" meaning and translates it generally as "flowering branches" which disregards official kiln conventions in the Ming Dynasty. As the original text does not imply the exact plant, it is preferable to adopt the hybrid notation by The Percival David Foundation's Ming Ceramics Catalogue: "zhezhi' (scrolling floral) patterns". On the other hand, DeepSeek's translation "alternating floral and fruit sprays" accurately conveys the compositional characteristic of the alternating arrangement of the patterns, but it still does not provide any explanation of this motif in Chinese culture. Therefore, "Zhe-zhi-hua" can be translated as "scrolling floral sprays (symbolizing prosperity in Chinese iconography)".

This terminological ambiguity extends to the treatment of decorative techniques. The translation of "暗刻" as "incised lines" (ChatGPT) or "outlined with incised lines" (DeepSeek) inadequately conveys the dimensional characteristics of this type of carving. According to Wang (2002, p. 210), "刻花" (carved decoration) is

a technique of ceramic decoration whereby a design is carved on a "leather-hard" or half-dried clay body with a knife made of bamboo, bone or iron. The decoration may be in relief or in intaglio, both cut to display depth.

It can be indicated from the original text that, the motif was carved in intaglio first then filled with underglaze brown, and thus "暗刻" should better be translated as "carved in intaglio".

Furthermore, both translations exhibit deficiencies in reconstructing the manufacturing sequence. The original text's explicit temporal marker "先暗刻线条" (first carve lines) demands linguistic emphasis on the two-phase process of carving followed by pigmentation. Current renditions reduce this crucial technical hierarchy to a passive chronological indicator ("first incised"). A more precise formulation, like "motifs underwent shallow relief carving prior to underglaze application", would better help foreign readers comprehend. Similarly, descriptions of glaze interaction remain superficial. While ChatGPT and DeepSeek note the contrast between

underglaze brown patterns and white glaze, neither addresses the multi-layered optical effects arising from underglaze application beneath translucent coatings. Incorporating observations like "multi-layer refraction enhances dimensional depth under angled light" would align with materials science analyses of glaze stratigraphy in the Ming Dynasty.

Divergences in historical documentation reveal varying adherence to museological protocols. ChatGPT's generic "Hongzhi period" disregards standard chronological formatting, whereas DeepSeek appropriately incorporates regnal years "(1488-1505)". In transcription practices, DeepSeek's retention of the original Sinographic reign mark "大明弘治年制" with "regular script" annotation exemplifies best practice, contrasting with ChatGPT's paraphrased "Made in…" formulation that sacrifices philological precision. Regarding historical lineage, DeepSeek's specification of Xuande (1426-1435) and Chenghua (1465-1487) reign dates strengthens contextualization, though both versions neglect critical references to kiln excavation data.

Regarding the above analysis, both translations exhibit strengths and limitations in conveying the technical and cultural nuances of ceramics. ChatGPT's rendition misrepresents core technical terminology, notably translating "酱彩" as "overglaze brown enamel", which erroneously suggests a cloisonné technique rather than the authentic underglaze process. This inaccuracy risks distorting readers' understanding of Ming ceramic technology. While DeepSeek avoids this categorical error with "brownish-glazed", the term remains imprecise, lacking the specificity of "underglaze brown" endorsed by institutions like the British Museum.

Both versions inadequately address the dimensional nature of "暗刻", reducing it to generic "incised lines" rather than capturing the tactile depth implied by "carving in intaglio". Similarly, in floral motif interpretation, ChatGPT oversimplifies "折枝花纹" as "flowering branches", neglecting Ming design conventions, whereas DeepSeek's "alternating floral and fruit sprays" better conveys compositional logic but omits botanical specificity.

Documentation practices reveal divergent rigor: DeepSeek excels in chronological precision ("1488-1505") and calligraphic annotation ("regular script"), while ChatGPT's vague "Qing imperial collection" and paraphrased reign mark lack scholarly utility. However, both fail to integrate material science data (e.g., "clay shrinkage rates") or archaeological references critical for contextualization.

Ultimately, these translations underscore the necessity of hybridizing technical accuracy, process-oriented descriptions, and interdisciplinary referencing. A robust framework combining underglaze terminology, stratigraphic glaze analysis, and accession metadata would bridge art-historical discourse with scientific rigor, advancing Ming ceramic scholarship beyond superficial aesthetics.

Example (2) 淡黄地粉彩海水江崖桃蝠纹花口花盆,清光绪,高20.6厘米,口径31.2厘米,足径19.8厘米。花盆折沿,口部呈24花瓣形,深腹,圈足。底部开有两个渗水圆孔。盆内及圈足内均施白釉,釉面泛波浪纹。外壁淡黄釉地饰粉彩。折沿上绘缠枝瓜和蝴蝶,沿边绘回纹,沿下绘如意头纹。腹部绘海水江崖中长出两株桃树,树上硕果累累,空间点缀10个蝠衔结带"卍"字。外底中心以矾红彩署篆体"体和殿制"4字双行款。该花盆应有配套的花奁。盆上所绘图案皆寓意吉祥,如折沿上的图案寓意"瓜瓞绵绵",腹部图案寓意"江山永固(海水江崖)"、"万福('卍'字及蝙蝠)长寿(寿桃)"。

ChatGPT version: A pale yellow ground famille rose flowerpot with a floral rim, decorated with motifs of waves, cliffs, peaches, and bats, from the Guangxu period of the Qing Dynasty. Height: 20.6 cm, mouth diameter: 31.2 cm, base diameter: 19.8 cm. The flowerpot features a flared rim with 24 petal-shaped lobes, a deep belly, and a circular foot. The base has two round drainage holes. Both the interior of the pot and the inside of the foot are coated with white glaze, which exhibits a rippling texture. The exterior is adorned with a pale yellow glaze ground and famille rose decorations. The flared rim is

painted with entwined melon vines and butterflies, bordered by a key-fret pattern along the edge and a ruyi-head motif below. The belly is decorated with a scene of waves and cliffs, from which two peach trees grow, bearing abundant fruit. The space is further embellished with ten bats holding ribbons tied with the "卍" symbol. The center of the base bears a two-line inscription in seal script, reading "Made for the Hall of Embodied Harmony," written in iron-red enamel. This flowerpot was likely part of a matching set with a flower stand. The motifs on the pot are rich in auspicious symbolism. For instance, the designs on the flared rim signify "endless generations of descendants" (瓜瓞绵绵), while the decorations on the belly convey wishes for "eternal stability of the nation" (江山永固, symbolized by waves and cliffs), "abundant blessings" (万福, represented by the "卍" symbol and bats), and "longevity" (长寿, symbolized by peaches).

DeepSeek version: Pale Yellow-Ground Famille-Rose Flower Basin with Seawater, Peach, and Bat Motifs, Floral Rim. Qing Dynasty, Guangxu reign (1875-1908). Height: 20.6 cm, mouth diameter: 31.2 cm, foot diameter: 19.8 cm. This flower basin features an everted rim shaped into 24 petal-like lobes, a deep belly, and a ring foot. Two drainage holes are pierced at the base. The interior and foot are coated in white glaze with a subtly undulating texture. The exterior is decorated with famille-rose enamels over a pale yellow ground. The everted rim is adorned with scrolling vines bearing gourds and butterflies, bordered by keyfret patterns along the edge and ruyi-head motifs below. The main body depicts two peach trees growing from a seawater and mountain (jiangya) landscape, their branches heavy with fruit. Ten bats clutching ribbon-tied swastikas (卍) are scattered across the composition. The center of the exterior base bears a seal-script inscription in iron-red enamel: *Tihedian zhi* ("Made for the Hall of Harmonious Governance"). This basin would have originally been paired with a matching jardinier. The motifs carry auspicious symbolism: the gourd-and-butterfly design on the rim signifies "endless generations" (*guadie mianmian*), while the sea-water and mountain motif represents "eternal stability of the realm" (*jiangshan yonggu*). The peaches symbolize longevity, and the bats (*fu*) with swastikas (*wan*) collectively convey "myriad blessings (*wanfu*) and long life."

The second example is a famille-rose flowerpot made in Qing Dynasty. In terms of lexical treatment, both translations demonstrate different approaches to terminology management. ChatGPT prioritizes accessibility through standardized English ceramic terminology, employing terms like "famille rose" and "key-fret pattern". However, this approach occasionally leads to cultural imprecision. Taking the translation of "瓜瓞绵绵" for example, "瓜" and "瓞" respectively refer to melons and small melons. As mentioned in Chapter 5, the earliest use of melons to describe human descendants can be traced back to 《诗经》(shījīng; *The Book of Songs*, AD 11 to AD 6), a famous book of ancient Chinese folk songs, which wrote "绵绵瓜瓞, 民之初生" (miánmián guādié mín zhī chū sheng; "the numerous big and small melons are the first born of the people"). A conceptual metaphor, "human descendants are melons", is derived in the Chinese culture.

Therefore, when metaphors are present in ceramic discourse, a more appropriate translation approach is to first translate the literal meaning and then explain its metaphorical implications or directly translate the metaphorical meaning. The latter is exactly the approach taken by ChatGPT, but it loses the cultural connotations of Chinese culture and fails to help readers understand why plants are associated with descendants. It should be better translated as "the numerous big and small melons with vines (it has a metaphorical meaning of family prosperity)". Another problematic translation is the oversimplification of "海水江崖" (literally means "sea waves and river cliffs", symbolizing national stability) which is oversimplified as "waves and cliffs", omitting the critical "river" component. A hybrid translation—"seawater and river cliffs"—with annotations would better preserve cultural specificity. These choices, while making the text more accessible to general readers, sacrifice important cultural nuances embedded in the original Chinese terms.

Conversely, the DeepSeek version exhibits greater cultural sensitivity, particularly in its treatment of symbolic motifs. Its hybrid approach—combining pinyin transliteration with English glosses (e.g., "瓜瓞绵绵" with "endless generations")—effectively preserves cultural nuance while ensuring comprehensibility. However,

this version occasionally struggles with consistent annotation practices, as seen in its treatment of terms like "江 山永固" (literally means "the river and mountain will be solid forever", the dynasty will last forever), where the translation is sometimes omitted after pinyin transliteration.

Syntactic analysis reveals contrasting strategies in information presentation. The ChatGPT version employs complex syntactic structures that effectively link descriptive elements but occasionally result in information overload. For instance, its description of the flowerpot's physical features combines multiple technical specifications into single, complex sentences, potentially obscuring important details through excessive embedding. While grammatically sound, such constructions can challenge readers' comprehension of technical specifications.

The DeepSeek version favors shorter, more discrete units of information, enhancing clarity but potentially sacrificing narrative flow. Its segmented approach to description, while technically precise, sometimes creates a disjointed reading experience. This is particularly evident in its treatment of decorative elements, where separate sentences for each motif, while clear, may fragment the overall visual narrative of the piece.

In terms of textual organization, the translations differ markedly in their structural approaches. ChatGPT presents information in a continuous narrative, integrating physical description with symbolic interpretation. While this creates a cohesive reading experience, it complicates information retrieval for readers seeking specific details. DeepSeek adopts a more systematic structure, clearly delineating physical attributes, decorative elements, cultural significance, and technical specifications. This hierarchical organization aligns with academic cataloging conventions but occasionally fragments the narrative flow.

Both translations demonstrate complementary strengths and weaknesses in their approaches to cultural content transmission. The ChatGPT version excels in readability and narrative coherence but sometimes compromises technical precision. The DeepSeek version prioritizes accuracy and cultural fidelity but may challenge non-specialist readers through its technical density and occasional inconsistency in annotation practices.

Another noticeable result is the translation of homophones. In terms of handling homophonic symbolism in ceramic motifs, both AI models demonstrate limitations in conveying the complex phonetic wordplay inherent in Chinese decorative arts. A notable example is the bat ("蝠" fú) motif, which creates a homophonic connection with "福" (fú, blessing). While both ChatGPT and DeepSeek identify the presence of "bats" in their translations, neither of them adequately explains this crucial phonetic relationship that gives the motif its cultural significance. DeepSeek makes a partial attempt by noting "bats (fu)" but does not explicitly connect this to the homophonic meaning of blessing. Similarly, when translating the combination of bats with the "卍" (wàn) symbol, both models recognize the literal meaning but fail to fully capture the phonetic wordplay that creates "万福" (wànfú, "myriad blessings").

To better convey these homophonic elements, translations should incorporate explicit explanations of such phonetic relationships. For example, a more complete translation might be: "bats (蝠 fú, homophonic with 福 fú 'blessing') carrying ribbon-tied swastika symbols (卍 wàn, forming a phonetic compound with 'bat' to suggest 万福 wànfú 'myriad blessings')". This approach would help readers understand not just the visual elements but also the sophisticated linguistic wordplay that gives these motifs their cultural significance. Additionally, the translations should consistently maintain this level of linguistic annotation throughout the text, particularly when

dealing with other homophonic symbols like "M" (guā) and its relationship to prosperity and continuity in Chinese cultural symbolism.

Based on this analysis, optimal translation strategies for Chinese ceramic descriptions should employ systematic pinyin transliteration with English glosses for cultural terms, balance technical precision with accessible explanation, maintain clear information hierarchy while preserving narrative coherence, and provide consistent cultural annotations. Such an approach would better serve both academic and general audiences, maintaining scholarly rigor while ensuring accessibility.

Discussion

The comprehensive analysis of AI translation in Chinese ceramic culture reveals significant insights into both the capabilities and limitations of current AI models, specifically ChatGPT-40 and DeepSeek-R1, in handling specialized cultural-technical content. The study demonstrates that while these AI models show promising potential in processing complex ceramic descriptions, they face considerable challenges in accurately conveying the intricate relationships between technical specifications, cultural significance, and historical context that characterize Chinese ceramic artifacts.

Summary of AI Translation in Ceramic Texts

In examining the translation of descriptions of Ming Dynasty dish and Qing Dynasty flowerpot, the research identifies several critical areas where AI translation currently falls short. The handling of specialized terminology presents a particular challenge, with both models demonstrating inconsistent accuracy in translating technical terms specific to ceramic production and decoration techniques. This inconsistency extends to the treatment of culturally-specific terms, where the deeper cultural implications and historical significance often become diluted or lost in translation. A detailed examination of specific translation examples reveals the nuanced challenges in AI translation of ceramic terminology. In the case of technical terms like "Jiangcai" (營彩), both AI models demonstrated significant limitations in accurately conveying the technical process. ChatGPT's translation as "overglaze brown enamel" fundamentally misrepresents the underglaze nature of the technique, while DeepSeek's "brownish-glazed" lacks technical precision. This highlights a critical gap in AI models' ability to distinguish between similar but technically distinct ceramic processes, potentially leading to significant misunderstandings in professional contexts.

The treatment of culturally significant terms presents another layer of complexity. The translation of "Zhezhi-hua" (折枝花) exemplifies this challenge, where both models struggled to capture the term's full cultural and technical implications. While ChatGPT's "flowering branches" and DeepSeek's "alternating floral and fruit sprays" each capture certain aspects of the jargon's meaning, neither fully conveys its cultural significance within Ming Dynasty royal kiln conventions or its metaphorical implications regarding cultural continuity. This suggests a need for AI models to develop more sophisticated approaches to handling terms that carry both technical and cultural significance.

Suggestions on Future Translation Teaching Pedagogy

The analysis of AI performance in translating ceramic cultural texts provides valuable insights for reshaping translation pedagogy in the digital era. As translation education faces unprecedented technological disruption,

educators must develop innovative approaches that integrate AI tools while enhancing human expertise in areas where machines currently struggle. This section proposes several evidence-based strategies for translation teaching that leverage the complementary strengths of human and AI.

Translation curricula should be redesigned to incorporate AI literacy as a core component. This entails not merely teaching students how to use AI tools, but developing their critical understanding of underlying algorithms, training data biases, and the strengths and limitations of different models. Based on the analysis of ChatGPT and DeepSeek translations, curricula should include comparative analysis exercises where students evaluate multiple AI translations against human translations, identifying patterns of error in technical terminology as observed with "酱彩" and "暗刻". Technical modules on AI translation evaluation metrics can enable students to systematically assess output quality beyond intuitive judgment. Domain-specific training in recognizing cultural-conceptual gaps that AI models struggle to bridge, particularly in areas rich with cultural metaphors and homophonic words as seen with "瓜瓞绵绵" and "蝠" homophony, should also be integrated.

The ceramic text analysis demonstrates that neither AI models nor inexperienced human translators alone can adequately handle culturally complex technical texts. Translation pedagogy should therefore emphasize hybrid workflows that capitalize on the respective strengths of human and machine translation. Post-editing training modules that focus specifically on technical-cultural content can teach students to efficiently identify and correct AI mistranslations of specialized terminology. Pre-processing strategies where students learn to annotate source texts with explanatory metadata before AI translation, particularly for culturally-embedded terms, should be developed. Collaborative translation exercises where students work in teams with AI assistance can help develop skills in negotiating between technical accuracy and cultural sensitivity.

The limitations in AI translation of ceramic terminology underscore the continued importance of deep cultural and technical knowledge. Future translation teaching should strengthen interdisciplinary approaches that combine cultural studies, material science, and linguistics, ensuring students understand both the physical processes and cultural significance of specialized terms. Developing specialized glossaries and annotation practices for cultural-technical domains can teach students to create hybrid translations that preserve original terminology while ensuring accessibility. Incorporating field-specific expertise through collaborative projects with museums, cultural institutions, and technical experts can expose students to authentic translation challenges.

Rather than positioning AI as either threat or panacea, translation pedagogy should focus on developing students' abilities to strategically augment AI output. Prompt engineering exercises can teach students how to craft effective instructions for AI models, particularly for handling culturally specific content like ceramic descriptions. Error recognition training helps students quickly identify typical AI mistranslations in cultural-technical domains, based on the patterns observed in the ceramic text analysis. Comparative output evaluation across different AI models, as demonstrated with ChatGPT versus DeepSeek analysis, teaches students to select appropriate tools for specific translation challenges.

Translation assessment must evolve to evaluate students' abilities in an AI-integrated era. Developing rubrics that assess not only translation quality, but also effective AI tool utilization, error recognition, and cultural sensitivity becomes essential. Creating authentic assessment tasks that mirror real-world complex translation scenarios, such as museum catalogue preparation with specialized cultural-technical content, provides meaningful evaluation opportunities. Implementing portfolio-based assessment that demonstrates students'

abilities across the AI-human translation spectrum, from independent translation to sophisticated post-editing, offers a comprehensive picture of student capabilities.

The integration of these pedagogical approaches would prepare translation students for a professional landscape where AI serves as both tool and collaborator. By focusing on the development of human expertise in areas where AI currently demonstrates limitations—particularly in cultural interpretation, technical precision, and contextual sensitivity—translation education can ensure that graduates possess complementary skills rather than competing with algorithmic capabilities. This hybrid approach aligns with the findings from ceramic text analysis, which revealed that optimal translation of cultural-technical content requires both technological efficiency and nuanced cultural understanding.

Conclusions

The analysis of translation strategies suggests that successful AI translation of cultural-technical content requires a delicate balance between technical precision and cultural sensitivity. The current AI models show limitations in their ability to maintain this balance, often sacrificing one aspect for the other. This observation highlights the importance of developing more sophisticated approaches that can simultaneously address both technical accuracy and cultural nuance, particularly in the context of Chinese ceramic culture, where these elements are inextricably linked.

For translation teaching, these findings suggest the need for substantial adaptation in current workflows and quality control mechanisms. The integration of AI translation tools into existing teaching processes requires careful consideration of how to maintain high standards of accuracy while leveraging the efficiency benefits of AI technology. This may necessitate the development of new training programs for university teachers and the establishment of specialized style guides that address the unique challenges of cultural-technical content.

Looking toward the future, the implications for international cultural exchange are particularly significant. While AI technology shows promise in facilitating broader dissemination of cultural knowledge, the current limitations in handling complex cultural-technical content suggest that continued development is necessary. This development should focus on creating more sophisticated AI models that can better preserve cultural authenticity while maintaining technical accuracy, potentially through enhanced integration of multi-disciplinary approaches and comprehensive cultural knowledge bases.

In conclusion, while current AI models demonstrate potential in translating Chinese ceramic culture, significant advancement is still required to achieve optimal results. The path forward appears to lie in developing more nuanced approaches that can effectively balance technical precision with cultural sensitivity, supported by continued research and development in both AI technology and cultural translation methodologies. This balanced approach, combining technological capability with cultural understanding, represents the most promising direction for advancing the field of cultural-technical translation and ensuring the effective dissemination of Chinese ceramic culture to international audiences.

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