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| RESEARCH ARTICLE

Reforming Traditional Medicine Translation Courses in Higher Education through a Human–Machine Collaborative Blended Teaching Model: An Empirical Study

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| ABSTRACT
The need for qualified translators with expertise in traditional medicine has increased due to China's fast globalisation. This study investigated a human–machine collaborative blended teaching model using the Feiyi platform to improve undergraduate students' translation performance in light of the drawbacks of conventional translation techniques. The model, which was based on constructivist and social learning theories, combined guided machine translation exercises, in-person training, and online terminology databases. The model's effect on translation efficiency and accuracy was evaluated using a quasi-experimental design. Results from tests conducted before and after the intervention (N = 25) showed notable gains in efficiency (pre-test M = 43.0 min, post-test M = 31.0 min, p <.001) and overall translation accuracy (pre-test M = 68.2%, post-test M = 76.5%, p <.001). Significant improvements in cultural appropriateness (d = 1.51) and terminological accuracy (d=1.57) were noted, suggesting the model successfully addressed important issues in translating traditional medicine. These results show that the blended model promotes positive affective outcomes and enhances quantifiable translation performance. Among the ramifications are the methodical integration of machine-assisted phases to standardise specialised language and encourage the development of independent, critical translation abilities.

| KEYWORDS

Traditional medicine translation; blended learning; Feiyi platform

| ARTICLE INFORMATION

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1. Introduction

The need for qualified translators with expertise in specialised fields like traditional medicine is rising sharply as a result of China's fast globalisation. At the same time, the scale and efficiency needed in contemporary translation workflows have put traditional translation techniques to the test. Machine translation, in particular, is one of the emerging artificial intelligence technologies that provides solutions for effectively managing large translation tasks.

Traditional Chinese medicine (TCM) has a very specialised vocabulary, strong cultural roots, and no internationally recognised translation standards, making translation challenging even with major advances in language technology. According to scholars, many TCM terms need culturally sensitive, context-aware translation techniques because they have no direct equivalents in Western medicine (Cappuzzo, 2022). Accurate communication of TCM concepts in international contexts is hampered by these problems, which are exacerbated by inconsistent terminology use and disparate translation practices (Xue et al., 2019; Ji et al., 2023). Furthermore, it can be challenging to become an expert in this specialised field because students and inexperienced translators frequently do not have enough opportunities to work on actual TCM translation tasks (Ye & Tong, 2019). In order to close this training gap and satisfy the increasing demand worldwide, researchers stress the necessity of creative teaching approaches, such as corpus-based instruction, digital tools, and term standardisation projects (Lu & Coxhead, 2023).

Based on constructivist and social learning theories, this study suggests and assesses a human–machine collaborative blended teaching model that fills these gaps by integrating guided MT integration through the Feiyi Platform, online terminology databases, and in-person lectures. The purpose of this study is to evaluate how the blended model affects (1) translation efficiency and (2) translation accuracy. Questions for research:

RQ1: Does the blended model significantly improve traditional medicine translation accuracy?
RQ2: Does the blended model significantly improve traditional medicine translation efficiency?

2. Literature Review

2.1 Traditional medicine Translation Challenges

Because traditional medicine translation involves inherent linguistic and cultural complexities, it holds a special place in translation studies, particularly in fields like Traditional Chinese Medicine. The philosophical and conceptual underpinnings of TCM diverge greatly from those of Western medicine. Therefore, translating TCM texts entails more than just changing the language; it also entails communicating traditional knowledge systems and culturally embedded meanings. The specific terminology of TCM and other minority medical systems, which frequently lack direct equivalents in target languages, is one of the main obstacles (Zhang, 2022). It is difficult to translate concepts like "Qi" or "Gan Huo Wang," which are deeply ingrained in Chinese philosophical and cultural thought, into Western biomedical terminology without losing their subtlety or meaning.

The lack of standardised translation standards or glossaries makes this issue even worse. Variability and misunderstanding in academic, clinical, and cross-cultural communications result from inconsistent translations of fundamental medical concepts. To increase quality and coherence across TCM texts, research has shown how urgent it is to create standardised terminology libraries and translation guidelines (Wang & Zhou, 2005). Contradictions and misunderstandings are likely to continue in the absence of such standardisation.

Semantic ambiguities and cultural quirks add another level of complexity to terminological challenges. When translators lack adequate knowledge of the source culture, the connotative meanings of many traditional terms—which have been shaped by centuries of historical and cultural evolution—often result in translations that are imprecise or superficial (Liu & Wang, 2018). More than just bilingual fluency is needed for effective translation in this setting; translators must also be culturally literate and have domain-specific medical knowledge. As a result, the translator's job shifts from being a language converter to an intercultural mediator.

The pedagogical framework necessary to facilitate this degree of translator training is still lacking, though. Further separating academic training from practical requirements is the fact that student translators frequently do not have access to authentic translation exercises and high-quality, domain-specific reference materials (Cui & Ji, 2021). In the context of traditional medicine, where content knowledge is just as important as language proficiency, this is particularly problematic.

Researchers support pedagogical models grounded in constructivist learning principles in order to address these issues. These methods place a strong emphasis on using authentic, task-based learning to scaffold domain knowledge, enabling students to internalise medical terms' cultural and contextual meanings in addition to their vocabulary. Despite being well known, Vygotsky's (1978) constructivist framework has not been widely used in traditional medicine translator education. Recent efforts to apply culturally sensitive, domain-specific pedagogy in TCM translation training suggest a promising direction, which integrates communicative, linguistic, and cultural dimensions of translation.

2.2 Technology in Translation Education

Recent developments in machine translation and artificial intelligence have led to revolutionary shifts in translation education. In order to support the acquisition of practical skills, platforms that combine machine translation (MT) with human oversight—often referred to as human-machine collaborative translation systems—have become more and more popular in educational settings. Students' motivation and engagement are positively impacted by the active learning and teamwork that are fostered by technology-enhanced translation education.

Additionally, because they offer flexible learning environments and real-world task-based experiences, blended learning models that combine online platforms with in-person instruction have been found to be effective for teaching specialised translation (Sun & Zhao, 2021). These results lend credence to the inclusion of Feiyi-like platforms in translation courses for traditional medicine.

Additionally, by combining online and in-person interactions, blended learning offers flexibility and enhances student experiences by utilising a variety of learning modalities. In particular, the human-machine collaborative component improves students' practical problem-solving skills and gets them ready for the demands of the workplace in the future (Rasheed, Kamsin, & Abdullah, 2020).

Even with the increasing amount of research, there is still little attention paid specifically to translation education for traditional medicine. The use of human-machine collaborative platforms designed for this field, which poses particular terminological and cultural challenges, has not received much attention in research. Furthermore, little longitudinal research has been done on the long-term effects of these technologies on professional preparedness and student learning outcomes.

2.3 Theoretical Framework

The study is anchored in constructivist learning theory (Vygotsky, 1978), where learners build knowledge through collaboration, emphasizing observational learning and shared problem-solving. Central to this theory are principles such as learner agency (individuals build knowledge by integrating new information with existing cognitive schemas), social negotiation (collaborative dialogue refines meaning-making, as emphasized by Vygotsky's Zone of Proximal Development), and situated cognition (authentic contexts anchor knowledge application). The blended model operationalizes these theories by coupling instructor modeling with peer/technology-aided practice.

3. Research Design

Using a quasi-experimental design, this study assessed the effect of the Feiyi Human-Machine Collaborative Translation Platform on undergraduate students' performance in translating traditional medicine using pre- and post-intervention assessments. The research was conducted over a 11-week semester at a Medical University. A total of 25 undergraduate translation students enrolled in the traditional medicine translation course participated voluntarily.

3.1 Instruments

3.1.1 Translation Tests

Two sets of parallel translation tests were created, each with two 800-word passages pertaining to traditional medicine. In order to guarantee relevance and constant difficulty, the texts featured specific terminology from ethnic minority medical knowledge and traditional Chinese medicine that had been carefully selected and verified by subject matter experts. Both the pre-intervention (baseline) and post-intervention evaluations made use of these tests.

3.1.2 Accuracy Measurement

Each student's translation was assessed using a four-domain rubric (linguistic fluency, coherence & logical consistency, cultural appropriateness, and terminological accuracy), with three separate translators assigning a score between 0 and 100 to each domain. To determine the overall percentage accuracy for the pre- and post-tests, domain scores were averaged, weighted based on rubric percentages (40/30/20/10), and then combined.

3.1.3 Efficiency Measurement

Efficiency was measured via task completion time, which was automatically logged by the Feiyi platform during the post-test, while the pre-test completion times were recorded manually under supervised conditions.

3.1.4 Procedures

The five stages of the instructional sequence were based on the "online + offline + human–machine collaborative" framework and corresponded with the project's implementation path. To guarantee theory-practice alignment and ongoing optimisation, instructors painstakingly planned and executed each phase:

Phase 1: Needs Analysis and Strategy Formulation (Weeks 1–2)

Demand Assessment: To find out about students' translation skills, platform familiarity, and particular terminology issues in traditional medicine, instructors held focus groups at the beginning of the semester. Key competency requirements for translating traditional medicine in professional contexts were also influenced by discussions with industry partners and local healthcare professionals.

Strategy Design: Teachers developed a customised Feiyi platform application strategy based on these insights, mapping platform features (translation memory, machine suggestions, and termbase search) to course modules (learning terminology, peer collaboration, and machine-aided practice).

Phase 2: Platform Familiarization and Corpus Construction (Weeks 3–4)
Platform Workshops: To illustrate the fundamental functions of the Feiyi Platform, educators led interactive workshops. Students were able to examine the user interface, access the carefully selected corpus of traditional medicine, and practise basic translation tasks with the help of guided prompts during live screen-sharing sessions. For self-paced review, instructors offered video tutorials and detailed instructions.

Development of the Corpus: At the same time, teachers and teaching assistants added verified texts from the primary course textbook and additional sources to the platform's traditional medicine corpus. Additional passages and terminology were suggested by the students.

Phase 3: Integrated Blended Sessions (Weeks 5–8)
Online Modules: Students focused on 800-word passages and completed weekly machine-assisted translation tasks on Feiyi. For every module, teachers established clear learning objectives and gave feedback based on rubrics within 48 hours using the platform's comment feature.

Offline Workshops: Online learning was reinforced by biweekly in-person meetings. Small-group collaborative translation exercises were a feature of each workshop, and instructors moved around to lead conversations about cultural context, term choice, and MT post-editing techniques. Teachers highlighted common pitfalls and best practices using shared annotation boards and real-time polling.

Human–Machine Collaboration: By translating a sample text in real time while switching between manual draughting and Feiyi's MT recommendations, instructors demonstrated efficient hybrid workflows. By verbalising decision-making procedures, they showed how to assess machine output, check terminology, and preserve cultural integrity.

Phase 4: Iterative Optimization (Weeks 9–10)
Refinement of the Strategy: Following each assessment, instructors got together to make changes to the platform application plan, including adding new glossary entries, adjusting group assignments, and adjusting termbase filters. Constant feedback loops made sure that the needs of the learners were met.

Phase 5: Summative Assessment and Reflection (Week 11)
Posttest Administration: Students completed the parallel translation passages solely on Feiyi while being closely monitored. To make sure that protocol was followed, teachers kept a close eye on time logs in real time.

4. Results

Data were analyzed using SPSS version 27.0. Paired-samples t-tests evaluated within-subject differences in translation accuracy and task completion time between pre- and post-tests. Table 1 shows the pre- and post-intervention translation accuracy and completion Time.

Table 1 Pre- and Post-Intervention Translation Accuracy and Completion Time

Measure	Phase	Mean (SD)	t	df	p
Accuracy (%)	Pre-test	68.2 (4.5)			
(score)	Post-test	76.5 (2.8)	-7.84	24	< .001
Efficiency	Pre-test	43.0 (4.2)			
(minutes)	Post-test	31.0 (3.7)	10.71	24	< .001

4.1 Translation Accuracy

As shown in Table 1, there was a statistically significant increase in accuracy from pre-test (M = 68.2%, SD = 4.5) to post-test (M = 76.5%, SD = 2.8); $t(24) = -7.83$, $p < .001$. Table 2 shows the specific accuracy results of each four dimension of pre-test and post-test.

Table 2 Dimension-Specific Scores

Dimension	Weight	Cronbach's α	Pre-test Mean (SD)	Post-test Mean (SD)	Change (pp)	Cohen's d
Terminological Accuracy	40%	0.92	61.3 (7.2)	79.7 (6.1)	18.4	1.57
Linguistic Fluency	30%	0.89	72.4 (5.8)	83.6 (5.0)	11.2	0.94
Coherence & Consistency	20%	0.88	65.8 (5.1)	80.2 (4.3)	14.4	1.17
Cultural Appropriateness	10%	0.9	58.7 (6.8)	75.4 (5.9)	16.7	1.51

Table 2 reveals that all four rubric domains exhibited statistically and educationally meaningful gains. Terminological accuracy showed the largest improvement with an 18.4-point increase (pre M = 61.3%, post M = 79.7%; d = 1.57), indicating that targeted terminology support strongly benefited students' mastery of specialized vocabulary. Cultural appropriateness rose by 16.7 points (d = 1.51), underscoring enhanced awareness of culturally nuanced phrasing. Coherence & consistency improved by 14.4 points (d = 1.17), reflecting better structural organization of translations. Finally, linguistic fluency increased by 11.2 points (d = 0.94), showing moderate gains in general readability and sentence flow. Together, these results suggest that while all aspects of translation benefited, domain-specific tools within the blended model most powerfully impacted terminology and culturally sensitive conversions.

4.2 Translation Efficiency

It can be seen from Table 1 that the a significant reduction in task completion time from pre-test (M = 43.0 min, SD = 4.2) to post-test (M = 31.0 min, SD = 3.7); $t(24) = 10.73$, $p < .001$. Production time declined by 27.9% (from 43 to 31 minutes), indicating that the platform's features, such as machine-generated suggestions and terminology assistance, substantially enhanced the efficiency of the translation process.

5. Discussion

Through the implementation and evaluation of a blended teaching model that integrates human–machine collaboration via the Feiyi platform, the current study aimed to address significant gaps in traditional medicine translation education. Results show that this novel method greatly increased undergraduate translation students' translation efficiency and accuracy, underscoring the value of technology-enhanced, scaffolded learning environments.

Notable improvements in terminological accuracy were especially noticeable, which is consistent with previous research highlighting the advantages of incorporating domain-specific technology into translation instruction. In addition to facilitating instantaneous accuracy gains, this kind of focused terminology support may have helped people learn and remember specialised terms more thoroughly.

Furthermore, the model's ability to increase students' sensitivity to cultural nuances—a crucial element that is frequently disregarded in conventional teaching methods—is demonstrated by the notable improvement in cultural appropriateness (pre-test M = 58.7%, post-test M = 75.4%). The instructional strategy probably enhanced students' capacity to contextualise translations successfully, maintaining authenticity and scientific integrity, by simulating human-machine collaborative workflows and openly discussing culturally-sensitive translation choices during in-person sessions.

Prior research supporting the incorporation of machine-assisted tools to optimise translation workflows is supported by the significant improvement in translation efficiency (pre-test M = 43.0 min, post-test M = 31.0 min) (Jiang & He, 2021). This increased efficiency was a direct result of the Feiyi platform's features, which included translation memories and automated terminology suggestions. These features also reflected the larger trend towards AI-assisted translation practices in professional settings.

5.1 Limitations and Future Directions

The study's one-semester duration and single-institution setting limit it, despite its encouraging results. Longitudinal studies should be part of future research to look at the blended model's long-term effects on students' professional development and translation proficiency. Furthermore, the study's generalisability and validity would be improved by reproducing it across various academic institutions and translation specialities. The model's wider educational value could be further confirmed by investigating its use in other specialised translation contexts.

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