

Intercultural Interfaces:

Artificial intelligence and the challenges of cultural sensitivity

Interfaces Interculturais:

A inteligência artificial e os desafios da sensibilidade cultural

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ABSTRACT: This study investigates the intersection of cultural sensitivity and AI-driven machine translation tools in translation education, with a focus on Portuguese-Chinese language pairs. Drawing on mixed-methods research, it explores how students perceive and use AI tools for translation, the challenges they face, and the tools' limitations in managing cultural nuances, idiomatic expressions, and contextually rich texts. Findings highlight that while tools like DeepL and ChatGPT offer efficiency and accessibility, they often fail to capture cultural and emotional depth, necessitating human oversight. Higher-performing students critically engage with AI outputs, while less proficient students rely heavily on these tools, often overlooking errors. The study underscores the need for translation curricula to integrate AI literacy, critical thinking, and cultural analysis to prepare students for hybrid human-AI workflows. This research contributes to a deeper understanding of AI's role in culturally sensitive translation and its pedagogical implications.

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KEYWORDS: Machine Translation; Artificial Intelligence; Intercultural Translation; Cultural Sensitivity; Portuguese-Chinese Translation; Translation Pedagogy

RESUMO: Este estudo investiga a intersecção entre a sensibilidade cultural e as ferramentas de tradução automática suportadas por IA no ensino de tradução, com especial enfoque no par linguístico português-chinês. Recorrendo a uma abordagem de métodos mistos, analisa como os estudantes percebem e utilizam estas ferramentas, os desafios que enfrentam e as limitações inerentes no tratamento de nuances culturais, expressões idiomáticas e textos ricos em contexto. Os resultados evidenciam que, embora aplicações como o DeepL e o ChatGPT ofereçam eficiência e acessibilidade, muitas vezes falham em captar a profundidade cultural e emocional, exigindo, por conseguinte, supervisão humana. Observou-se que os estudantes de melhor desempenho se envolvem criticamente com as traduções produzidas pela IA, ao passo que os menos proficientes tendem a depender excessivamente destas ferramentas, ignorando frequentemente erros e imprecisões. O estudo salienta, assim, a necessidade de integrar nos currículos de tradução a literacia em IA, o pensamento crítico e a análise cultural, de modo a preparar os futuros tradutores para fluxos de trabalho híbridos entre humanos e IA. Esta investigação contribui para uma compreensão mais aprofundada do papel da IA na tradução culturalmente sensível e para as suas implicações pedagógicas.

PALAVRAS-CHAVE: Tradução Automática; Inteligência Artificial; Tradução Intercultural; Sensibilidade Cultural; Tradução Português-Chinês; Pedagogia da Tradução

1. Introduction

Cultural sensitivity, rooted in the anthropological tradition, focuses on understanding cultural contexts, practices, and the systems of meaning shaping human interactions (Geertz, 1973). In translation studies – an inherently intercultural activity requiring extensive cross-cultural communication – cultural sensitivity involves addressing the values, customs, and contexts of both the Source Language (SL) and Target Language (TL) (House, 2015; Katan, 2014). Beyond linguistic equivalence, translation demands cultural adaptation, as Venuti (1995) asserts, requiring translators to mediate cultural differences while retaining the source culture's distinctiveness. Similarly, Martín Ruano (2018) emphasizes that culturally sensitive translation strategies should preserve cultural differences, highlighting the need for translators to master the nuances of cultural competence. Additionally, Greenholtz (2005) underlines intercultural sensitivity as essential for effective cross-cultural communication, a cornerstone of translation practice.

The rise of advanced translation technologies, including Machine Translation (MT), Neural Machine Translation (NMT), and Artificial Intelligence (AI), introduces questions about their ability

to integrate the complexities of cultural sensitivity, as Pym (2023) notes. While these tools prioritize efficiency, their capacity to address cultural nuances remains an area requiring further investigation. This evolving dynamic between human expertise and machine capabilities necessitates deeper exploration into the role of cultural sensitivity in an increasingly technology-driven translation landscape.

This study focuses on Portuguese-Chinese translations, a language pair with stark linguistic and cultural differences. Portuguese, a Romance language, relies on inflectional morphology and gender agreement, while Chinese, a Sino-Tibetan language, uses analytic morphology, contextual cues, and lacks inflection. These contrasts often challenge AI-driven translation tools, leading to literal translations and missed cultural nuances (Kunst & Bierwiazzonek, 2023). This context provides a compelling case to examine the intersection of AI translation technologies and cultural sensitivity in a linguistically complex pairing.

AI and MT have transformed translation practices (Eszenyi, Bednárová-Gibová, & Robin 2023; Amini, Ravindran, & Lee 2024) and education (Amaro & Pires 2024; Li, Cao, & Li 2024; Alharbi, 2024), enabling faster, more cost-efficient translations. Language service providers increasingly rely on these tools, creating a collaborative mode of human-AI interaction that enhances productivity and accuracy. However, significant gaps exist between traditional translator education and industry demands, particularly in training students on AI and NMT tools. Scholars like Amaro & Pires (2024), Humanika & Radjaban (2024), and Pym & Hao (2025) emphasize the need to integrate both technical and intercultural skills into translation curricula to better prepare students for the evolving industry.

Despite advancements, AI translation tools face notable limitations in handling culturally rich texts and domain-specific terminology (Łoboda & Mastela, 2023; Sanz-Valdivieso & López-Arroyo, 2023). Research highlights AI's challenges with cultural nuances, idiomatic expressions, and maintaining cultural integrity, which require human intervention in culturally sensitive contexts (Łoboda & Mastela, 2023). The linguistic disparities between Portuguese and Chinese further compound these challenges, frequently resulting in literal or contextually inappropriate translations. Kunst and Bierwiazzonek (2023) argue that linguistic dissimilarity significantly affects AI translation accuracy, underscoring the continued importance of human expertise in ensuring culturally appropriate translations.

While AI tools like NMT and post-editing software enhance translators' efficiency and learning, debates persist about whether AI will complement or replace human translators. Given this backdrop, the present study explores translation students' perceptions and experiences with AI and MT tools, focusing on their ability to address cultural nuances and their reflections on the challenges and opportunities these technologies present. By concentrating on Portuguese-Chinese translation, the

research provides insights into one of the most linguistically and culturally complex language pairs, examining how AI tools navigate these challenges.

This research explores four central questions: (1) How do students perceive and utilize machine translation (MT) and AI tools in their translation practices? (2) What challenges do they face when engaging with AI tools during real-time translation processes? (3) How do they evaluate AI's ability to manage cultural nuances, idiomatic expressions, and culturally rich texts? (4) What recommendations do they offer for effectively integrating AI into translation pedagogy? By addressing these questions, the study aims to provide a nuanced understanding of students' experiences with AI-driven translation tools and their implications for the future of translation education and professional practice.

2. Materials and Methods

The methodology for this study adopts an explanatory sequential mixed methods design, which is particularly well-suited for research aiming to understand complex phenomena through multiple forms of data (Creswell & Clark, 2017; Creswell & Creswell, 2022; Hesse-Biber, 2010). It begins with a quantitative phase to collect extensive, numerical data on students' perceptions and experiences with AI translation tools. This initial phase allows for the identification of general trends and patterns, providing a broad overview of the research problem. Following this, a qualitative phase is conducted to further interpret and expand upon the quantitative findings, offering deeper insights and contextual understanding.

The choice of a mixed methods approach is driven by the need to capitalize on the strengths of both quantitative and qualitative research. Quantitative data provides the ability to generalize findings to a larger population, enhancing the external validity of the study (Tashakkori, Johnson, & Teddlie, 2020). Meanwhile, qualitative data contributes to a rich, detailed exploration of individual experiences and perspectives, adding depth and nuance to the research findings (Denzin & Lincoln, 2017).

Moreover, the integration of quantitative and qualitative data allows for a more comprehensive examination of the research questions. This approach facilitates the triangulation of data, which can corroborate findings and increase the credibility of the results (Greene, Caracelli, & Graham, 1989). By addressing the research questions from multiple angles, this study aims to provide a holistic understanding of students' experiences with AI translation tools, including the identification of specific strengths, weaknesses, and areas for improvement in handling cultural nuances.

Additionally, the study is underpinned by a qualitatively driven approach, which includes various theoretical traditions that emphasize the constructed nature of social reality and the importance of subjective meaning (Hesse-Biber, Bailey-Rodriguez, & Frost, 2015). These traditions

commonly assert that social reality is constructed, with subjective meaning playing a key role in the creation of knowledge. While emphasizing the subjective creation of meaning, this approach does not entirely dismiss aspects of objectivity, thereby allowing for a balanced and nuanced exploration of the research phenomena.

2.1 Data Collection

To gather quantitative data, we developed a questionnaire informed by student interactions and qualitative class explorations, which helped identify key areas of concern and interest. This method ensured the questionnaire was relevant and comprehensive. Initially, it was distributed to a select sample of eight students for validation, whose feedback was used to refine and enhance its reliability. The finalized questionnaire consisted of 17 bilingual questions (Chinese and Portuguese), incorporating closed-ended, semi-closed, and filter questions. To allow for flexible responses, open-ended questions were permitted in any of the two languages. A 10-point scale was used for certain questions to capture a broad spectrum of student perspectives, enabling detailed expressions of agreement or disagreement. This scale, though similar to both Likert and semantic differential scales, was chosen for its broader range and finer nuance in capturing attitudes and is referred to as a modified Likert scale in our study for simplicity and respondent accessibility.

The questionnaire was designed to be straightforward and user-friendly, with a completion time of five to eight minutes to encourage maximum participation. Data collection was carried out using Google Forms, which offered advantages in terms of speed, accessibility, and efficiency over traditional methods. The questionnaire was distributed to approximately 280 undergraduate and postgraduate students enrolled in the Translation and Interpretation programs at the Macao Polytechnic University. To ensure a representative sample, teachers assisted in collecting responses during lecture times, and class representatives played a crucial role in encouraging their peers to participate. This coordinated effort ensured the survey reached students in various settings, both inclass and outside, effectively enhancing participation rates. Administered in October 2023, the survey targeted students across all academic years of their respective degrees. As a result, 150 valid responses were obtained, providing a confidence level of over 90%, considering a margin of error of 5%.

In the qualitative stage, data collection was based on three methods: in-class observations, focus groups, and individual interviews. For the in-class observations, students with high proficiency in both Chinese and Portuguese were selected as participant observers. They were given detailed briefings on the study's objectives, guidelines, and observation sheets to systematically document their findings. This approach not only provided a comprehensive understanding of how students interact with AI tools in real-time and the specific challenges they encounter during the translation

process but also facilitated peer observations. By involving peers, students felt more comfortable and were able to engage in their usual activities without the fear of being judged, thus ensuring more natural and authentic interactions.

The observations took place during two sessions of the module “Communication Skills in Portuguese”, held between January and April 2023. The participants were 44 fourth-year undergraduate students, all native Chinese speakers, enrolled in a degree program in Chinese-Portuguese/Portuguese-Chinese Translation and Interpretation. In each session, two different students were appointed as participant observers, in which their peers received various types of authentic materials in Portuguese, such as excerpts of literary works, poetry, humoristic sketches, jokes, and idiomatic expressions, all containing culturally nuanced content. In small groups of up to four students, students were required to analyze the material, discuss the cultural nuances, explain it in Portuguese, and provide strategies to translate these texts into Chinese. Students were permitted to use any online tool during the sessions, and intentionally no boundaries were set. This approach was designed to observe how students naturally respond to linguistic and translation challenges, providing insights into their typical strategies and interactions with AI tools.

Notably, the observations focused solely on the process of how students engaged with the material and used AI and MT tools, rather than on the final outcomes, which are beyond the scope of this article. This methodological choice aimed to capture authentic student behavior and strategy use in real-time learning scenarios. Observers specifically noted the stages at which students resorted to AI and MT tools, the purposes for which they relied on them, and the dynamics of peer discussions around the AI-generated outputs. This provided a comprehensive understanding of the natural integration of technology in the learning process and highlighted areas where students may benefit from further guidance or support.

Each observation session lasted for 120 minutes, and in total, eight hours of sessions were observed, with detailed notes recorded. Students who served as observers also explained their observations in detail to researchers, which were incorporated as qualitative data. This approach provided a comprehensive understanding of how students interact with AI tools in real-time and the specific challenges they encounter during the translation process.

Data collection through focus groups aimed to facilitate in-depth discussions on specific aspects of AI and MT outputs and cultural sensitivities. The focus groups consisted of 10 groups, each with 4-5 students, selected to ensure diversity in language background and experience levels. Each pair of groups was assigned a task focused on one of the themes identified in the previous stages of data collection and analysis. These themes included AI failures in capturing cultural subtleties, AI’s translation outcomes of idioms, proverbs, local sayings, and humor, the strengths and weaknesses of

AI in maintaining cultural integrity, students' experiences with AI translations of text rich in cultural context, and recommendations for improving AI's cultural sensitivity.

The focus groups were conducted mid-study to allow the initial insights from the questionnaires and in-class observations to inform the discussion prompts. The sessions encouraged students to share their experiences and perspectives in a collaborative environment. The discussions were recorded, transcribed, and then coded and analyzed thematically to identify key themes and insights. This approach provided a deeper understanding of the students' experiences and perceptions of AI translation tools, particularly regarding cultural nuances and sensitivities.

Lastly, to gain detailed insights into individual experiences with AI translation tools, we conducted interviews with nine senior students chosen for their diverse perspectives from focus groups. To capture a wide range of challenges and experiences, we purposefully selected students with different proficiency levels in Portuguese and varying academic performance: three students with advanced proficiency and A grades, three with intermediate proficiency and B/B+ grades, and three with lower intermediate proficiency and C/D grades. This diverse selection allowed for a more holistic view of how AI translation tools are perceived and utilized by students with differing capabilities, ultimately providing richer data and more varied insights. The interview questions were tailored to delve deeper into personal anecdotes, specific instances of cultural missteps, and detailed suggestions for improving AI's cultural sensitivity.

These interviews were conducted towards the end of the study, in late May 2024, to allow for comprehensive reflection on the entire experience. The detailed accounts collected during the interviews provided rich qualitative data, which was analyzed using narrative and thematic analysis. This method helped capture the complexities of personal experiences and insights, adding depth to the overall understanding of how students interact with AI tools in translation tasks.

2.2 Data Analysis

This study employed a mixed-methods approach to analyze students' perceptions and experiences with AI translation tools. Quantitative data from questionnaires, using a 10-point scale, was analyzed through descriptive statistics (means, medians, standard deviations) and correlation analyses to identify trends and relationships, particularly between satisfaction, cultural sensitivity, and accuracy. Qualitative data from open-ended responses, observations, focus groups, and interviews underwent thematic and narrative analysis. Thematic analysis identified key patterns, such as challenges with cultural nuances and strengths in cultural integrity. Narrative analysis focused on interview data, mapping participants' personal stories to uncover deeper insights into their interactions with AI tools.

3. Results

3.1 Patterns of AI tool usage among translation students

In the first stage of this research, we collected 150 valid questionnaire responses to understand students' perceptions and usage of AI tools in their language and translation studies. This data illustrates the widespread adoption of AI tools, particularly among students aged 20 to 24, as discussed earlier by Amaro and Pires (2024).

The demographic breakdown showed most respondents were 21 years old (28.7%) and primarily female (72.0%). The majority were from Macao (86%) and bachelor's degree students (83.3%). The survey revealed varied frequencies of AI tool usage: 44.7% "often" use them for academic assignments, 29.3% "occasionally", and 18.7% "always". Google Translate and DeepL were the main platforms used, by 84.5% and 81.1% of respondents, respectively.

A significant portion of students (53.3%) "fully" or "partially" rely on AI tools for comprehending complex texts, while 45.3% use them "only as a reference". Confidence in translation accuracy varied, with 43% "somewhat confident" and 40.5% "neutral". Main benefits included "assistance with unfamiliar terms" (83.1%) and "speed" (75.7%). However, 24.3% reported significant errors, especially with complex sentences and idiomatic expressions. The survey indicates a marked adoption of AI translation tools, reflecting a shift towards personalized, data-centric education. Concerns about the decline in demand for human translators and cultural nuances emphasize the need for a balanced approach. The quantitative data was essential for understanding MT usage and developing the qualitative research for this study. Given the accuracy concerns with culturally dense materials, the second stage of data collection focuses on classroom observations to understand, analyze, explain, and provide translation strategies.

3.2 Observing student engagement with AI tools

The first two observations conducted in the classroom focused on students engaging with short literary texts in Portuguese. Eight excerpts, each ranging from 350 to 450 words, were selected from narrative works by Portuguese-speaking authors, considering the students' intermediate to advanced language proficiency. For each text, the instructor prepared a list of guiding questions about the author, the context of the text, the characters, and the plot.

Students were instructed to form groups of 4-5 members and begin by reading the assigned text silently multiple times to understand the content and identify unfamiliar vocabulary and specific contexts. Following this, they were tasked with a deeper linguistic and cultural analysis of the text, exploring themes, contextual nuances, and the author's intent. Once they had a solid grasp of the material, the students were advised to practice elements of prosody—intonation, stress, rhythm, tempo, pauses, and loudness—to enhance their reading and performance skills. This comprehensive

approach aimed to improve their cultural understanding of the texts, expressive reading, and overall fluency in Portuguese. Finally, they were required to read the text aloud, present their analysis results, and discuss translation challenges and strategies from Portuguese to Chinese with their peers.

During the process, students were permitted to use personal devices, such as smartphones, tablets, or laptops, to support their learning without any specific restrictions on their usage. Four observers were tasked with monitoring if and when students resorted to MT and AI tools, the specific stages at which they used it, the purposes for which they relied on it, and how they discussed the outcomes with their peers.

Observers noted that even before the first reading in Portuguese, most students copied the literary text into a translation tool, such as DeepL or Google Translate, and read the Chinese version first. Observer 1 noted, “The majority of students prefer to have a general idea of the content of the text in Chinese before reading it in Portuguese.” Observer 2 commented on the observation form, “Only two students out of 20 read the text in Portuguese several times and occasionally checked the translation of individual terms online.” Observer 3 added, “Students are more focused on outcomes expected by teachers than on truly learning something, as they didn’t make any effort to read the text in Portuguese.” Observer 4 elaborated that a significant portion of students “simply copied the whole assignment instructions into MT tools to get the Chinese version, and their group discussion was based on the Chinese translation from the MT, not on their comprehension skills in Portuguese.”

When students had to engage in deeper linguistic and cultural analysis of the text, exploring themes, contextual nuances, and the author’s intent, observers noted that a considerable number of students used ChatGPT to get the answers. They copied the text and the analysis questions into the chat, briefly checked the answers provided, and then moved on to the next task without much further engagement. Observer 2 wrote that “students rarely discussed or considered the cultural nuances of the texts in Portuguese, relying on automatic translations.” For pronunciation practice, students also resorted to online tools to listen and repeat pronunciation but largely ignored other prosody elements.

In terms of translation strategies, students also frequently relied on MT for direct translations without critically evaluating or adjusting the output to ensure accuracy and appropriateness in context. Observer 1 remarked, “Students often accepted the MT output as final without questioning its accuracy or making necessary adjustments based on their knowledge of Portuguese and Chinese.” Observer 2 noted that “there was minimal effort to understand the nuances of the original text, leading to translations that were often literal and sometimes incorrect.” Observer 3 observed that “students did not discuss potential alternative translations or the implications of word choices, which are crucial aspects of the translation process.” Additionally, Observer 4 highlighted that “group discussions rarely included debates about the best translation strategies or the challenges of conveying cultural nuances, indicating a superficial engagement with the material.” This reliance on MT and lack of critical

evaluation suggest that students may not be developing the necessary skills to become proficient translators.

For the second set of observations, the activities focused on humor, utilizing comedic sketches and jokes in Portuguese to explore the cultural and linguistic nuances of humor. The tasks for the students were multifaceted. Firstly, they were instructed to read the comedic texts in groups of 4-5 and analyze the cultural references and societal norms depicted in the jokes. For instance, they examined humorous texts that referenced political and social events, with a strong cultural and contemporary component, as well as jokes with word games. Secondly, the groups identified specific elements that made the texts humorous, such as wordplay, satire, and punchlines. An example of this would be recognizing a pun based on a Portuguese idiom that has no direct equivalent in Chinese. Thirdly, students discussed why certain jokes might not translate well into Chinese, considering cultural differences, linguistic structures, and contextual meanings. They explored scenarios where a joke's humor relied on a play on words in Portuguese that lost its impact when translated literally.

Observers noted that again students relied heavily on MT tools to translate the jokes, which often led to the loss of humor due to literal translations that missed cultural subtleties. Observer 5 pointed out, "Humor is deeply rooted in cultural context, and students struggled to convey the same humor in Chinese because they relied on direct translations." Observer 6 added, "Students found it challenging to explain why a joke was funny in Portuguese, indicating a lack of deep cultural understanding."

In terms of pronunciation practice, students used online tools to listen and repeat the pronunciation of the jokes. However, other crucial elements of prosody, such as timing and intonation, were largely ignored. Observer 7 noted, "While some students attempted to perform the jokes, many read them flatly without considering the importance of timing and delivery in humor." Group discussions often centered on the direct outputs from MT tools rather than critical evaluations or adjustments to improve the translation. Observer 8 mentioned, "The use of MT tools was prominent, and students often defaulted to these tools instead of trying to understand and convey the humor through their own interpretation."

These observations highlight the urgent need for more guided practice in critical thinking and deeper engagement with the material to enhance students' translation skills and cultural understanding. Encouraging students to critically analyze MT and AI results, discuss translation options with peers, and focus on understanding the underlying cultural and linguistic elements can significantly improve their proficiency and confidence in both Portuguese and Chinese. Overall, the observations indicate a clear need for instructional strategies that foster deeper engagement with the source material and promote critical thinking about translation outputs. A more comprehensive approach to language learning is required, one that goes beyond the use of technological tools for

quick solutions. By focusing on the critical evaluation of MT results and fostering discussions on translation choices and cultural nuances, students can develop a more profound understanding and skillset in translation.

This reliance on MT and AI tools suggests a tendency among students to prioritize efficiency over a deeper understanding of the translation process. Such an approach may lead to superficial learning and hinder the development of essential translation competencies. Therefore, it is crucial to implement strategies that encourage students to immerse themselves more fully in the target language. This includes engaging more critically with the texts, understanding the cultural contexts, and thoughtfully considering the implications of their translation choices.

The observations indicate a pressing need for educational practices that support students in developing a nuanced comprehension of both languages. This can be achieved by integrating activities that require deeper analysis, peer discussions, and critical reflection on the translation process. By doing so, students can enhance their linguistic proficiency, cultural understanding, and translation skills, leading to more accurate and contextually appropriate translations.

3.3 Focus groups: Student reflections on AI and cultural nuances

During the focus group activities, which were conducted mid-study aiming at further elaborating on insights from questionnaires and in-class observations, students were divided into 10 groups and assigned five different tasks for discussion and reflection. The instructor developed a list of key questions for each focus group, and students were instructed not to use any electronic devices during the discussion and reflection stages. Each group engaged in a brainstorming session on their assigned topic, followed by a guided discussion, and a reflection period where each student articulated their thoughts and perspectives. At the end of the activity, students were required to submit a short written report with additional examples.

3.3.1 Cultural subtleties

During the discussion activity on the theme “Recounting instances where AI failed to capture cultural subtleties”, two groups of students separately shared their experiences and reflections on the limitations of automated translation tools when dealing with culturally rich texts. This discussion was fundamental in understanding the challenges and differences between machine and human translations.

The first group discussed a culturally rich text related to the Chinese legend of Hou Yi and Chang'e. They reported that AI translation failed to capture the cultural depth and emotional nuances of the story. For example, the automatic translation of the text included significant errors, such as translating “刀” (which means “sword” in the ancient Chinese context) as “faca” (“knife”), which

diminished the accuracy and authenticity of the narrative. The automatic translation provided by DeepL was compared with the human translation done by the students. The AI version simplified and lost important details, such as in the phrase “Chang’e calmly said,” translated as “Chang’e disse” without capturing the tension and gravity of the moment. In contrast, the human translation added emotional and cultural nuances that enriched the story, such as translating “Chang’e firmly replied” to “Chang’e respondeu com confiança,” highlighting the character’s courage in a critical moment.

Another point raised was the translation of idiomatic and cultural expressions. For instance, when Chang’e responded to Peng Meng saying “你不信我， 可以看看,” the AI translated it literally as “If you don’t give me the elixir, don’t blame me for what happens later,” while the human translation better contextualized the fear and urgency of the situation: “If you don’t believe me, you can see for yourself!” The students concluded that human translation surpasses AI in terms of cultural and emotional accuracy. The ability of human translators to interpret and adapt cultural nuances is a significant advantage that AI cannot fully replicate yet.

The second group focused on the Chinese fable “狐假虎威” (“A raposa que enganou o tigre”/ “The fox who fooled the tiger”). They analyzed how automatic translation failed to convey the context and moral of the story. The DeepL translation, titled “The Fox and the Tiger,” did not capture the essence of the fable, while the human translation, “The Fox Who Fooled the Tiger,” provided a title that better reflected the narrative and intrigued the readers. The text analysis revealed that AI translation often missed crucial details. For example, the AI translated “在森林里遇到一只狐狸” as “in the forest found a fox,” simplifying the encounter without conveying the tension and atmosphere of the story. The human translation, “o tigre deparou-se com uma astuta raposa no meio da densa floresta” (“The tiger encountered a cunning fox in the midst of the dense forest”), added details that helped to better contextualize the scene.

Furthermore, the group discussed the translation of the characters’ dialogues. The AI often translated literally without capturing the tone or intention of the dialogues. For example, the phrase “我真的是森林之王” was translated by the AI as “I really am the king of the forest” (“eu sou realmente o rei da floresta”) while the human translation better captured the character’s arrogance and assertiveness with “I am indeed the king of the jungle” (“eu sou de facto o rei da selva”).

The group also highlighted that the AI failed to convey the cultural symbolism and moral of the fable. In the MT outcome, the lesson that “the fox tricked the tiger” was obscured by the lack of context and cultural nuances. The human translation, on the other hand, managed to preserve the moral and enrich the narrative, making it more understandable and relevant to the audience, as it added a more cultural interpretation using the Portuguese sayings “nem tudo o que reluz é ouro” (“not all that glitters is gold”), “quem vê cara, não vê coração” (“don’t judge a book by its cover”), and “as

aparências enganam” (“appearances can be deceiving”) to explain how appearances can be deceiving, and power or authority borrowed from others can give a false impression of one’s own strength. In the story, a fox convinces a tiger that he is the king of the forest by claiming that all the animals are afraid of him, when in reality, they fear the tiger walking behind him. The fable teaches us to be cautious of those who might manipulate situations to appear more powerful or influential than they actually are.

Both groups concluded that MT outcomes have significant limitations in capturing cultural and emotional nuances. MT tends to produce literal translations that often miss the cultural context and emotional depth of the original texts. In contrast, human translations are more effective at interpreting and adapting these nuances, resulting in more accurate and culturally sensitive translations. The groups acknowledged that while AI tools offer notable advantages in terms of speed and efficiency, the outputs are not entirely reliable and require careful post-editing and revision. This post-editing process demands deep cultural knowledge from translators to ensure the accuracy and appropriateness of the final translation.

3.3.2 Idiomatic expressions

In the second topic of the discussion activity, the groups focused on how AI handles idiomatic expressions, proverbs, and sayings. The activity required students to share examples where AI misinterpreted these elements, discuss the impact on the overall meaning, and suggest improvements for automated translation tools. The first group began the discussion by analyzing various Chinese proverbs and their automated translations provided by the instructor. One highlighted example was the proverb “亡羊补牢” (wáng yáng bǔ láo), which means “to repair the sheepfold after the sheep are lost.” The AI translation provided was “lock the stable door after the horse has bolted,” a literal translation that failed to capture the essence of the proverb and its equivalent in Portuguese, “Antes tarde do que nunca” (“Better late than never”).

The students noted that when translating idiomatic expressions, MT often resorts to literal translations that do not make sense in the target language. For instance, the proverb “班门弄斧” (bān mén nòng fǔ), which means “to show off one’s skills in front of an expert,” was translated by MT as “Pregando peças regularmente”, a nonsensical phrase. The appropriate human translation would be “ensinar o pai-nosso ao vigário” ou “ensinar o padre a rezar a missa” (“to teach one’s grandmother to suck eggs,” or “to preach to the choir”).

Another example discussed was the proverb “画蛇添足” (huà shé tiān zú), which means “to draw a snake and add feet to it.” The AI translation was simply “supérfluo” (“superfluous”) which fails to convey the idiomatic meaning of “adding unnecessary details and ruining something.” The

students suggested that a more suitable human translation would be “colocar a carroça à frente dos bois” (“to put the cart before the horse”) or “meter os pés pelas mãos” (“to mess things up”), both of which convey the idea of ruining something by doing too much or adding unnecessary elements.

The students reflected on how MT’s failures in translating proverbs and idiomatic expressions affect the clarity and accuracy of the translated text. They observed that MT’s literal translations often result in confusing and nonsensical phrases, losing the cultural richness and original intent of the proverbs. This can lead to significant misunderstandings and compromise the effectiveness of communication.

The second group also discussed several examples of inadequate AI translations of proverbs and idiomatic expressions. A notable example was the expression “隔墙有耳” (gé qiáng yǒu ěr), which means “the walls have ears.” The MT translation was “paredes divisórias têm orelhas,” which, while literally correct, did not convey the implicit warning to be careful about what is said because someone might be listening. Another example discussed was the expression “杯弓蛇影” (bēi gōng shé yǐng), which means “to see a reflection of a snake in a cup of water,” used to describe a situation where someone is frightened by something that poses no real danger. The MT translation was only “extremamente suspeito” (“extremely suspicious”) which does not convey the idiomatic meaning of “fazer tempestade em copo d’água” (“to make a mountain out of a molehill”).

The students also analyzed the expression “人要脸，树要皮” (rén yào liǎn, shù yào pí), which means “people need dignity just as trees need bark.” The MT translation was “as pessoas querem rosto, as árvores querem casca” (“people need faces, trees need bark”), a literal translation that fails to capture the importance of dignity for humans. A more suitable human translation would be “a honra é o maior tesouro do homem” (“honor is a man’s greatest treasure”).

During the discussion, the students suggested several improvements for MT tools. They recommended that developers incorporate specialized databases for idiomatic expressions and proverbs from different cultures. Additionally, they suggested that AI be trained to recognize specific cultural contexts and offer more contextual and accurate translations. One student mentioned, “AI should be able to identify when an expression is idiomatic and seek the cultural equivalent instead of providing a literal translation.” The students also emphasized the importance of human oversight in the translation process. They argued that while AI can provide a useful starting point, human translators are essential to ensure that translations are culturally sensitive and accurate. “Human intervention is crucial to adjust and improve automatic translations,” concluded one of the participants.

The groups concluded that although automated translation tools are useful for quick translations, they have significant limitations when dealing with idiomatic expressions, proverbs, and sayings. The

literal translations provided by AI often result in misunderstandings and loss of cultural nuances. The students recommended that AI developers enhance the tools by incorporating more cultural knowledge and specific contexts, along with maintaining human oversight as an essential step in the translation process. The discussion highlighted the need for a more balanced approach that combines the speed and convenience of AI tools with the sensitivity and precision of human translators.

3.3.3 Cultural integrity

The third discussion centered on the strengths and weaknesses of AI in maintaining cultural integrity. Both groups identified several strengths, such as speed and efficiency. AI can process large volumes of text in seconds, making it useful for quickly translating complex documents with cultural nuances. Additionally, AI provides broad accessibility, allowing people from different cultural backgrounds to access information in their native languages. However, the groups noted significant weaknesses in AI's ability to understand and translate cultural nuances accurately. One major issue is the lack of deep cultural comprehension. While AI can recognize some cultural nuances, it generally lacks an in-depth understanding of specific traditions, customs, and values, leading to inaccurate translations. For example, when translating the idiom “骑驴找马” (qí lú zhǎo mǎ), which means “to ride a donkey while looking for a horse,” the AI translated it literally as “ride a donkey to find a horse.” This misses the idiomatic meaning of “making do with something while looking for something better.” A human translator would understand the idiom's significance and provide an appropriate equivalent, such as “trocar o certo pelo duvidoso” (“settling for less while seeking something better”).

Another weakness is AI's limited cultural sensitivity. AI tools often struggle to capture the necessary context to translate idiomatic expressions, puns, or specific cultural references accurately. This limitation can result in translations that miss the intended meaning, as seen in the translation of “嫁鸡随鸡，嫁狗随狗” (jià jī suí jī, jià gǒu suí gǒu), meaning “if you marry a chicken, follow the chicken; if you marry a dog, follow the dog.” The AI's literal translation, “marry a chicken, follow the chicken; marry a dog, follow the dog,” fails to convey the idiomatic meaning of “accepting and adapting to one's circumstances.”

The groups also discussed AI's failure to capture the emotional and cultural depth of certain texts. For instance, the AI's translation of the Chinese idiom “纸包不住火” (zhǐ bāo bù zhù huǒ), meaning “paper cannot wrap fire,” was translated literally as “paper can't contain fire,” missing the idiomatic meaning of “the truth will eventually come out.” In translating the phrase “放虎归山” (fàng hǔ guī shān), meaning “to release a tiger back to the mountain,” the AI produced a literal

translation that did not convey the underlying warning of “letting a dangerous person go free.” These examples highlight AI’s limitations in understanding deeper cultural contexts.

Both groups concluded that while AI offers notable strengths like speed and accessibility, it also has significant limitations in maintaining cultural integrity during translation tasks. AI’s ability to quickly process large volumes of text and provide initial translations is beneficial, making information accessible to a broader audience across different languages. However, its lack of deep cultural comprehension often results in inaccurate translations that miss the nuances of specific traditions, customs, and values. The groups emphasized that human intervention remains crucial for ensuring cultural sensitivity and accuracy in translations. Moreover, the integration of AI tools with human expertise can provide a balanced approach to translation. While AI can offer speed and initial translations, human translators are indispensable for refining these translations to ensure cultural accuracy and sensitivity. This collaboration can help achieve more accurate, meaningful, and contextually appropriate translations, preserving the richness of cultural expressions and improving intercultural communication.

3.3.4 Culturally rich texts

The fourth topic addressed students’ experiences with AI translations of texts rich in cultural context, such as those involving prominent historical and cultural figures, culturally dense places, and significant events. The groups explored how AI handled these complex translations and whether the tools could effectively convey the deeper meanings embedded in such texts.

The first group selected a text about the Chinese poet Li Bai and his poem “静夜思” (Jing yè sī), which reflects his longing for home during a tranquil night. The AI translation rendered the title as “Thoughts on a Quiet Night” and the lines as follows:

- “床前明月光” (chuáng qián míng yuè guāng) was translated as “luar na frente da cama” (“Moonlight in front of the bed.”)
- “疑是地上霜” (yí shì dì shàng shuāng) became “suspeito de haver geada no chão” (“It looks like frost on the ground.”)
- “举头望明月” (jǔ tóu wàng míng yuè) was translated as “olha para a lua brilhante” (“look at the bright moon.”)
- “低头思故乡” (dī tóu sī gù xiāng) became “incline a cabeça e sinta falta da sua cidade natal” (“lower your head and think of your hometown.”)

While the translations were technically correct, the students noted that the AI failed to capture the emotional depth and cultural context of the poem. The poem’s imagery evokes a profound sense

of homesickness and the serene beauty of the moonlit night, which the literal translation did not fully convey. The students highlighted that a human translator would likely provide more nuanced interpretations, such as emphasizing the melancholic tone and the cultural significance of moon gazing as a symbol of longing and separation (O luar à frente da cama brilha intensamente / Suspeito que seja geada cobrindo o chão/ Levanto a cabeça e contemplo a brilhante lua/ Abaixo a cabeça e sinto saudades da minha terra natal). They reflected on how the AI's translation stripped the poem of its poetic essence, reducing its impact and failing to resonate with readers on a deeper level.

The second group analyzed a text about the ancient Chinese city of Xi'an, famous for its historical and cultural heritage, including the Terracotta Army. They used AI to translate a passage describing the city's rich history and cultural significance. The AI translation was as follows:

- “西安是中国历史文化名城，有着丰富的历史遗产和文化积淀。” (Xī'ān shì Zhōngguó lìshǐ wénhuà míngchéng, yǒuzhe fēngfù de lìshǐ yíchǎn hé wénhuà jīdiàn.) was translated as “Xi'an é uma cidade histórica e cultural famosa na China, com um rico patrimônio histórico e depósitos culturais”. (“Xi'an is a famous historical and cultural city in China, with a rich historical heritage and cultural deposits”).

The students observed that while the translation was mostly accurate, it lacked the depth and vibrancy of the original text. The AI's rendering of “文化积淀” (wénhuà jīdiàn) as “cultural deposits” felt flat and did not capture the dynamic and living nature of cultural accumulation. A human translator might choose a more evocative term like “cultural legacy” or “cultural wealth” to better convey the sense of ongoing cultural significance and richness. They reflected on how AI translations can sometimes feel mechanical, missing the human touch that brings cultural and historical narratives to life.

Both groups concluded that AI translations, while useful for understanding the general meaning of culturally rich texts, often lack the ability to fully capture the emotional and cultural nuances. AI's literal approach to translation tends to miss the deeper connotations and contextual subtleties that are crucial for conveying the true essence of such texts. The students emphasized the importance of human oversight in translating culturally significant materials. They suggested that AI tools should be enhanced with more comprehensive cultural databases and better contextual understanding to improve their ability to handle complex cultural references. Moreover, integrating AI with human expertise can provide a balanced approach, ensuring that translations are not only fast and accessible but also culturally and emotionally accurate.

3.4 Integrating AI into the Translation Curriculum: Student Recommendations

In exploring how AI can be effectively integrated into translation pedagogy, students offered a range of insights grounded in their own experiences using AI tools. Their recommendations focus on enhancing cultural sensitivity, ensuring human oversight, balancing efficiency with accuracy, and training academic staff – elements that can inform curriculum design and classroom practices aimed at preparing future translators. A recurring point of discussion was how AI tools often fail to capture cultural and contextual nuances, leading to literal translations that overshadow idiomatic and emotional depth. For instance, students highlighted the Chinese idiom “开门见山” (kāi mén jiàn shān), meaning “getting straight to the point,” erroneously rendered as “open the door and see the mountain,” a clear indication that AI systems need more robust cultural and linguistic databases.

Several students noted that teachers who are unfamiliar with the potential of AI sometimes view its use as “cheating” or even “illegal,” missing the opportunity to help students learn how to harness these tools during their translation studies. They explained that some instructors, wary of new technologies, simply forbid AI in class—but ironically, those same teachers are often impressed when students demonstrate how AI can accelerate translation tasks. One student shared a vivid example of translating “心花怒放” (xīn huā nù fàng), which literally means “the heart blossoms,” from the AI-generated Portuguese phrase “o coração está a florescer” to the more culturally fitting expression “sentir-se nas nuvens” (“to feel on cloud nine”). The student’s adaptation preserved the intended meaning and cultural nuance, illustrating how AI can be a powerful ally when guided by informed human input.

These interactions underscore the growing need for professional development programs that enable educators to harness AI’s efficiency while providing the cultural and contextual oversight essential for high-quality translations. Rather than relying solely on instinct or personal biases toward technology, teachers must be equipped with the skills to critically evaluate AI outputs and guide students in balancing speed with nuanced accuracy. This shift in perspective aligns with broader discussions on AI’s role in education, particularly in teacher training and professional development.

Students emphasized that human intervention remains critical for preserving cultural and contextual fidelity. One group shared that the Chinese proverb “狼吞虎咽” (láng tūn hǔ yàn), meaning “to gobble up food voraciously,” was translated as “engolir a tua comida” (“wolf down your food”), which distorted the intended meaning of “comer vorazmente” or “comer como um leão.” They concluded that, while AI provides a good starting point, human translators must refine and adjust translations to safeguard cultural integrity. They also proposed integrating structured feedback mechanisms into AI translation interfaces, allowing end users to comment on inaccuracies and suggest

improvements so that AI can learn from real-world usage: “Allowing users to correct and comment on translations can help AI systems learn and adapt to different cultural contexts more effectively.”

Students consistently highlighted the time-saving benefits of AI tools for quick comprehension and new vocabulary acquisition, but they cautioned against over-reliance. They observed that the more linguistically proficient students (A/A+ group) approached AI outputs more cautiously, recognizing the limitations in capturing subtle cultural and contextual elements. One noted, “In most cases, AI translation tools often fail to translate idiomatic expressions and proverbs; they usually adopt literal translation,” while another stressed the importance of manual checks for academic texts to ensure accuracy and cultural relevance. Meanwhile, less-proficient students or those in the C/D range reported minimal verification of AI translations, often due to their limited ability to detect errors. Such students acknowledged AI’s helpfulness for understanding class content and language structure, yet recognized the risk of dependency, which can impede vocabulary retention and critical thinking about translation choices.

To address these issues within the curriculum, students suggested several practical measures. First, they urged the development of AI modules or tools that incorporate specialized cultural corpora and contextual algorithms, encouraging learners to reflect on idiomatic expressions and compare AI outputs with human translations. Second, they recommended post-editing tasks where students refine AI-generated texts, highlighting errors and proposing solutions that preserve cultural nuances, along with peer review exercises that prompt collaborative evaluation of AI outputs. Third, tasks can be scaffolded to balance AI use with independent linguistic exploration, and rubrics can reward critical awareness of AI’s limitations. Furthermore, students stressed the importance of providing feedback directly to AI tools, thereby “teaching” these systems about cultural nuances in real time. In addition, many pointed out that effective integration requires teacher training, since instructors themselves are sometimes unfamiliar with the functionalities and best practices for using AI translation tools. Students therefore recommended professional development opportunities to help teachers guide learners more effectively, maximize AI’s benefits, and address any cultural or contextual pitfalls in real-world classroom scenarios.

Although students expressed optimism regarding the future capabilities of AI translation tools, they overwhelmingly agreed that human translators are indispensable, particularly for content requiring deep cultural insight and emotional sensitivity. One student noted, “I think AI will not completely replace human translation in the end because machine translation is demonstrated on the basis of human translation,” while another emphasized, “Our creativity still is an important key.” As AI tools continue to evolve and become more context-aware, their role in translation is expected to expand. However, the general recommendation from the student perspective is to integrate AI in a balanced manner – leveraging its efficiency and convenience without sacrificing rigorous human

oversight. Such collaboration allows for rapid processing of texts, enriched language learning, and fidelity to cultural and emotional dimensions, all of which are essential to forming skilled, culturally aware translators.

3.5 Balancing efficiency and accuracy: Student insights

The analysis of student interviews on the use of AI translation tools in language studies reveals a multifaceted perspective that underscores both the benefits and limitations of these technologies. The primary advantage highlighted by the students is the significant time-saving aspect and the convenience these tools offer. One student noted, “Using AI translation tools not only saved me a lot of time but also allowed me to learn new vocabulary and observe sentence structures.” Students confirm that MT tools, such as DeepL and Google Translate, are frequently used to help understand a general idea of a written or oral text. However, when the material is more complex, requires thorough understanding, or when students need to produce content in either Chinese or Portuguese, they turn to ChatGPT for its reliability and accuracy.

Linguistic proficiency seems to have a strong correlation with the level of dependence on AI tools for academic performance. The three students in the A/A+ grade group were the most concerned and cautious about the results generated by AI tools. Student A1 highlighted the struggle of AI tools to capture cultural nuances, noting, “In most cases, AI translation tools often fail to translate idiomatic expressions and proverbs, and they usually adopt literal translation. This can lead to translations that are technically correct but culturally and contextually inappropriate.” Student A2 pointed out the frequent errors with AI translations, especially with idiomatic expressions and context-specific translations, recalling an incident where the translation tool misunderstood the word “lighthouse” as “bacon,” leading to an embarrassing scenario in front of the class. Student A3 provided an example illustrating the limitations of AI tools: “The term ‘dumplings’ will be translated as ‘bolinhos de massa’ when translated by AI, but ‘bolinhos de massa’ does not mean Chinese dumplings at all.” This highlights the need for careful proofreading and human intervention to ensure the accuracy of translations.

Additionally, student A2 noted that while AI translation tools are convenient, they lack flexibility and struggle with culturally loaded terms. A2 mentioned, “AI translation tools often provide very literal translations, which can lead to misunderstandings in culturally nuanced texts.” Similarly, Student A1 emphasized the necessity of human oversight, especially for academic translations, saying, “For academic texts, I always prefer to manually check the AI’s output to ensure accuracy and cultural relevance.”

In contrast, students in the C/D grade group reported a greater reliance on these tools. They often did not verify the AI outcomes due to their insufficient linguistic and cultural knowledge, which

hindered their ability to critically analyze the results. Student D1 acknowledged the heavy reliance on AI tools throughout her studies, especially as her proficiency in Portuguese was not strong. She noted, “I use ChatGPT for everything. I believe strongly in the translation and other outcomes that have been done by the AI because it has a big vocabulary dictionary... Humans can easily make mistakes in translation, but AI do much better.” This student found AI tools particularly beneficial for understanding class contents and language structure, significantly relying on them for academic work requiring translations, comprehension, interpretation, and writing.

Student D2 shared a similar perspective, emphasizing the convenience and perceived accuracy of AI tools: “When I first started learning Portuguese, I found AI tools incredibly helpful for understanding complex texts and completing assignments. Over time, I started to rely on them more and more.” However, D2 also recognized the drawbacks, stating, “Sometimes I don’t fully grasp the meaning of the translated text because I rely too much on the AI.”

The impact of AI translation tools on language learning is complex. While these tools can aid in learning new vocabulary and improving sentence structures, they can also foster a dependency that may hinder deeper learning. Student C1 admitted, “AI translation tools affected my language learning process a lot because I just relied on Google Translate for finding the new vocab and I won’t memorize those new words.” This reliance on AI can make students complacent, reducing their incentive to engage deeply with the language. Another student, B1, mentioned the dual impact of AI tools on language learning, stating, “It would make me lazier sometimes and not willing to memorize new vocabs.”

Despite the efficiency and convenience of AI translations, students expressed a general preference for human translations in contexts requiring a nuanced understanding of culture and emotion. Student B3 observed, “While AI translations are faster in delivering translated text, human translations are more accurate, especially in dealing with idioms, proverbs, and cultural context.” Student A2 emphasized the importance of human translators for cultural and emotional nuances, noting that AI tools often produce literal translations that miss deeper meanings.

Student B2 also discussed the limitations of AI in handling cultural nuances and idiomatic expressions, explaining, “AI tools often fail to capture the essence of idiomatic expressions and proverbs. They tend to translate them word-for-word, which can distort the original meaning.” This sentiment was echoed by student B3, who added, “For translating culturally rich texts, I still prefer human translators because they understand the context and cultural background better.”

Looking ahead, students are optimistic about the future capabilities of AI translation tools but do not believe that AI will completely replace human translators. As Student A3 stated, “I think AI will not completely replace human translation in the end because machine translation is demonstrated on the basis of human translation.” Student B2 shared this view, noting, “AI tools will continue to

improve and become more integrated into our workflows, but they will never fully replace the need for human translators who can understand and interpret cultural subtleties. Our creativity still is an important key”.

While AI translation tools provide considerable advantages in efficiency and convenience, their deficiencies in accuracy, cultural sensitivity, and their impact on the learning process underscore the necessity for a balanced approach. Integrating the strengths of AI with the insights and expertise of human translators can enhance the overall effectiveness of the translation process, ensuring both rapidity and cultural fidelity. As AI technology continues to advance, its role in translation is anticipated to expand; however, the indispensable value of human translators will persist.

4. Discussion

This study’s findings align with and extend existing scholarship on AI’s role in translation education, particularly regarding cultural sensitivity and pedagogical integration. Below, we synthesize key insights while contextualizing them within broader academic discourse.

4.1 Perceptions and uses of AI tools in translation practices

Students’ reliance on AI tools for efficiency and accessibility mirrors trends observed in prior studies (Kenny, 2018; Bowker & Ciro, 2019). However, our findings deepen this narrative by revealing a proficiency-dependent engagement: higher-performing students critically evaluate AI outputs, while less-proficient ones uncritically accept them. This dichotomy aligns with Kenny’s (2018) caution that convenience risks fostering superficial engagement and underscores Bowker and Ciro’s (2019) emphasis on structured pedagogical integration. Our results further resonate with Alharbi (2024), who highlights the need for curricula that balance AI literacy with critical thinking to mitigate over-reliance.

4.2 Challenges faced in real-time AI translation processes

AI’s struggles with cultural nuances and idiomatic expressions corroborate Olohan’s (2020) assertion that AI lacks contextual adaptability. For instance, literal translations of humor and proverbs—common pitfalls in our observations—echo Alqahtani’s (2024) findings on AI’s failure to grasp cultural subtexts. These limitations align with Pym and Hao’s (2025) argument for human oversight to address AI’s deficiencies, particularly in real-time tasks. Our data extend this discourse by demonstrating how students’ uncritical reliance exacerbates these challenges, necessitating pedagogical interventions to foster post-editing skills.

4.3 Evaluating AI's management of cultural nuances and rich texts

AI's inability to preserve emotional and symbolic depth in culturally rich texts, such as poetry or fables, reflects Leppihalme's (1997) assertion that cultural markers are vital for effective translation. While NMT advancements improve linguistic accuracy (Amini *et al.*, 2024), our focus group examples—e.g., flattened translations of Li Bai's poetry—illustrate persistent gaps in cultural resonance. These findings reinforce Asi *et al.*'s (2024) and Li's (2024) call for hybrid workflows, where human expertise refines AI outputs to ensure fidelity to cultural and emotional dimensions.

4.4 Recommendations for integrating AI into translation pedagogy

The study underscores the need for translation pedagogy to evolve toward a balanced integration of AI efficiency and human cultural expertise. Central to this is enhancing AI's cultural sensitivity through context-aware algorithms and expanded cultural databases, as proposed by Łoboda and Mastela (2023), to address persistent gaps in handling idioms and nuanced texts. Concurrently, students and scholars emphasize the critical role of post-editing training to refine AI outputs for linguistic and cultural accuracy, a stance reinforced by Alharbi's (2024) advocacy for curricula that prioritize critical evaluation skills.

Equally vital is addressing the gap in teacher preparedness for AI-augmented classrooms (Tan *et al.*, 2025). Research by Tammets and Ley (2023) and Sharma (2024) highlights the urgency of professional development programs that equip educators to navigate AI tools ethically and pedagogically, moving beyond tool familiarization to fostering critical assessment of AI-generated content. Fakhar *et al.* (2024) and Bekdemir (2024) further advocate for structured workshops and mentoring to bridge technological literacy gaps, ensuring teachers can guide students in balancing AI's speed with cultural insight.

Pedagogically, students advocate for hybrid workflows that blend AI's efficiency with human creativity, such as peer-review exercises analyzing AI translations or projects integrating real-world culturally dense texts. These approaches align with the EMT Competence Framework (2022), which stresses technical, cultural, and interpersonal competencies, and resonate with Amini *et al.*'s (2024) call for curricula that balance AI proficiency with analytical rigor. He (2024) further explores the role of prompt engineering in refining AI translation processes, stressing the importance of responsible AI use in education. By embedding such practices, translation education can prepare students to leverage AI's strengths while mitigating its limitations, ensuring culturally resonant and ethically grounded outcomes in an increasingly technology-driven field.

5. Conclusion

The integration of AI translation tools has transformed the field of translation education, offering significant advantages in terms of efficiency and accessibility. These tools provide students with opportunities to manage complex assignments, navigate unfamiliar vocabulary, and enhance their exposure to diverse sentence structures. However, the study highlights critical limitations in AI's ability to manage cultural nuances, idiomatic expressions, and contextually rich texts. These deficiencies underscore the continued importance of human oversight and the need for pedagogical approaches that emphasize critical thinking, cultural analysis, and post-editing skills.

By recalibrating translation curricula to incorporate AI literacy, post-editing expertise, and collaborative learning, educators can equip students with the competencies needed to navigate the complexities of AI-augmented translation. Such an approach encourages students to critically engage with AI outputs, fostering a deeper understanding of linguistic and cultural elements. Translation programs must integrate real-world scenarios into their activities, bridging the gap between theoretical learning and professional practice, and enabling students to address the unique challenges presented by AI in translation workflows.

Furthermore, the findings of this study reaffirm the essential role of human translators in ensuring cultural and linguistic fidelity. While AI tools excel in speed and efficiency, they often fail to capture the emotional depth and cultural richness inherent in source texts. These limitations reinforce the need for a balanced approach that combines the technological strengths of AI with the irreplaceable cultural insights and adaptability of human expertise.

Looking forward, the future of translation education lies in hybrid models that integrate technical and cultural training. Frameworks such as the European Masters in Translation (EMT) Competence Framework (2022) provide valuable guidance in this regard, emphasizing the importance of developing well-rounded translators who can effectively collaborate with AI systems while maintaining cultural sensitivity and linguistic accuracy. As the translation industry continues to evolve, the collaboration between AI and human translators will shape the field, ensuring that the richness of cultural diversity is preserved in global communication.

By embracing these educational innovations and fostering an environment of critical engagement, translation programs can prepare students for the dynamic demands of the profession. This balanced approach not only enhances students' technical and cultural competencies but also ensures that the transformative potential of AI is harnessed responsibly, ultimately contributing to the development of high-quality translations that resonate across cultural boundaries.

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The authors report there are no competing interests to declare.

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