Proceedings of ICADSS 2026 Symposium: Interpreting Culture: Context in Art, Literature, and Mass Media
DOI: 10.54254/2753-7064/2026.HT35436

A Comparative Analysis of AI Translation Tools for Chinese University Students' English Writing Assistance

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Abstract. With the rapid development of artificial intelligence, AI translation tools have gained widespread popularity among Chinese university students in their daily lives and academic studies. College students have grown accustomed to relying on such tools to finish English writing and revise linguistic errors, making AI translation an indispensable auxiliary resource for their English learning. This paper selects three mainstream translation platforms, namely Doubao, Youdao Translate and ChatGPT, which represent domestic Chinese generative AI, traditional Chinese translation software and the most popular overseas generative AI respectively. This paper compares their translation accuracy on formal news articles and informal personal letters from three dimensions: grammar, lexical selection and textual coherence. Adopting data analysis and comparative analysis to ensure objectivity and rigor, this research intends to help undergraduates pick high-quality translation aids. The experimental results reveal that ChatGPT achieves the best overall translation performance, followed by Youdao Translate and then Doubao. In conclusion, ChatGPT is the most suitable option for Chinese college students in English writing practice.

Keywords: machine translation, college English writing, writing instruction, comparative study

1. Introduction

With the rapid development of artificial intelligence technology, machine translation has evolved from neural machine translation to the current generative artificial intelligence translation. Chinese college students frequently use AI-assisted translation tools and use various AI-assisted translation software to improve their English writing [1]. This writing method has improved writing efficiency and accuracy [2]. However, college students cannot distinguish the quality of the translations produced by different AI translation tools. Existing research mostly focuses on the study of generative auxiliary translation tools, lacking comparative studies of Chinese-native AI tools. This paper aims to analyze through three tools, Grammarly, Lingualyzer, and VocabProfiler, and compare the impact of Doubao, Youdao, and ChatGPT on the output of translating Chinese into English. This study uses experimental control methods and comparative analysis methods to analyze two types of materials: formal news style and daily letter style. This paper aims to provide the best translation tool selection suggestions for Chinese college students. Students in different writing scenarios and

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with different basic skills can choose the most suitable AI-assisted translation tool through this research.

2. Literature review

Existing research analyses have primarily been monolithic, focusing on a single translation tool, with a lack of horizontal comparisons across multiple translation tools [3, 4]. Moreover, most studies have examined foreign generative AI tools, with insufficient comparative research between Chinese domestic translation tools and foreign translation tools. This paper employs three analytical tools to construct a three-dimensional analysis of Doubao, Youdao, and ChatGPT across grammar, vocabulary, and discourse dimensions.

3. Tools used

3.1. Translation tools

This study employs three mainstream machine translation tools to translate the source texts, aiming to systematically compare translation quality across different technological paradigms. Specifically, the three tools are Doubao (Doubao-Seed 2.0), Youdao (v5.2.1), and ChatGPT (languageX). Doubao, developed by ByteDance, is a Chinese domestic generative AI large language model that leverages extensive Chinese corpora and demonstrates strong capabilities in understanding and generating Chinese-contextualized content. Youdao, a product of NetEase, represents a traditional neural machine translation engine built upon the encoder-decoder architecture; it has undergone years of iterative optimization and accumulated substantial bilingual resources and engineering expertise in Chinese-English translation. ChatGPT, developed by OpenAI, is an internationally leading generative AI system based on the GPT architecture with large-scale pretraining; it exhibits robust performance in contextual understanding, semantic reasoning, and cross-lingual transfer.

3.2. Analytical tools

Three specialized analytical tools are employed in this study to conduct a multi-dimensional evaluation of the translated texts: Grammarly, Lingualyzer, and VocabProfiler. Grammarly, a widely adopted AI-powered writing assistant, is utilized to assess grammatical correctness by detecting and categorizing errors related to syntax, morphology, punctuation, and sentence structure, thereby providing a quantitative measure of linguistic accuracy [5]. Lingualyzer, a discourse analysis tool, is employed to evaluate discourse coherence by analyzing textual cohesion, logical flow, and the organizational structure of information at both intra-sentential and inter-sentential levels, which is essential for examining the overall readability and textual integrity of the translations [6]. VocabProfiler, a lexical analysis software based on established word frequency lists, is used to measure lexical richness through multiple indicators, including type-token ratio (TTR), lexical diversity, and the distribution of vocabulary across different frequency bands, offering insights into the sophistication and variation of lexical choices in the translated outputs.

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4. Comparative analysis of the impact of different AI-assisted translation tools on Chinese university students' English writing

4.1. Comparative design

Two authentic Chinese texts were purposively selected for this study to represent distinct registers and communicative contexts. The first text is a data-based news article characterized by formal register, objective tone, standardized structure, and information-dense content with statistical evidence and factual reporting. The second text is a personal letter marked by an informal register, subjective expression, conversational style, and relational language oriented toward interpersonal communication. This deliberate pairing enables a systematic investigation of how different machine translation systems handle the divergent linguistic features, stylistic conventions, and pragmatic functions inherent in formal versus informal text types. Both texts were translated using the three translation tools, and the resulting English translations were analyzed using the three analytical tools to draw conclusions.

4.2. Grammatical accuracy of text correction

The data indicate that ChatGPT's translation contains the fewest grammatical errors, with only minor lexical inaccuracies. Its stylistic flow is smooth, with reasonable variation in sentence length and moderate use of passive voice. Youdao's translation has relatively few grammatical errors, primarily characterized by semantic redundancy, a colloquial stylistic tone, a low proportion of passive voice, and a high proportion of active voice. Doubao's translation exhibits more grammatical issues than both ChatGPT and Youdao, mainly involving tense errors, punctuation misuse, collocation errors, and inappropriate word choice. Its stylistic tone is rigid, with some sentences being excessively long, and it employs a high proportion of passive voice. Therefore, in terms of grammatical correctness, ChatGPT performs best, Youdao performs well in various aspects, and Doubao has the poorest attention to detail.

4.3. Discourse coherence

Table 1 presents sentence length statistics for all six translations. For the news text, the average sentence lengths are 29.33 words (Doubao), 28.67 words (Youdao), and 52 words (ChatGPT). The maximum sentence lengths are 44 (Doubao), 38 (Youdao), and 61 (ChatGPT), and the minimum lengths are 10 (Doubao), 19 (Youdao), and 43 (ChatGPT). The standard deviations are 17.47 (Doubao), 9.5 (Youdao), and 12.73 (ChatGPT). For the letter text, the average sentence lengths are 12.12 words (Doubao), 10.33 words (Youdao), and 12 words (ChatGPT). The maximum lengths are 21 (Doubao), 17 (Youdao), and 20 (ChatGPT), and the minimum lengths are all 6 words. The standard deviations are 5.74 (Doubao), 4.18 (Youdao), and 5.59 (ChatGPT).

Table 1. Sentence length statistics across translation tools and text types

Metric	DoubaoNews	YoudaoNews	ChatGPTNews	DoubaoLetter	YoudaoLetter	ChatGPTLetter
Word Count	88	86	104	97	93	108
Type Count	64	64	67	80	73	79
Sent Avg (words)	29.33	28.67	52	12.12	10.33	12
Sent SD	17.47	9.5	12.73	5.74	4.18	5.59

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Table 1. (continued)

Sent Max	44	38	61	21	17	20
Sent Min	10	19	43	6	6	6

The coefficient of variation in sentence length (CV) is calculated from Sent SD and Sent Avg (words):

$$CV = \frac{\text{Sent SD}}{\text{Sent Avg}} \times 100\% \quad (1)$$

A higher CV value indicates greater variation in sentence length, with better rhythmic flow; conversely, a lower CV value indicates more uniform sentence length and monotonous sentence patterns. The results show that Doubao has the highest value, Youdao falls in the middle, and ChatGPT has the lowest value. This indicates that Doubao frequently alternates between long and short sentences, Youdao maintains uniformity, and ChatGPT tends to integrate information into longer sentences.

4.4. Lexical richness

Table 2 shows vocabulary analysis results for all six translations. For the news text, K1 percentages are 79.8% (Doubao), 79.3% (Youdao), and 80% (ChatGPT); K2 percentages are 11.2% (Doubao), 12.6% (Youdao), and 9.5% (ChatGPT). TTR values are 0.66 (Doubao), 0.68 (Youdao), and 0.59 (ChatGPT). Lexical Density values are 0.71 (Doubao), 0.66 (Youdao), and 0.65 (ChatGPT). Singletons Ratio values are 0.64 (Doubao), 0.71 (Youdao), and 0.55 (ChatGPT). For the letter text, K1 percentages are 88.1% (Doubao), 87.8% (Youdao), and 90% (ChatGPT); K2 percentages are 8.9% (Doubao), 8.2% (Youdao), and 7.3% (ChatGPT). TTR values are 0.79 (Doubao), 0.77 (Youdao), and 0.73 (ChatGPT). Lexical Density values are 0.58 (Doubao), 0.55 (Youdao), and 0.53 (ChatGPT). Singletons Ratio values are 0.76 (Doubao), 0.72 (Youdao), and 0.72 (ChatGPT).

Table 2. Vocabulary analysis across translation tools and text types

Vocabulary Level	DoubaoNews	DoubaoLetter	YoudaoNews	YoudaoLetter	ChatGPTNews	ChatGPTLetter
K1	79.8%	88.1%	79.3%	87.8%	80%	90%
K2	11.2%	8.9%	12.6%	8.2%	9.5%	7.3%
TTR	0.66	0.79	0.68	0.77	0.59	0.73
Lexical Density	0.71	0.58	0.66	0.55	0.65	0.53
Singletons Ratio	0.64	0.76	0.71	0.72	0.55	0.72

VocabProfiler analysis reveals that K1 represents the most frequently used 1,000 words, which are more suitable for basic English learners. K2 represents the next most frequently used 1,000 words, which are more appropriate for intermediate to advanced English learners. ChatGPT uses K1 words most frequently, followed by Doubao, with Youdao using them least. This indicates that ChatGPT employs the most basic and colloquial vocabulary. K2 usage shows the opposite pattern: Youdao uses K2 words most frequently, followed by Doubao, with ChatGPT using them least. In terms of Lexical Density, Doubao's scores are higher than the other two tools for both texts, indicating that Doubao has the highest proportion of content words, resulting in more compact texts with greater information density. ChatGPT has the lowest Lexical Density, indicating a higher proportion of function words. Based on Singletons Ratio and TTR data, Youdao achieves the highest

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value for news texts, and Doubao achieves the highest value for letter texts, indicating richer vocabulary use and less repetition.

5. Conclusion

This study constructed a three-dimensional analysis framework of grammar, vocabulary and discourse to systematically compare the translation quality differences of three AI-assisted translation tools, namely Doubao, Youdao Translation and ChatGPT, in translating formal news style and daily letter style into English. It was concluded that the translations by ChatGPT had the highest grammatical correctness, the most fluent style, the largest number of basic vocabulary, and the strongest readability, making it the most suitable for Chinese college students to use in their studies. The data of Youdao Translation was the most balanced, with the most use of intermediate and advanced vocabulary. Doubao used a lot of short sentences alternately, but there were many grammatical errors. This paper has not deeply explored the styles in the text; it only covered the two types of formal news style and daily letter style. Moreover, the corpus is single, which may have an accidental influence on the final conclusion. The future research direction can be to expand the types of styles and form a corpus data. Secondly, more Chinese native AI-assisted translation tools can be analyzed and compared for data comparison, to obtain translation tools that are more suitable for Chinese college students.

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