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Assessing Scientific Translation Proficiency in Higher Education Through the Use of Google Translation: Evidence for Developing a Chinese Scientific Translation Curriculum

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***Abstract*—This study aims to examine and compare the abilities of university students from diverse academic backgrounds—Chinese, Science, Social Science, and Health Science—in translating scientific and technological content from Chinese to Thai. The objective is to assess how disciplinary knowledge influences translation performance in the context of Thailand's increasing economic and educational ties with China. A comparative analysis was conducted using translation tasks assigned to students enrolled in programs related to Chinese, Science, Social Science, and Health Science. Participants were assessed based on criteria such as language proficiency, scientific accuracy, and organizational clarity. The performance of each group was evaluated to identify strengths and gaps related to their respective academic training. The findings revealed that students from Science and Social Science programs outperformed others in Chinese-to-Thai translation tasks. Science students excelled in scientific accuracy and terminology, while Social Science students demonstrated better fluency and structure in written translations. In contrast, students from the Chinese language program showed lower performance in translating scientific content, highlighting a lack of scientific foundation that affected their comprehension and coherence. The study suggests that disciplinary background has a significant impact on translation abilities in science and technology contexts.**

***Index Terms*—machine translation, translation quality, translation assessment, scientific translation, Chinese language**

I. Introduction

The increasing globalization of scientific and technological knowledge necessitates effective cross-lingual communication, highlighting the crucial role of translation in disseminating advancements and fostering international collaboration (Juarez & Kenet, 2018). While English has often been considered the lingua franca of science, relying solely on a single language creates barriers to accessing scientific careers and knowledge, hindering inclusivity and potentially slowing down the global advancement of science (Steigerwald et al., 2022). This situation poses a significant disadvantage for researchers and students from non-English speaking backgrounds, as they must navigate complex scientific literature and contribute to scholarly discourse in a foreign language (Kleidermacher & Zou, 2025; Ramírez-Castañeda, 2020). The dominance of English in scientific publications has led to a scarcity of scientific records in other languages, further reinforcing its role as the primary language for scholarly communication (Navarro et al., 2017). Furthermore, language and cultural barriers present considerable obstacles to international exchange in social sciences, despite advancements in translation technology (Yonezawa, 2012).

Given the limitations of current translation methods, particularly when dealing with scientific and technological content characterized by lexical ambiguity, syntactic complexity, and semantic nuances, it is imperative to investigate the translation abilities of university students from diverse academic backgrounds (Zhao & Wang, 2025). Differences in linguistic structures and cultural contexts between Chinese and Thai, for instance, pose unique challenges for translators, requiring a deep understanding of both languages and cultures. Moreover, specialized knowledge in science and technology is indispensable for accurately conveying the intended meaning of technical texts. The effectiveness of human translation can be amplified through the integration of technology (Shen et al., 2022). It is important to consider that translation is not merely a linguistic exercise but also a cultural one, and problems in translation can arise from failures

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to achieve cultural equivalence (Madkour, 2018). Therefore, it is essential to investigate how students from various academic disciplines, such as Chinese language, Science, Social Science, and Health Science, approach the task of translating scientific and technological content from Chinese to Thai. Differences in training, exposure to scientific concepts, and linguistic proficiency may significantly impact their translation strategies and outcomes.

Evaluating translation competence requires a multifaceted approach that considers linguistic accuracy, technical precision, and cultural appropriateness. In addition to grammatical correctness, translators must ensure that the translated text accurately reflects the scientific concepts and technical details presented in the original text. The study of translation errors made by students reveals persistent challenges and difficulties in translating texts with cultural elements, which validates the importance of integrating specific learning objectives to develop translator competence (Sirinit, 2018). Cultural competence plays a vital role in conveying the intended meaning and avoiding misunderstandings that may arise from cultural differences. Moreover, the evaluation should assess the students' ability to adapt the translated text to the target audience, ensuring that it is accessible and comprehensible to Thai readers with varying levels of scientific literacy. Nguyen and Dao (2020) highlighted the difficulties faced by English majors in assessing the quality of translated texts, including time constraints, non-equivalence between languages, insufficient cultural understanding, and the lack of official frameworks for quality assessment.

By examining and comparing the abilities of students from diverse academic backgrounds, this research aims to identify the specific strengths and weaknesses of each group, shedding light on the factors that contribute to successful translation outcomes. The ultimate goal is to inform the development of targeted training programs and pedagogical strategies that enhance the translation skills of university students, equipping them with the necessary tools to bridge the language gap in scientific and technological communication. The ability to understand nuances, context, and subtleties differentiates human translation from machine translation (Rahmaniah & Anggriani, 2018). The nuances of translating idioms and cultural references, ensuring the translated text resonates with the target audience, require an understanding of cultural contexts (Choi et al., 2012; Naveen & Trojovský, 2024). The integration of technology into translator training programs offers new avenues for enhancing translation skills and preparing students for the demands of the modern translation industry (Lyons, 2016).

II. Theoretical Framework

To provide a robust foundation for this study, a theoretical framework incorporating key concepts from translation studies, cognitive linguistics, and science communication will be employed. This framework will guide the analysis of translation strategies, error patterns, and the impact of academic background on translation performance. The student agency is central to language teaching and learning, translating a potentially exciting skill in foreign language learning (Gutiérrez, 2020).

A. Translation Studies

Translation studies provide a robust theoretical framework for examining the complexities inherent in translating scientific and technological texts, particularly when dealing with language pairs as typologically distinct as Chinese and Thai. At its core, translation studies seek to understand the multifaceted processes involved in transferring meaning across linguistic and cultural boundaries, acknowledging that translation is not merely a linguistic exercise but a deeply contextualized act of communication (Plyth, 2020). The discipline encompasses a wide range of theoretical perspectives, from linguistic approaches that focus on the structural and semantic equivalences between languages (McGee, 2019) to cultural approaches that emphasize the role of cultural context and ideology in shaping the translation process (Sirinit, 2018). Functionalist theories, for instance, highlight the purpose and intended audience of the translation, arguing that the translator's primary goal should be to produce a text that effectively serves its communicative function in the target culture (Gutiérrez, 2020). Systemic Functional Linguistics, developed by Michael Halliday, offers a framework for analyzing language as a system of choices, where each linguistic feature contributes to the overall meaning and function of the text; SFL can be particularly useful in dissecting the grammatical and lexical differences between Chinese and Thai, and in identifying potential areas of difficulty for translators (Huang & Agbanyo, 2022). Moreover, sociocultural theories of translation emphasize the translator's role as a mediator between cultures, navigating the complex web of social, political, and historical factors that influence the interpretation and reception of texts.

Applying these theoretical lenses to the context of Chinese-to-Thai scientific and technological translation reveals a number of critical considerations. First, the linguistic differences between the two languages pose significant challenges. Chinese, a predominantly isolating language, relies heavily on word order and grammatical particles to convey meaning, while Thai, also an isolating language, employs a different set of grammatical markers and tonal distinctions. These structural dissimilarities can lead to ambiguity and misinterpretations if the translator lacks a deep understanding of both languages' grammatical systems. Furthermore, scientific and technological texts are characterized by their specialized terminology and precise use of language. The accurate translation of technical terms requires not only linguistic competence but also subject matter expertise, as a translator must grasp the underlying scientific concepts to convey them effectively in the target language. In addition, cultural factors play a crucial role in shaping the translation process. Scientific and technological knowledge is not culturally neutral; it is often embedded in specific cultural contexts and reflects the values and assumptions of the society in which it is produced (Sun, 2022). A translator must be aware of these

cultural nuances and adapt the translation accordingly to ensure that it is accessible and relevant to the Thai audience. Finally, the translator's own background and training can significantly influence their approach to translation.

B. Cognitive Linguistics

Cognitive Linguistics provides a complementary theoretical framework for examining the cognitive processes involved in translation, offering insights into how translators mentally represent and manipulate meaning as they move between languages. Unlike traditional linguistic approaches that focus on abstract rules and formal structures, Cognitive Linguistics emphasizes the role of human cognition in shaping language and meaning. Central to this framework are concepts such as conceptual metaphor, image schemas, and mental spaces, which highlight the embodied and experiential basis of language. Conceptual metaphor theory, for example, posits that abstract concepts are often understood in terms of more concrete experiences and that these metaphorical mappings can vary across cultures. Image schemas are basic, recurring patterns of experience, such as CONTAINER, PATH, and FORCE, that provide a foundation for understanding more complex concepts. Mental spaces are dynamic cognitive structures that allow us to represent and reason about different situations, viewpoints, and possibilities (Tairova, 2021). In the context of translation, Cognitive Linguistics suggests that translators do not simply replace words in one language with equivalent words in another; rather, they engage in a complex process of conceptual mapping, transferring meaning from one mental space to another (Massey & Ehrensberger-Dow, 2017). This process involves identifying the relevant conceptual structures in the source text, activating corresponding structures in the target language, and adapting them to fit the specific context and communicative goals. The interrelationship of language and thought serves as a starting point. Cognitive Linguistics views language as providing key insights into cognitive structures and processes, including their experiential basis (Horst, 2020). Embodied cognition, a core tenet of Cognitive Linguistics, emphasizes the role of sensory and motor experiences in shaping our understanding of the world and our use of language (Zhou & Luo, 2024). Cognitive linguistics, with its emphasis on the experiential grounding of meaning, provides a robust framework for examining how individuals understand and communicate through language (Fang, 2014; Pelkey, 2023). Furthermore, linguistic interpretation reveals static and dynamic processes of cognition, shaping both collective and individual knowledge of language speakers (Boldyrev & Dubrovskaya, 2016).

Furthermore, the idea that language might provide insightful observations on human cognition, with language serving as the framework for assessing and refining significant ideas, is implicitly suggested (Cane, 2015). Thinking is more than just abstract reasoning; it also involves cognitive photographs, the building blocks of more complex mental representations (Ding, 2021). Mental imagery and metaphorical thinking both play a role in how we comprehend and convey information, highlighting the creative and flexible nature of human understanding and communication (Ibarretxe-Antuñano, 2013). The capacity to combine language, culture, and computation offers a thorough basis for resolving problems and improving communication in a globalized environment (Kirby, 2013). The use of language to build cognitive images, portray realities, and plan for the future highlights its significance in higher-level thought (Zuberbühler, 2013). The reciprocal link between language and cognition explains our extraordinary capacity for communication and representation.

Furthermore, Cognitive Linguistics posits that language is learned and used dynamically through real-world interactions, moving it beyond the syntax-centric view of Chomskyan linguistics and situating it as an interdisciplinary field that incorporates psychology and philosophy (Zhou & Luo, 2024). This perspective facilitates the study of how the structural features of languages affect cognition, opening up new avenues for studying language change, bilingualism, and cross-cultural communication. The embodied experiences that shape our conceptual understanding are frequently expressed in language (Löffler et al., 2015). It also allows for the investigation into how language affects cognition and how language changes.

III. METHODOLOGY

This research will employ a mixed-methods approach, combining quantitative and qualitative data collection and analysis techniques. To establish the inclusion criteria for selecting sample groups for this study, we will consider the following characteristics: Group 1: Students enrolled in the Chinese language program from Years 1 to 3. The Year 1 sample group completed two introductory Chinese courses and acquired a vocabulary of at least 600 Chinese words. These students can write Chinese characters, read basic pinyin, and understand simple Chinese conversations. Year 2 students completed six intermediate Chinese courses, expanding their vocabulary to at least 1,200 words. They are capable of communicating in everyday situations and translating sentences from Chinese to Thai. Year 3 students completed eight advanced courses, which include topics on Chinese history, culture, and the reading and writing of Chinese texts. They know at least 1,800 Chinese words. Group 2: Science students not enrolled in the General Chinese Language courses from Years 1 to 3. In Year 1, this group studied foundational courses in general mathematics, chemistry, biology, and physics. From Year 2 to Year 3, students continued their studies with lectures and laboratory courses in their respective majors, including mathematics, chemistry, biology, and physics. In Year 3, students also engaged in reading research papers and completed a seminar course. Group 3: Year 2 students of the Health Science program enrolled in General Chinese Language courses. In Year 1, this group studied foundational courses in general mathematics, chemistry, biology, and physics. In Year 2, they completed courses related to their health science major, such as biochemistry, microbiology,

nutrition, public health, and others. Group 4: Students in the Social Science programs, including Law and Political Science, from Years 1 to 3. This group of students did not study any courses related to science but focused solely on Thai and English language-related courses.

Based on the instructions provided for participants in the research project, the research methodology can be outlined as follows: Introduction and explanation, Test procedure, Access to tools, Purpose of the test results, and Permission for future use. This methodology ensures that participants are adequately informed about the research project and their role in it, while also providing clear guidelines for their participation in the test. Additionally, it emphasizes transparency regarding the use of their test results and seeks their consent for future utilization. The consent form is included in Supplemental Material A.

Test and Rubric score for evaluation

The test form was designed for test-takers to translate words, phrases, sentences, and scientific articles from Chinese within 60 minutes, with the option to use Google Translate. The test-takers were asked to provide information regarding their current level of education or the highest educational attainment if not currently studying, their age, and their email address. They were also required to indicate their proficiency level in the Chinese language, ranging from no proficiency to highest proficiency, and whether they had previously studied Chinese. If they had studied Chinese before, they were prompted to specify the period of study. Details of the test form are provided in supplementary material B. The test is divided into 3 parts as follows. Part 1: Translate words or phrases from 20 technical terms in science; Part 2: Translate sentences from 3 sentences in science; Part 3: Translate a short article of "China's New Manned Spacecraft Set to Launch: A Game-Changer in Gravitational Wave Exploration!": It was chosen based on a variety of vocabularies related to science, and the content was of worldwide interest in 2022. The article contains 400 scientific technical terms out of 860 words.

The rubric for evaluating scientific accuracy in translation comprises five levels, ranging from none (no answer), poor, fair, good, very good, and excellent. The topics of evaluation contain 3 parts. In Part 1, which focuses on translating words and phrases, students are assessed based on their use of correct scientific vocabulary. Translation performance was rated on a six-level scale: None (no words or phrases translated), Poor (1–10), Fair (11), Good (12–13), Very Good (14–15), and Excellent (16–20 words or phrases translated). Part 2 assesses sentence translation, with criteria including the correctness of scientific vocabulary usage and overall understanding. Scores vary from using all correct scientific terms and providing accurate overall meaning to significant errors in scientific terminology usage and comprehension difficulty. Translation quality was evaluated on a six-level scale: None (no sentence translated), Poor (incorrect scientific terms and failure to understand the sentence), Fair (more than six errors, partial understanding), Good (3–5 errors, generally understandable), Very Good (1–2 errors with correct use of scientific terms), and Excellent (accurate translation with correct technical terminology throughout). Part 3 is based on the translation of short articles in subsection 5.2.1. Translation quality was assessed on a six-level scale: None (nothing translated), Poor (incorrect scientific terms and lack of sentence comprehension), Fair (many errors with partial understanding), Good (some errors but generally understandable), Very Good (few errors with correct use of scientific terms), and Excellent (completely accurate with correct technical terminology).

The rubric for evaluating translation from Chinese to Thai comprises five levels, ranging from none (no answer), poor, fair, good, very good, and excellent. The topics of evaluation contain 3 parts. In Part 1, which focuses on translating words and phrases, students are assessed based on their use of correct translation to the target language. Translation output was rated on a six-level scale based on the number of words or phrases translated: None (no translation), Poor (1–10 words or phrases), Fair (11), Good (12–13), Very Good (14–15), and Excellent (16–20 words or phrases). Part 2 assesses sentence translation, with criteria including the correctness of scientific vocabulary usage and overall understanding. Scores vary from using all correct scientific terms and providing accurate overall meaning to significant errors in scientific terminology usage and comprehension difficulty. Translation quality was evaluated on a six-level scale: None (no sentence translated), Poor (incorrect scientific terms and failure to understand the sentence), Fair (more than six errors, partial understanding), Good (3–5 errors, generally understandable), Very Good (1–2 errors with correct use of scientific terms), and Excellent (accurate translation with correct technical terminology throughout). Part 3 is based on the translation of short articles in subsection 5.2.1. Translation quality was assessed on a six-level scale: None (nothing translated), Poor (incorrect scientific terms and lack of sentence comprehension), Fair (many errors with partial understanding), Good (some errors but generally understandable), Very Good (few errors with correct use of scientific terms), and Excellent (completely accurate with correct technical terminology).

Students were evaluated across multiple dimensions, ensuring a comprehensive assessment of their translation skills. Each criterion provides specific guidelines, allowing for consistent and fair evaluation. By utilizing this rubric, educators can effectively assess students' translation and language abilities and provide targeted feedback for improvement.

IV. Results and Discussion

The data collection process commenced in December 2023 and concluded in February 2024. Volunteer students from various academic programs, as specified in the research methodology, were enlisted to participate in the testing. The testing procedures were conducted remotely via online meeting rooms for about one hour, with test proctors initially guiding the examination setup. Subsequently, students were allotted one hour to complete the test, following which they

submitted their answer sheets electronically to the researchers. The purpose of this testing was to evaluate both the scientific accuracy and linguistic correctness of the translations performed by the students. After completing the test, participants were asked the following questions: They answered a question of "Did you use only your knowledge or only Google translator, or a combination of your knowledge and Google translator?

In data collection, 15 students from the Chinese language program, aged 19 to 21, in their second to third year of undergraduate studies, participated. These students self-assessed their Chinese language proficiency at level 3.1 out of 5, with none having prior experience in Chinese language learning beyond a pre-collegiate level. Among them, 12 students utilized translation tools from Chinese to Thai, followed by self-checking and language refinement, while the remaining 3 students solely relied on translation tools for Chinese to Thai conversion. Thirteen students from the science program, aged 18 to 21 and in their first to third year of studies, participated in the research. These students self-assessed their Chinese language proficiency at level 0.7 out of 5, with two individuals having prior experience in Chinese language learning. Out of the aforementioned group, one student utilized a translation tool from Chinese to Thai and subsequently checked and refined the language by their knowledge. Additionally, the remaining 12 students solely relied on a translation tool from Chinese to Thai.

Seven students from the social sciences program, aged 20 to 21 and in their second to third year of studies, participated in the research. These students self-assessed their Chinese language proficiency at level 0.4 out of 5, with three individuals having prior experience in Chinese language learning. Out of the aforementioned group, one student used a translation tool from Chinese to Thai and then proceeded to check and revise the language by their knowledge. Additionally, six other students solely relied on a translation tool from Chinese to Thai.

The final group comprises two students from the field of health sciences, both aged 20 years, in their 2nd to 3rd year of undergraduate studies. Both students in this group self-assessed their Chinese language proficiency level at 2 out of 5, and both had prior experience studying Chinese. Both students utilized a translation tool from Chinese to Thai and then proceeded to review and revise the language by their knowledge.

Statistical Results

Examples (out of 20) of scientific words and phrases that participants were required to translate are as follows.

Speed	速率	Velocity	速度	Distance	距离
Friction	摩擦力	Work	功	Viscosity	粘度
Ideal gas	理想气体	Degree of freedom	自由度	Projectile motion	抛体运动
Atmospheric pressure	大气压力	Nuclear plant	原子核物理学	Electric current	电流
Heat	热量	Free falling	自由落体	Surface tension	表面张力

After translation, 2 evaluators specialized in the Chinese language and Science evaluated the translations using the rubric scores provided in Appendices C and D. A comparison of scores across the programs is shown in Figure 1.

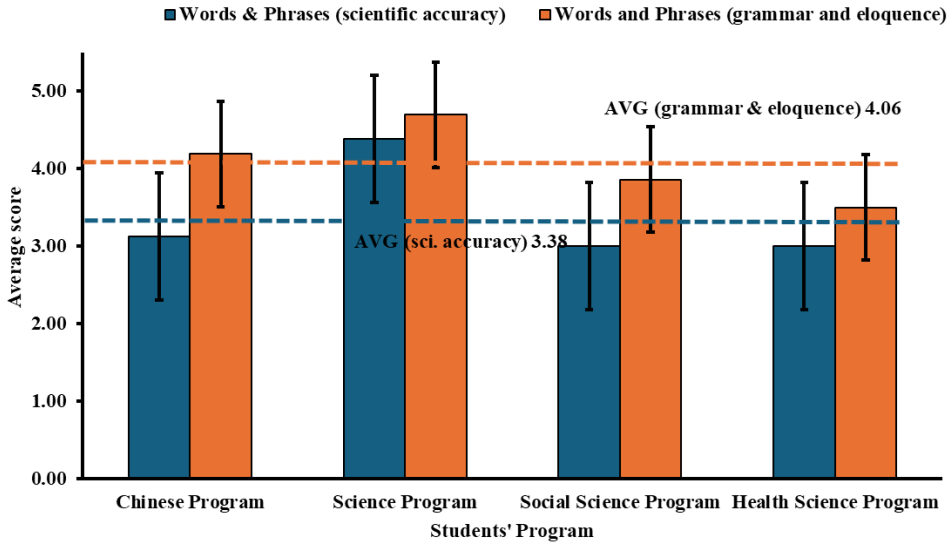

Figure 1. Average Scores From Translating Words and Phrases of Students in the Chinese Program, Science Program, Social Science Program, and Health Science Program, in Comparison of Evaluation on Science Accuracy, Grammar, and Eloquence. All Everage (Both Science Accuracy, Grammar, and Eloquence) is 3.72 out of a Full Score of 5.

The comparison among the 4 programs of participants in translating scientific words and phrases, as shown in Figure 1, reveals that the accuracy of students from the Chinese, Social Science, and Health Science programs was relatively similar, with an average score of approximately 3. However, their performance was below the overall average for

translation accuracy. In contrast, participants from the Science program achieved the highest accuracy, with an average score exceeding 4. Regarding grammar and eloquence, participants from the Chinese and Science programs performed above the overall average, while those in the Social Science and Health Science programs scored below it. The scientific terms that participants commonly translated correctly included speed, distance, friction, viscosity, degree of freedom, ideal gas, projectile motion, and electric current. However, many participants struggled with terms like velocity, work, acceleration, and free fall, translating them incorrectly. This suggests that while some scientific concepts are readily transferable across languages, others pose significant challenges due to linguistic nuances or the lack of direct equivalents. The challenge of translating scientific texts, particularly abstracts, from one language to another highlights the critical need for effective strategies that ensure accuracy and clarity (Hong-ping, 2020). One approach involves leveraging language resources, such as pre-compiled offline corpora of academic articles, which can significantly improve grammar and word choices in translations (Giampieri, 2020). The importance of accurate translation in scientific communication cannot be overstated, especially with the increasing globalization of research (Hong-ping, 2020). Many academic journals are predominantly published in English, creating a significant barrier for researchers whose native language is not English (Kleidermacher & Zou, 2025). Overcoming language barriers in academia is crucial for fostering a more inclusive and globally representative scientific community (Steigerwald et al., 2022). The translation of scientific works plays a pivotal role in disseminating knowledge across different cultures and linguistic backgrounds (Van Dalen, 2011). It is crucial to consider the cultural context and nuances of both the source and target languages to produce translations that are not only accurate but also culturally appropriate (Naveen & Trojovský, 2024). Moreover, involving younger individuals in translation projects can foster a stronger connection between scientists and the broader community, sparking curiosity and encouraging active participation in scientific discovery (Juarez & Kenet, 2018).

In the sentence translation task, participants were asked to translate 3 sentences. Here is an example of one such sentence.

由电子与中子、质子所组成的原子，是物质的基本单位。相对于中子和质子所组成的原子核，电子的质量显得极小。 (The atom, consisting of electrons, neutrons, and protons, is the fundamental unit of matter. In comparison to the atomic nucleus, which consists of neutrons and protons, the mass of electrons is negligible.)

The scores from the evaluation of sentence translations are presented in Figure 2.

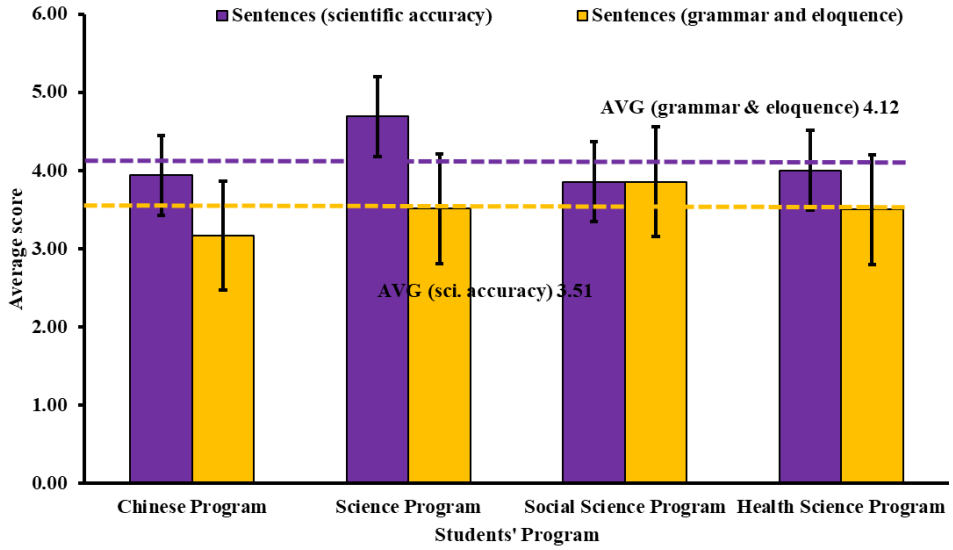

Figure 2. Average Scores From Translating Sentences of Students in the Chinese Program, Science Program, Social Science Program, and Health Science Program, in Comparison of Evaluation on Science Accuracy, Grammar, and Eloquence. All Everage (Both Science Accuracy and Grammar and Eloquence) is 3.82 out of a Full score of 5.

In Figure 2, from a scientific perspective, participants in the Science program achieved the highest translation score, approximately 4.6, placing them above the overall average. In terms of grammar and eloquence, participants from the Social Science program scored the highest, while those in the Science and Health Science programs performed at a similar level. Interestingly, participants from the Chinese program, who were expected to achieve the highest scores, did not. Insights from interviews revealed that these participants refined their translations after using the Google translation tool. However, due to their limited background in scientific terminology, their refinements often worsened the translated sentences. On the other hand, participants from the other programs relied solely on the Google translation tool for their sentence translations. Despite lacking expertise in translation, some participants were able to produce fluent and accurate translations of scientific content, benefiting from the capabilities of the translation tool (Juarez & Kenet, 2018). These findings highlight the intricate balance between leveraging machine translation tools and the necessity of domain-specific knowledge in achieving high-quality translations, especially within specialized fields like science, where precise terminology and contextual understanding are paramount. The integration of machine translation tools in academic and

research environments presents a multifaceted challenge, demanding a nuanced understanding of both the capabilities and limitations of these technologies (Kleidermacher & Zou, 2025).

The final part of the test involved translating paragraphs from a short article. An example of one such paragraph is shown below.

近年来，中国在载人航天领域取得了大量成就，让 14 亿国人感到自豪，不论是对月球，火星的探测，还是空间站的建造，以及明年将要发射的首个中国空间望远镜巡天号，都让人们感受到，中国科技实力和国家综合实力的强大，如今，又一个超级工程即将问世，中国新一代载人飞船即将重磅出世，一旦建成，建成后可搭载 7 名宇航员。 (In recent years, China has attained significant milestones in manned spaceflight, instilling pride in its 1.4 billion citizens. The exploration of the Moon and Mars, the construction of space stations, and the impending launch of China's inaugural space telescope, Xuntian, next year, exemplify the formidable scientific and technological prowess, as well as the comprehensive national strength, of China. A new major project is imminent. The new generation of manned spacecraft from China is poised for launch. Upon completion, it will accommodate 7 astronauts.)

All participants completed the paragraph translation task, and their translations were evaluated. The results are presented in Figure 3.

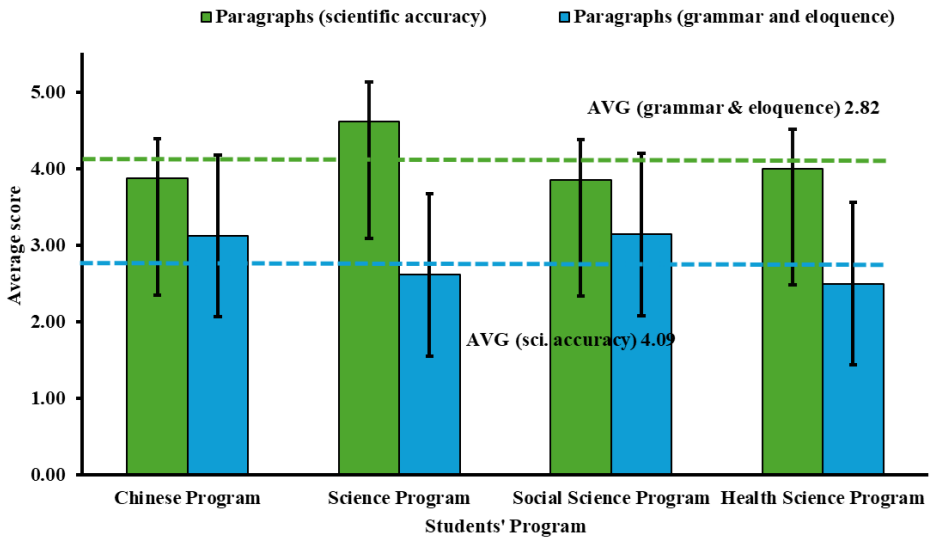

Figure 3. Average Scores From Translating Paragraphs of Students in the Chinese Program, Science Program, Social Science Program, and Health Science Program, in Comparison of Evaluation on Science Accuracy, Grammar, and Eloquence. All Everage (Both Science Accuracy, Grammar, and Eloquence) is 3.47 out of a Full Score of 5.

Similar to the translation of words, phrases, and sentences, participants from the Science program achieved the highest score in the paragraph translation task. However, their performance in grammar and eloquence was relatively lower compared to participants from the Chinese and Social Science programs. Their scores in grammar and eloquence were below the overall average, similar to those of participants in the Health Science program. In contrast, participants from the Chinese and Social Science programs scored the highest in grammar and eloquence, likely due to their greater experience with writing in their respective fields. It has been observed that evaluating the quality of translations of news articles based on isolated sentences, without considering the broader context of the entire document, can lead to skewed evaluation results (Popel et al., 2019). Furthermore, it has been recognized that collaborative strategies have improved students' translations, with the translated materials deemed "novel and appropriate" and possessing validity (Halimah, 2015).

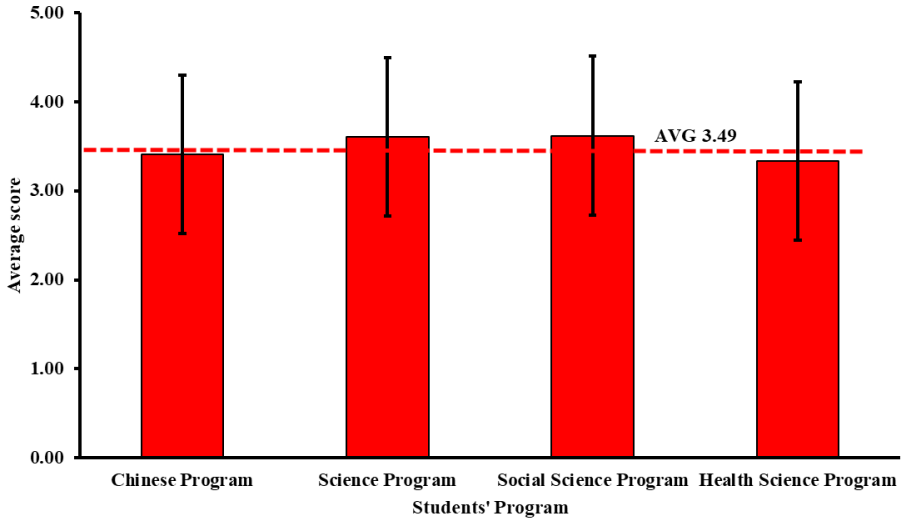

Figure 4. Overall Average Scores From Translating Paragraphs of Students in the Chinese Program, Science Program, Social Science Program, and Health Science Program, in Comparison of Evaluation on Science Accuracy, Grammar, and Eloquence. All Everage (Both Science Accuracy, Grammar, and Eloquence) is 3.49 out of a Full Score of 5.

The overall scores, combining scientific accuracy, grammar, and eloquence evaluations, are presented in Figure 4, reflecting the translation abilities of participants from the four programs. The results show that participants in the Science and Social Science programs achieved scores above the average line, while participants from the Chinese and Health Science programs scored below the average. The overall score for participants in the Science program was largely driven by their scientific translation performance, whereas the Social Science program's scores were dominated by grammar and eloquence. These results highlight areas for improvement in both scientific knowledge and writing skills among participants from the Chinese language program.

Observations on Translation Errors

The evaluators identified the following causes of the mistakes made by participants as follows.

1. Lack of post-translational review.
2. Utilization of nonsensical numerical data, such as the passage's segment that conveys "让 14 亿国人感到自豪--making 14 million Chinese people proud." By the majority of participants, the passage was successfully translated. Nevertheless, in the final sentence of the paragraph, "建成后可搭载 7 名宇航员" as "Upon completion, it will accommodate 7 astronauts." participants translated "The spaceship will be capable of transporting 10,000 individuals once it is completed," which is truly remarkable.
3. Inappropriate word choices that do not align with the context; failure to assess whether translated words provided by the translation tool fit the content, or not, such as the experimental test showed that some participants mistranslated the phrase "research possibilities" as "sexual research". This indicates that certain participants copied the sentence as a line rather than a sentence because Chinese "性" means "sex" and "研究" means "research". Therefore, it is advisable to use a translation tool to translate from words or sentences to preserve the original meaning rather than translating into lines.
4. Incomplete or fragmented translation of the content, such issues arise from PDF file translation via the Google translation tool, resulting in omitted numerals and leading to misinterpretations of values such as '5' as' several years' and '1,500' as '150,000 yuan', significantly altering the intended meanings.
5. Translation inaccuracies, especially regarding numerical figures.
6. Assessment of language and scientific accuracy during the translation process.
7. Foundational translation skills at each program specialize among the programs of participants.

These identified errors shed light on the critical aspects that need improvement in the translation process. Addressing these issues is crucial for ensuring the quality and reliability of translated scientific content. Additionally, understanding the foundational translation skills required at different academic levels can inform targeted interventions and training programs aimed at enhancing translation proficiency among students. Incorporating systematic post-translation review processes and promoting a deeper understanding of the subject matter can further contribute to more accurate and comprehensive translations in scientific research contexts.

Individuals lacking a background in science may face challenges in accurately translating scientific texts, as they may not fully comprehend the technical terminology and concepts involved. This reliance on translation tools without adequate scientific knowledge can lead to errors, misinterpretations, and inconsistencies in the translated content. Moreover, our research suggests that linguistic proficiency alone may not suffice for producing accurate scientific translations. While language skills are crucial, they must be complemented by a solid understanding of scientific principles and terminology to ensure the fidelity of translations.

The experimental group specializing in science exhibited closely clustered scores in both the Language Translation and Science Translation sections. Conversely, other groups' scores were more disparate, indicating a more consistent performance level within the science cohort. Such findings suggest a potential correlation between scientific acumen and proficiency in translation tasks. Further investigation into this relationship could yield insights into the interplay between language skills and scientific comprehension, offering valuable implications for educational practices and research methodologies. It is observed that students who studied science courses in their native language demonstrated a superior grasp of scientific concepts compared to those who studied in a foreign language (Kocakülah et al., 2005). This underscores the importance of linguistic accessibility in facilitating effective science education and knowledge acquisition (Charamba, 2023; Webb, 2010).

V. Conclusion

The finding of this research is that students from Science and Social Science programs outperformed others in Chinese-to-Thai translation tasks. Science students excelled in scientific accuracy and terminology, while Social Science students demonstrated better fluency and structure in written translations. In contrast, students from the Chinese language program showed lower performance in translating scientific content, highlighting a lack of scientific foundation that affected their comprehension and coherence. Based on the results of this research, the suggestions for improvement are to enhance scientific translation quality. It is recommended to examine how a scientific background influences translation accuracy, especially when using tools like Google Translate. Emphasizing linguistic proficiency is crucial, as it affects clarity and fluency. Specialized training programs should be developed to teach effective use of translation tools, focusing on context and terminology. Integrating AI-powered tools, such as adaptive translation models and grammar checkers, can support accuracy and refinement. Promoting interdisciplinary education that combines science and language enhances translation competence. Evaluating current translation practices will help identify effective strategies and inform practical guidelines for improvement.

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