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Optimisation of AI translation tools for English literacy in secondary education: An analysis of opportunities and challenges

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SUBJECT

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Abstract

The integration of artificial intelligence (AI) translation tools in educational settings is progressing rapidly; however, their effectiveness in English literacy learning necessitates a more in-depth examination. This study explores the role of artificial intelligence (AI)-based translation tools in enhancing English literacy at the junior high school level. Utilising a Systematic Literature Review method, the research examines three key aspects: the impact of AI technology on students' literacy skills, the opportunities arising from its application, and the challenges in its implementation in the educational context. Findings indicate that AI Translation tools significantly improve time efficiency, vocabulary comprehension, and independent learning. Additionally, these tools enhance student motivation and text analysis skills. However, the study also identifies limitations, including students' reliance on translation results without critical analysis, technical barriers related to device access, and AI tools' inability to capture cultural nuances. The findings highlight the need for intensive teacher training to effectively utilise AI technology and the development of culturally adaptive AI tools. This study contributes to both theoretical and practical understandings of AI integration in education while opening avenues for further research on communication skills and cross-cultural understanding.

Introduction

In the current digital era, English literacy has become an essential competence for students, particularly at the junior high school level. Proficiency in English is not only crucial for academic purposes but also serves as a gateway to accessing global information (Wang & Si, 2023), preparing students for the professional world (Lee, 2020), and enhancing skills in cross-cultural communication (Laskowska, 2024). In Indonesia, although English education is an integral part of the curriculum, the primary challenge is improving students' English comprehension (Mayuni et al., 2022; Lestari et al., 2024). A common obstacle faced is students' ability to accurately understand and translate English texts, which is often hindered by limited vocabulary and mastery of language structures (Amalia et al., 2024).

The advancement of technology, particularly in artificial intelligence (AI), has led to the development of various AI-based translation tools that are increasingly utilised, including in educational contexts. Applications such as Google Translate offer the convenience of instant translation, thereby accelerating the learning of English (Deng & Yu, 2022). These technologies assist students in understanding English texts more efficiently, enhancing vocabulary acquisition, and supporting comprehension of more complex materials (Lo, 2024). AI-based translation tools also serve as practical solutions for students with limited language proficiency, offering easier access to learning materials (Xu & Jumaat, 2024). Numerous studies have confirmed the benefits of these tools in English language learning. For instance, a study by Li et al. (2024) demonstrated that technologies such as ChatGPT can enhance students' ability to recognise and comprehend new words. Moreover, such applications help students overcome language barriers in challenging texts, thereby facilitating a more efficient learning process (Nugroho et al., 2023). In the context of modern education, which increasingly relies on digital technologies, AI-based translation tools enrich the learning experience by offering flexible, accessible approaches (Karataş et al., 2024).

Numerous previous studies have explored the use of AI-based translation tools in educational contexts. For instance, Lee (2022) examined the accuracy of Google Translate in aiding students' comprehension of academic literature, while Alrajhi (2023) highlighted its application in academic writing at universities. Other research, such as that conducted by Naveen & Trojovský (2024), assessed the reliability of these tools in translating technical texts, and Wang (2023) investigated their benefits in higher education in China. Moreover, Asratie et al. (2023) studied the impact of AI-based translation tools on students learning English as a Foreign Language (EFL). However, limited attention has been given to their application in lower-level educational contexts. Recent studies have begun to explore these gaps more comprehensively, such as Rybina et al. (2025), which reviews the pedagogical opportunities and challenges of integrating AI into translation education, emphasising both its benefits and limitations in language learning environments.

Although research on this technology is abundant, most studies focus on higher education or the technical aspects of translation accuracy. The context of junior high school education, particularly in Indonesia, remains underexplored despite the unique characteristics that distinguish it from other educational levels. A study by Wen et al. (2024) investigates AI anxiety among secondary school students in EFL contexts, highlighting how students' perceptions of AI tools influence their willingness to use them in learning environments. Similarly, Zhu & Li (2025) propose a Teacher-AI-Student triad model, illustrating how AI tools can collaborate with teachers and students in

college-level English education to optimise learning outcomes. However, similar frameworks for junior high school students remain scarce. In addition, Muñoz-Basols et al. (2023) discuss the potential of AI-powered translation tools to promote critical thinking and digital literacy in L2 classrooms, which can be adapted to enhance English language learning at the secondary school level.

Addressing this research gap is essential, given the potential of AI translation tools to support English language learning at the junior high school level, enhancing literacy and language proficiency. A study by Denecke et al. (2023) on the potential and risks of AI-based tools in higher education provides insights into how AI can personalise learning experiences, yet underscores the need for critical awareness in the face of potential biases and ethical concerns. Such studies suggest that AI, when responsibly implemented, can play a key role in enhancing students' language acquisition and intercultural competence. Therefore, this study aims to examine the opportunities and challenges of using AI translation tools in junior high school classrooms in Indonesia. Furthermore, it seeks to explore how this technology can be optimised to improve students' English literacy and to provide guidance for teachers and educational practitioners on effectively integrating it into the learning process.

This study aims to explore the use of AI-powered translation tools to enhance English literacy among junior high school students. With the advancement of digital technology, AI tools have the potential to help students overcome language barriers and accelerate learning. However, their implementation requires a thorough understanding to avoid ineffective use. To address this, the study will answer the following questions: (1) How does the use of AI translation tools impact students' ability to comprehend English texts? (2) What opportunities can be utilised from AI translation tools to improve English literacy in junior high school classrooms? (3) What challenges do teachers and students face in integrating AI translation tools into English literacy instruction? This research will examine the benefits and limitations of AI translation tools in English education and offer practical recommendations for optimising their use.

However, despite their considerable potential, AI-based translation tools also pose significant challenges. One of the primary issues is accuracy, particularly in translating long and complex sentences, which often leads to inaccurate interpretations (Abbott, 2024). Additionally, students' understanding of the broader context of the translated output is often limited, potentially leading to misinterpretation of the text's meaning (Gebbia, 2023). Overreliance on such tools is also a concern, as it may undermine students' critical thinking skills and their ability to analyse texts (Kong et al., 2024) independently. Therefore, while AI-based translation tools hold substantial promise for enhancing English language learning, more targeted strategies are required to leverage their benefits fully.

Literature review

AI-Based Translation Tools

Machine translation, which emerged in the mid-20th century, has evolved into a pivotal technology in translation (Armengol-Estapé & Costa-jussà, 2021). This technology leverages computer systems to automatically translate texts between two languages, integrating elements of computer science and linguistics (Vieira et al., 2023). As a form of automated translation, machine translation utilises computers and specialised software to independently perform translation tasks (Domingo et al., 2019). Its primary objective is to convert text from the source language to the target language rapidly and

accurately (Eikema & Aziz, 2019). With technological advancements, machine translation has been categorised into three main types: Rule-Based Machine Translation (RBMT), Statistical Machine Translation (SMT), and Neural Machine Translation (NMT) (Duan et al., 2021). Rule-Based Machine Translation, as an initial stage, relies on linguistic rules such as syntax, morphology, and semantics for the language pairs being translated (Kharate & Patil, 2021). This system aims to minimise grammatical errors in translation outputs (Khanna et al., 2021).

Meanwhile, Statistical Machine Translation (SMT) utilises parallel corpora and dynamic translation systems trained to generate translation rules (Ren et al., 2019). For instance, Google employed SMT technology for its translation services until 2016, when it transitioned to the Neural Machine Translation (NMT) system, widely recognised as Google Neural Machine Translation (GNMT) (Reddy, 2024). Although both SMT and NMT rely on parallel corpora for training, their primary distinction lies in how each system processes data. SMT systems analyse and compare training data to translate text based on the probability of word occurrences in the target language, producing translations grounded on the most probable word or sentence combinations (Vu & Moschitti, 2021). This method tends to be more effective for languages with similar syntactic structures (Fadaei & Faili, 2020).

Unlike SMT, which relies on a static software framework, NMT utilises neural network technology, a component of artificial intelligence (AI), enabling the system to be trained in a bottom-up manner (Hlaing et al., 2022). This process is akin to human learning, allowing the system to recognise language patterns in-depth with minimal programmer intervention (He, 2023). The deep learning capabilities of NMT enhance its translation quality, enabling it to produce translations comparable to human translations (Kunst & Bierwiaczonek, 2023).

In terms of performance, Neural Machine Translation (NMT) offers several advantages over Statistical Machine Translation (SMT). NMT excels at understanding word relationships within a sentence and considers overall context during translation (Nair et al., 2023). This system is also more efficient in learning complex interlanguage relationships (Garugu & Bhaskari, 2023). As AI technology advances, machine translation is increasingly approaching human translation capabilities, opening the door to more efficient and effective cross-linguistic communication (Sasaki et al., 2024). Krause et al. (1992) also identified two types of barriers in translation: translation difficulties and translation problems. Translation difficulties are related to individual factors such as language competence, specialised knowledge, or the translator's skills, while translation problems are more closely associated with the technical or structural aspects of the translated text.

English and digital literacy in secondary education

English literacy in secondary education plays a crucial role in enhancing students' communication skills in an increasingly globalised world. According to Turner & Tour (2024), English literacy encompasses the ability to read, write, speak, and listen in English, as well as to understand and produce texts in various contexts. The goal of English language instruction at the secondary level, both in junior and senior high schools, is to develop students' skills in comprehending English texts and communicating effectively (Sun & Zhu, 2023). However, the greatest challenge lies in how to integrate holistic English literacy into the existing curriculum (Krishna et al., 2024).

The critical literacy theory proposed by Paulo Freire (2020) emphasises students' ability to analyse and evaluate texts in depth. Critical literacy involves not only understanding the text but also analysing the social, political, and cultural contexts that underpin it. In secondary education, critical literacy becomes a crucial element in equipping students with critical thinking skills, enabling them to analyse English texts both objectively and creatively (Sirén & Sulkunen, 2023; Munibi et al., 2024).

Moreover, the importance of developing digital literacy in English language teaching has gained increasing attention. Digital literacy, as defined by Son & Ha (2024), encompasses the ability to utilise digital technologies to process information. In the context of English language teaching, digital technologies such as learning applications, online platforms, and automated translation tools offer students opportunities to expand their learning experiences and enhance their literacy skills (Rezai, 2024). The research by Hwang et al. (2023) reinforces this perspective by demonstrating that technology can enrich English language learning through access to authentic and contextual resources.

Furthermore, integrating technology into English language teaching can support the development of autonomous literacy, particularly in a world increasingly dominated by digital media. The use of AI-based translation applications and other digital media enables students to access more challenging English texts and deepen their understanding of global contexts (Kalantzis & Cope, 2024). Therefore, English literacy in secondary education should encompass critical literacy, digital literacy, and effective English communication skills.

Digital literacy refers to students' ability to access, analyse, and effectively communicate information through digital technologies (Mensonides et al., 2024). Prinsloo (2022) asserts that digital literacy encompasses both technical skills and the ability to evaluate and use information in the digital world critically. Meneses (2021) further emphasises that digital literacy also involves skills in communication, management, critical thinking, and ethics. In this context, the TPACK (Technological Pedagogical Content Knowledge) model developed by Koehler et al. (2013) is relevant, as it underscores the importance of integrating content knowledge, pedagogy, and technology in teaching. Digital literacy serves as a crucial foundation in preparing students to face the challenges of an increasingly technology-driven world.

Research method

Using the Systematic Literature Review method from Booth et al. (2021), this study systematically examines three main research questions regarding the optimisation of artificial intelligence (AI)-based translation tools for English literacy among junior high school students. The table below presents the research questions and the study's focus.

Table 1. List of Research Questions and Focus Areas

No	Research Questions	Focus Areas
1	How does the use of AI-based translation tools affect junior high school students' English literacy skills in comprehending texts?	Assessing the impact of AI technology on students' ability to comprehend, translate, and analyse English texts.
2	What opportunities can be leveraged from the implementation of AI-based translation tools to enhance English	Identifying the potential benefits offered by AI technology, such as time efficiency, enhanced language

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	literacy in junior high school classrooms?	comprehension, or autonomous learning.
3	What are the challenges faced by teachers and students in integrating AI translation tools into the process of English literacy instruction in junior high schools?	Analysing the technical, pedagogical, or other limitations that impact the effectiveness of AI translation tools in the context of English language learning.

The data in Table 1 highlight that the research questions have shaped the primary focus of this study, including the impact of AI technology on literacy skills, the opportunities that can be leveraged from its use, and the challenges encountered in its implementation in junior high school classrooms. The study used secondary data from various scholarly sources, analysed theoretically, and critically evaluated to produce relevant and reliable findings. Furthermore, the data sources for this research include scholarly literature, such as journal articles and conference proceedings, published between 2020 and 2024. The literature was obtained through a systematic search in databases such as DOAJ and SINTA. The keywords used in the search included "AI-based translation tools," "English literacy in secondary education," and "Digital literacy in schools." Only peer-reviewed publications with open access indexed in Scopus, Web of Science, SINTA 1, and SINTA 2, directly relevant to the context of secondary education, were selected for in-depth analysis. These databases were chosen for their reputations for maintaining high-quality, credible, and rigorously peer-reviewed academic content. Scopus and Web of Science are recognised globally as leading databases for scholarly research, offering comprehensive collections of high-impact, highly cited studies that ensure broad academic influence and relevance. SINTA 1 and SINTA 2, indexing journals recognised in Indonesia, were also included to capture research specifically relevant to the Southeast Asian educational context, providing insights into the regional application of AI tools in education. The choice of these specific indexes is grounded in their commitment to rigorous quality assurance, credibility, and relevance, aligning with the study's focus on evidence-based practices in secondary education. Limiting the review to these sources ensures the inclusion of high-quality, accessible, and impactful research that enhances the rigour and validity of this systematic literature review.

The data collection process was conducted through a step-by-step literature analysis, which involved identifying sources, selecting them based on abstracts and document content, and coding key information into thematic categories such as the impact, opportunities, and challenges of AI technology in English language learning. The data was carefully grouped, recording essential elements such as authors, publication years, methodologies, and key findings from each piece of literature. In the data analysis, this study employed both descriptive and critical approaches. The descriptive analysis provided an overview of patterns in the use of AI-based translation tools in junior high school English instruction. In contrast, the critical analysis evaluated previous studies to identify research gaps and compared them with best practices in other educational contexts. This analysis was supported by the application of a theoretical framework to understand the relevance of AI technology to the junior high school curriculum and its impact on pedagogical practices.

The validity of the findings is maintained through source triangulation, in which data from various sources are compared to ensure the consistency and accuracy of the

results. The validation process includes assessing the relevance of the literature to the research focus and testing the alignment between different study outcomes. The reliability of the review is also enhanced by detailed documentation of the analytical steps, enabling replication by other researchers. With this approach, the study aims to provide new insights into optimising AI-based translation tools for English literacy at the junior high school level, while also offering practical guidance for educators and policymakers on effectively utilising AI technology in teaching.

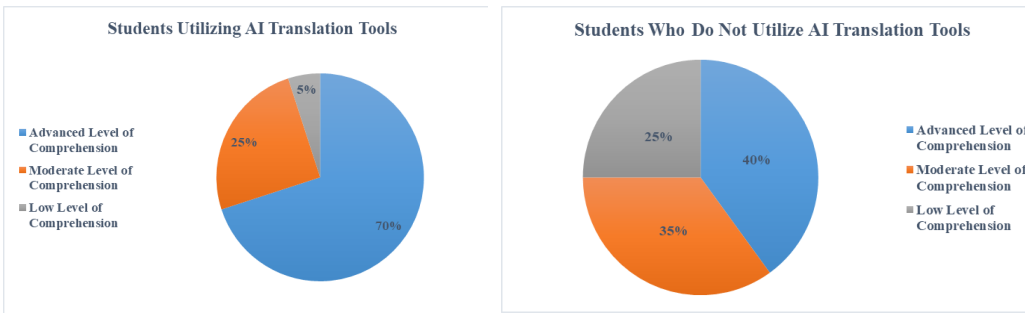
Result and discussion

A literature search of the DOAJ and SINTA databases identified 429 articles related to the specified keywords. After reviewing these numerous articles, we identified 36 that met the established criteria. Subsequently, based on data extracted from these 36 articles, this study conducted an in-depth analysis to formulate answers to the research questions posed. The following are the results of the analysis obtained as answers to the research questions:

The impact of AI translation tools on English literacy

The primary focus of this study is to evaluate the impact of the implementation of artificial intelligence (AI)-based translation tools on the English literacy skills of junior high school students, particularly in the areas of comprehension, translation, and analysis of English texts. The literature review reveals that tools such as Google Translate and DeepL can facilitate rapid understanding of texts by providing instant translations with relatively high accuracy. However, the effectiveness of these tools depends on their context of use and the students' ability to integrate the translated results into a deeper learning process (Deng & Yu, 2022).

The study by Henny Sutrisman et al. (2024) demonstrates that AI-based translation tools help students understand complex vocabulary and sentence structure in English texts. The graph in Figure 1 below illustrates the findings of this research:



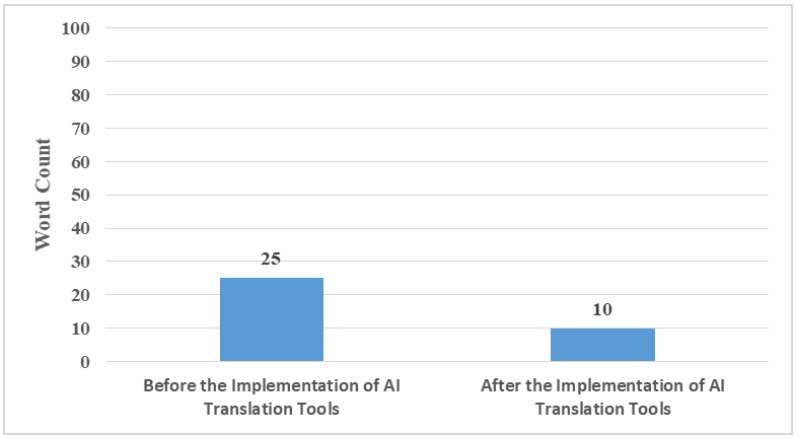
Picture 1. Enhancement of English Text Comprehension Using AI Translation Tools

The graph above compares comprehension levels between students who use AI translation tools and those who do not. From the data obtained, it is evident that 70% of students who use AI translation tools exhibit a high level of comprehension, while only 40% of students who do not use these tools achieve the same level of understanding. Additionally, 25% of AI tool users fall into the moderate comprehension category, as do 35% of non-users. Only 5% of AI tool users demonstrate a low level of comprehension, compared to 25% of non-users in the same category. These findings suggest that using

AI translation tools significantly enhances students' understanding of the material they are studying. Henny Sutrisman et al. (2024) reveal that students using AI-based translation tools comprehend descriptive texts more quickly than those in the non-user group. In junior high schools, students tend to feel more confident when faced with English texts after using these tools, particularly in understanding idioms and phrases that were previously difficult for them. This aligns with Vygotsky's (1978) sociocultural theory, which emphasises the importance of tools in facilitating learning.

However, several challenges remain. A study by Vinall et al. (2024) suggests that reliance on translation tools may diminish students' ability to engage critically with texts. Students tend to accept translations passively without further verification or analysis. Therefore, optimising these tools requires teacher intervention to guide students in critically evaluating translation results (Lee, 2021).

In the context of translation skills, artificial intelligence (AI)-based tools demonstrate significant potential, particularly for simple sentences. Hanifah et al. (2024) found that junior high school students were able to translate narrative texts into Indonesian with a lower syntactic error rate after using AI-based translation tools. However, for more complex texts, such as academic papers or texts containing technical terms, the translated results often require manual correction to ensure accuracy and contextual appropriateness, as noted by Naveen & Trojovský (2024). This highlights that while AI tools can expedite the learning process, the role of teachers or human supervision remains a crucial factor. The graph in Figure 2 below illustrates Hanifah et al. (2024)'s findings regarding the average syntactic error rate in AI-based translation results:

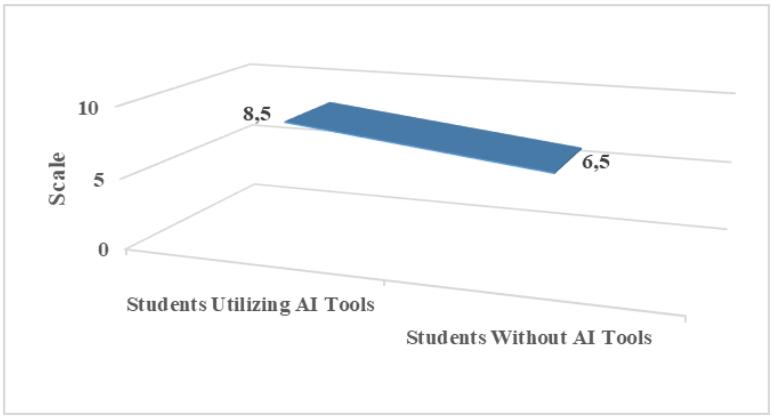


Picture 2. Average Syntax Error Rate

The graph in Figure 2 illustrates the average syntax error rate in translation, comparing manual translation and AI-generated translations. The data reveal that the syntax error rate in manual translations tends to be higher, with numerous errors involving improper sentence structure and incorrect grammar. In contrast, translations generated by AI translation tools demonstrate a significant reduction in syntax errors, reflecting the technology's improved ability to comprehend and apply grammatical rules. This suggests that AI translation tools not only enhance translation efficiency but also have the potential to produce more accurate, high-quality translations, thereby reducing the likelihood of errors that could hinder reader comprehension.

On the other hand, AI-generated translations face challenges when dealing with cultural context. For instance, Ho's (2024) study reveals that students using AI tools were only able to identify the literal elements of the text, without recognising the deeper figurative meanings. This finding supports the perspective of Untara & Setiawan (2020), who argued that AI technology remains limited in capturing cultural nuances in texts. Therefore, educators must provide additional guidance on cultural context and on how to utilise AI tools for more in-depth text analysis. In optimising AI translation tools, prompt formulation plays a crucial role in shaping translation quality. The structure of prompts directly influences the output, helping guide AI to produce more accurate, contextually appropriate, and culturally sensitive translations. By teaching students how to create effective prompts, educators can ensure that AI tools are used more critically and purposefully, enhancing both comprehension and cultural understanding.

The findings of this study align with previous research highlighting the potential of AI-based translation tools to support language learning. For instance, a study by Karataş et al. (2024) demonstrated that integrating AI technology into foreign language learning significantly affects student motivation. AI technologies, such as generative models, chatbots, and AI-based learning platforms, have proven to create more personalised, interactive, and engaging learning experiences. This approach not only enhances students' linguistic proficiency but also fosters positive affective attitudes, making the language-learning process more enjoyable and reducing anxiety. Therefore, the implementation of AI technology in language education focuses not only on cognitive aspects but also addresses emotional and motivational dimensions that support holistic learning. The graph in Figure 3 below illustrates the results of this study:



Picture 3. Average Scores of Student Learning Motivation

The graph compares the average motivation scores of students in English language learning with and without AI-based tools. Students who used AI tools achieved an average score of 8.5 on the motivation scale, while those without AI tools scored an average of 6.5. This 2-point difference indicates that the use of AI tools significantly enhances students' learning motivation. In other words, the presence of AI technology creates a more engaging and motivating learning experience compared to traditional methods without technological support. This data underscores the importance of integrating technology into the learning process to boost student engagement and enthusiasm in mastering the material. However, the study also found that without

teacher guidance, AI-based translation tools may foster passive, dependent learning patterns. Therefore, prompt strategies should be considered a critical component in ensuring that AI translation tools are used effectively to enhance motivation and engagement. Educators can guide students in designing prompts that not only direct the AI tools towards more accurate translations but also encourage active participation and deeper analysis of the content.

Among the literature reviewed above on the impact of AI translation technology on English literacy, this study focuses on junior high schools (SMP) in Indonesia, where English is taught as a foreign language. This research contributes new insights into understanding how AI tools can be adapted to meet the needs of students at the primary and secondary education levels. Furthermore, the study emphasises the crucial role of teachers in ensuring that translation outputs are used effectively for learning purposes.

Prompt formulation is not just a technical element but a pedagogical strategy that should be integral to the optimisation of AI translation tools. Theoretically, these findings contribute to a deeper understanding of the integration of technology into language learning. The results of this study indicate that AI translation tools can serve as a supplement in the learning process, but cannot fully replace the role of the teacher. The practical implication is the need for teacher training to integrate AI technology into English literacy instruction effectively. Furthermore, curricula should be designed to include technology-based learning strategies that promote critical use of AI tools.

In the long term, this study contributes to the development of blended learning theory in English language education by incorporating AI-based translation tools as a key component (Munibi, Boeriswati, et al., 2024). For further implementation, additional research is required to assess the effectiveness of various AI translation tools in different learning scenarios, including their impact on communication skills and cross-cultural understanding.

Opportunities to leverage the implementation of AI-based translation tools in enhancing English literacy in Junior High Schools

To identify the opportunities that can be leveraged through the implementation of AI-based translation tools in enhancing English literacy in junior high school classrooms, the table below presents a summary of the potential benefits identified through a literature review:

Table 2. Opportunities in the Use of AI-Based Translation Tools

No	Opportunity	Description	Success Indicators	References
1	Time Efficiency	AI tools such as Google Translate and DeepL accelerate the process of text translation, thereby reducing the time burden on both students and teachers.	The duration of translation is reduced, allowing students to focus more on comprehension.	Untara & Setiawan (2020), Polakova & Klimova (2023)
2	Enhancing Vocabulary Comprehension	AI features assist students in comprehending difficult vocabulary and the contextual	Improvement in vocabulary and context comprehension	Mittal et al. (2024) & Shardlow et al. (2022)

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		meanings of complex sentences.	scores in formative assessments.	
3	Self-Directed Learning	Students can utilize AI tools outside the classroom to engage in independent learning without the need for teacher supervision.	The increased frequency of AI usage by students outside of school hours.	Li et al. (2024) & Tan et al. (2024)
4	Improving Learning Motivation	The ease of use and interactivity of AI tools make English language learning more engaging and enjoyable.	Student motivation has increased, as reflected in their active participation in class and engagement with assignments.	Yeh (2024) & Zhang et al. (2024)
5	Assisting in Text Analysis	AI tools assist students in systematically understanding the main ideas, text structure, and themes.	Enhancing Students' Analytical Skills in Text Interpretation within Summative Assessments.	Schäffer & Lieder (2023) & Yue et al. (2022)

Based on Table 2, five key opportunities can be leveraged from the use of AI-based translation tools: time efficiency, enhanced vocabulary comprehension, self-directed learning, increased motivation, and text analysis skills. Each of these opportunities has significant implications for English language learning in junior high school classrooms. The use of AI translation tools in English instruction at the junior high school level offers valuable opportunities to improve student literacy. One of the primary opportunities is time efficiency in the translation process. Tools such as Google Translate and DeepL enable students to obtain translations within seconds, thereby reducing the time typically required for manual translation (Untara & Setiawan, 2020; Polakova & Klimova, 2023). This time savings enables teachers to allocate time more effectively during lessons, such as facilitating in-depth discussions of text content or analysing linguistic context. The time efficiency also allows for more focus on critical comprehension of texts rather than merely word-for-word translation. Research by Lee et al. (2021) supports this, showing that translation time can be reduced by up to 52.9%, while Wang et al. (2021) observed an increase in time productivity in text comprehension with AI assistance.

In addition to time efficiency, AI-based translation tools also enhance students' vocabulary comprehension. Not only do these tools provide literal translations, but they can also offer contextually appropriate equivalents, often supplemented with synonyms and usage examples (Mittal et al., 2024; Shardlow et al., 2022). With such features, students can better understand new vocabulary in more relevant and practical contexts. Gayed et al. (2022) found that the use of AI tools improves vocabulary comprehension, as students more quickly associate word meanings with different situations. In educational practice, teachers can encourage students to note down new vocabulary acquired through AI and apply it in their own sentences or paragraphs. This practice not only enriches students' vocabulary but also strengthens their understanding of English usage in context.

The next opportunity offered by AI technology is supporting self-directed learning. The ease of access and practicality of AI tools enable students to learn independently without full reliance on teacher guidance (Li et al., 2024; Tan et al., 2024). Through AI-based translation tools, students can explore texts, correct language errors, and independently comprehend their meanings (Vieira et al., 2021). This aligns with the findings of Jin et al. (2023), which show that students feel more confident in learning English independently with the assistance of AI. In this context, AI serves as an interactive learning companion that provides real-time feedback. Self-directed learning supported by this technology allows students to actively explore their abilities in understanding texts, translating sentences, and critically reflecting on their comprehension. Thus, AI can be a crucial component of a blended learning approach, where students engage in independent learning outside the classroom and continue discussions in class.

Moreover, the application of AI in English language learning can enhance students' motivation. The technology's practical, interactive nature makes the learning process more engaging and enjoyable (Yeh, 2024). This positive learning experience fosters students' intrinsic motivation to continue learning and exploring English (Zhang et al., 2024). Research by Hori & Fujii (2021) noted that the use of technology in education can increase student motivation. This motivation arises when students feel satisfied with the instant, valuable outcomes provided by AI technology. In practice, teachers can leverage this technology to design more engaging learning activities, such as gamified translation quizzes or group projects in which students compare AI-generated translations with their own interpretations. The interactivity offered by AI helps create a more dynamic, collaborative, and meaningful learning environment.

The final opportunity for optimisation is the AI-supported text analysis capability. Students not only learn to translate but also gain an understanding of sentence structure, contextual meaning, and stylistic choices in English texts (Schäffer & Lieder, 2023; Yue et al., 2022). With the aid of AI, students can analyse the nuances of meaning and distinguish word choices based on context. A study by Rad et al. (2023) demonstrates that the use of AI tools enhances students' text analysis skills. Teachers can encourage students to compare AI-generated translations with the original text, discuss differences in meaning, and identify linguistic elements such as idioms, metaphors, or complex sentence structures. This activity not only strengthens students' comprehension of the text but also fosters their critical and analytical thinking skills.

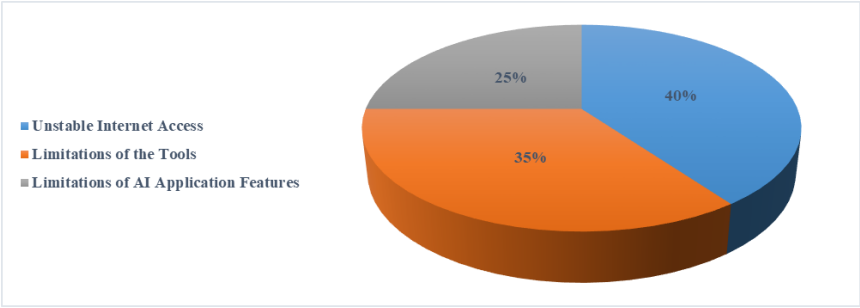
By maximising the opportunities offered by AI-based translation tools, such as time efficiency, enhanced vocabulary comprehension, self-directed learning, increased motivation, and strengthened text analysis skills, English literacy in junior high school classrooms can be significantly improved. When appropriately utilised, AI technology not only helps students understand English texts more quickly and effectively but also encourages them to become more independent, critical, and problem-solving-oriented learners. Therefore, the application of AI in English language learning holds great potential to drive positive transformation in student literacy in this digital age.

The challenges faced by teacher and students in integrating AI translation tools into the English literacy learning procress in junior high school

The integration of AI-based translation tools into the English literacy learning process at the junior high school level has become a significant focus in evaluating the effectiveness

of this technology's implementation. This literature review identifies several substantial barriers, including technical, pedagogical, and contextual limitations.

Technical barriers are among the most common challenges faced by both teachers and students. Issues such as unstable internet access (Khan et al., 2024), inadequate digital devices (Cheshmehzangi et al., 2023), and the limited features of AI translation tool applications have been identified as primary obstacles (Steigerwald et al., 2022). The studies by these three researchers are illustrated in the following graph:

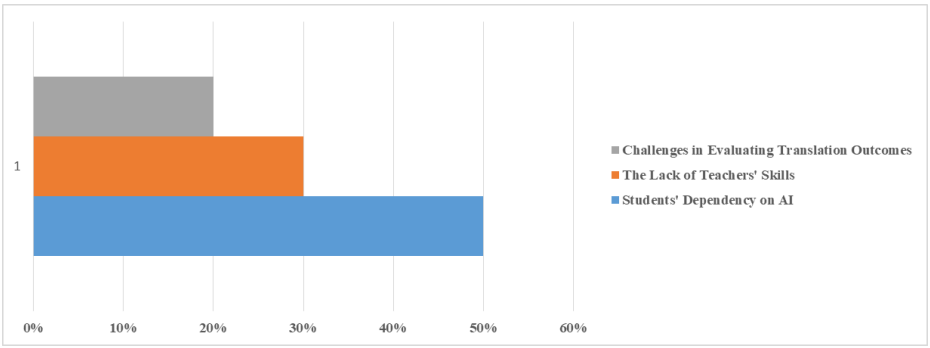


Picture 4. Distribution of Technical Barriers in the Integration of AI Translation Tools

The graph presented in Figure 4 illustrates the distribution of technical barriers encountered in the integration of AI-based translation tools. According to the data, 40% of respondents reported issues with unstable internet access, which can hinder the performance and reliability of translation applications. Furthermore, 35% of respondents identified device limitations as a significant barrier, indicating that not all users have access to adequate devices to run AI applications optimally. Lastly, 25% of respondents noted limitations in the AI application's features, suggesting that although this technology is advancing rapidly, there remains room for improvement in functionality and translation capabilities. The combination of these three factors creates challenges that must be addressed to enhance the adoption and effectiveness of AI translation tools across user groups, including educational settings.

Other studies have shown that schools in rural areas face significant challenges in providing adequate technology infrastructure (Rice, 2024). For instance, using Google Translate or DeepL requires a stable internet connection to produce accurate translations. When internet connectivity is weak, translation processing time increases, hindering learning efficiency. Furthermore, the limited availability of devices such as computers or tablets in many Indonesian junior high schools often forces students to share devices, ultimately reducing individual learning opportunities. The implications of these technical barriers highlight the need for better technology infrastructure, particularly in underdeveloped areas (Marshall et al., 2023). Solutions such as providing school hotspots or utilising AI applications that can function offline present potential areas for further development.

From a pedagogical perspective, the use of AI translation tools also presents challenges, particularly in terms of adapting teaching methods and monitoring students' use of these tools (Celik et al., 2022). Teachers often struggle to ensure that students do not rely solely on AI translation results without understanding the structure or context of the translated language. Celik et al. (2022) illustrate their findings in the graph shown in Figure 5 below:

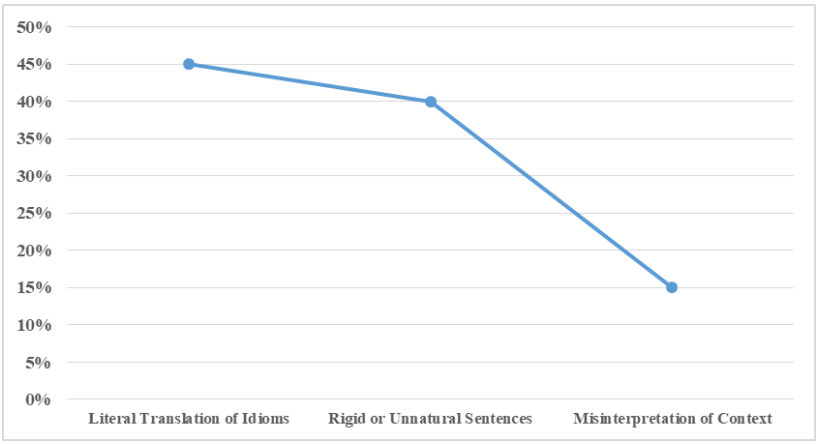


Picture 5. Pedagogical Challenges in the Use of AI Translation Tools

The graph in Figure 5 illustrates the pedagogical challenges associated with the use of AI translation tools, highlighting three key factors, each represented by a percentage. First, the difficulty of evaluating translation results accounts for 20% of the total challenges, indicating that some teachers struggle to assess the accuracy and context of translations generated by AI tools. Second, the lack of teacher skills accounts for 30%, suggesting that many educators lack sufficient knowledge or training to use this technology effectively in the learning process. Finally, student reliance on AI reaches 50%, suggesting that most students rely on translation tools without understanding the underlying linguistic processes, which can hinder the development of their language skills. Thus, the findings provide a clear picture of the challenges that must be addressed to optimise the use of AI translation tools in education.

Further research by Xiaolei & Teng (2024) reveals that the use of AI translation tools may diminish students' critical thinking skills if not accompanied by instruction on assessing translation accuracy. For instance, students tend to accept the translated results without questioning their accuracy or relevance to specific contexts. Moreover, some teachers lack the technical skills needed to integrate AI tools into the curriculum effectively. To address these challenges, teacher training has become an urgent need. Educators must be equipped with a deeper understanding of how to utilise AI tools as interactive learning media that promote a comprehensive understanding of the English language.

AI-based translation tools, despite their sophistication, often fail to capture cultural nuances and local context. For instance, idiomatic expressions or culturally specific phrases in English texts are frequently translated literally by AI tools, leading to confusion among students (Naveen & Trojovský, 2024). One of the findings from the study by Naveen & Trojovský (2024) is illustrated in the graph in Figure 6 below:



Picture 6. Errors of AI Tools in Handling Cultural Context

Based on the graph in Figure 6, AI-based translation tools' errors in handling cultural context are categorised into three groups: literal translation of idioms, rigid or unnatural sentences, and misinterpretation of context. Errors in literal translation of idioms account for the highest percentage, 45%, indicating that AI tends to translate idioms directly without considering their idiomatic meanings. The category of rigid and unnatural sentences ranks second at 40%, reflecting AI's challenges in generating sentence structures that align with natural grammar and communication flow. Meanwhile, the misinterpretation of context is the lowest category at 15%, suggesting that, while less frequent, AI still struggles to understand the broader context that shapes a text's meaning. These data emphasise the need for improving AI's ability to capture idiomatic meanings, natural flow, and cultural context to produce more accurate translations.

Subsequently, research by Davison et al. (2023) emphasises that AI translation tools have limitations in addressing cultural differences between languages, which can hinder the learning of cultural literacy through English texts. In the Indonesian context, the structural differences between English and Indonesian also present a challenge. For instance, translation tools often produce Indonesian sentences that are rigid or unnatural because they adhere to English grammatical structure. This can confuse students, particularly those who are just beginning to learn English.

A potential solution to this challenge is the development of AI tools that are more sensitive to cultural and local contexts. Additionally, teachers can play a crucial role by explaining cultural differences in translated texts to enhance students' understanding. The findings of this study align with global research indicating that technical and pedagogical challenges are the primary barriers to integrating AI technology into education (Tierney et al., 2024). However, the local context in Indonesia adds dimension to these challenges, particularly regarding uneven technological infrastructure and language-based cultural differences. Meanwhile, research by Wong-A-Foe (2023) shows that teachers in Indonesia tend to focus more on the technical aspects of teaching than on integrating digital tools such as AI. This supports the present study's findings that teacher training and improvements in technological infrastructure are strategic steps to address these challenges.

The implications of this study encompass two important dimensions: theoretical and practical. From a theoretical perspective, the findings offer new insights into how technical, pedagogical, and cultural constraints can shape the implementation of AI in

education. This understanding can serve as a foundation for developing new theories more relevant to the integration of AI in a multicultural educational environment. Meanwhile, on the practical level, these findings offer guidance to educators and policymakers in formulating effective strategies for leveraging AI. Implementable measures include enhancing technological infrastructure, providing intensive teacher training, and developing AI tools that are more responsive to the local cultural context.
Overall, although AI translation tools hold significant potential for enhancing English literacy at the junior high school level, various obstacles still need to be addressed. Technical, pedagogical, and cultural challenges may act as barriers if not properly managed. Therefore, solutions such as providing adequate infrastructure, improving teacher competence, and fostering innovation in the development of more contextual and culturally sensitive AI tools are necessary. With these efforts, the implementation of AI technology in education can be optimised, yielding maximum benefits for the learning process.

Conclusion

This study provides new insights into optimising the use of artificial intelligence (AI)-based translation tools in English literacy learning at the junior high school level. A systematic literature review found that AI-based translation tools can enhance learning efficiency, improve vocabulary comprehension, and support independent learning. Additionally, this technology has the potential to motivate students and strengthen text analysis skills. However, the findings also indicate several limitations, including students' reliance on translation results without critical analysis, technical barriers to access and device use, and the lack of cultural context sensitivity in AI tools. Thus, while AI technology holds significant potential, it still requires strong pedagogical intervention and contextual adaptation to ensure its success in English literacy education. Based on these findings, it is recommended that intensive teacher training be conducted to enhance their ability to utilise AI technology effectively and critically. The curriculum should also be designed to integrate technology-based learning strategies that incorporate AI usage. Furthermore, developing AI tools that are more adaptive to local cultural contexts should be prioritised, facilitating a more holistic approach to language learning. Further research is also needed to evaluate the effectiveness of these tools across various learning scenarios, particularly those that focus on students' communication and cross-cultural understanding skills.

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