

Machine translation for language learning: A review of pedagogical integration and digital literacy in ESL contexts

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Abstract

This systematic review investigates the integration of machine translation (MT) tools in English as a Second Language (ESL) education, focusing on pedagogical practices, learner perceptions, and digital literacy outcomes. Drawing from ten empirical studies published between 2020 and 2024, the review synthesizes findings across diverse educational contexts. The methodology follows PRISMA guidelines, involving a structured search across Google Scholar databases. From 200 initial records, 94 full-text articles were screened, and 10 studies were selected for thematic synthesis. Results are organized into four key themes: perceptions and attitudes, writing development, ethical concerns, and pedagogical integration. While many students report increased writing confidence and reduced anxiety when using MT, teachers express mixed views, ranging from cautious acceptance to concern about academic integrity and diminished language acquisition. Several studies emphasize the importance of guided MT use, including pre- and post-editing activities, as a means of promoting grammar awareness and critical language reflection. The review highlights MT's potential to foster digital literacy and learner autonomy when integrated with instructional scaffolding. Conclusively, this study proposes a balanced, reflective approach to MT use in ESL classrooms and calls for pedagogical training and clear assessment policies. The findings offer insights for educators, curriculum designers, and researchers seeking to adapt language instruction in an AI-enhanced learning environment.

Keywords: machine translation, ESL writing, digital literacy, pedagogical integration, language education.

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Contribution to Literature: This article introduces a pedagogical integration model for machine translation in ESL education, combining digital literacy, ethical use, and reflective language practice, an approach not yet thematically synthesized in previous systematic reviews.

1. Introduction

In recent years, the integration of machine translation (MT) tools such as Google Translate has dramatically transformed the landscape of English as a Second Language (ESL) learning. The increasing sophistication of neural machine translation (NMT) systems has enabled learners to access real-time translations that appear increasingly accurate, natural, and contextual (Ducar & Schocket, 2018; Niño, 2020). These developments have provoked pedagogical debates around the ethicality, reliability, and appropriateness of MT tools in classroom settings (Groves & Mundt, 2015; Shen & Bai, 2024).

Machine translation tools are widely used by ESL learners for vocabulary building, grammar checking, and writing development (Garcia & Pena, 2011; Lee, 2020). MT's potential to enhance metalinguistic awareness and support cross-linguistic comparisons has been acknowledged in studies exploring error-based learning strategies through pre- and post-editing (Correa, 2014; Enkin & Mejías-Bikandi, 2016; Somers et al., 2006). However, the pedagogical legitimacy of MT remains contested, particularly concerning its role in fostering or impeding language acquisition (O'Neill, 2019; Stapleton & Kin, 2019).

Learner perceptions toward MT tools are notably diverse. While a majority recognize their value for improving written outputs and facilitating self-correction (Lee, 2020; Niño, 2009), others question their impact on authentic language development and critical thinking (Clifford et al., 2013; White & Heidrich, 2013). Ethical concerns persist, with some students expressing guilt or ambiguity over the legitimacy of MT use in academic contexts, highlighting the blurred boundary between assistance and academic dishonesty (Baker, 2013; Jolley & Maimone, 2015).

Meanwhile, teachers remain ambivalent about MT. While some acknowledge its inevitability and advocate for instructional guidance to mitigate misuse, others regard MT use as counterproductive to communicative competence and learner autonomy (Case, 2015; Eriksson, 2021). Consequently, there is growing interest in pedagogical frameworks that embed MT within meaningful instructional design to foster awareness, promote critical evaluation, and avoid over-reliance (Merschel & Munné, 2022; Zhang & Torres-Hostench, 2022).

Table 1 presents selected key studies that illustrate the evolving discourse on the role of machine translation (MT) in ESL education. For example, Jolley & Maimone (2015) explored EFL students' responses to MT use in writing tasks and found a mix of perceived support and ethical concern, suggesting the need for clearer classroom policies. Lee (2020) investigated how Korean EFL learners revise written texts using MT tools, reporting increased writing fluency and confidence when students engaged in guided post-editing. Meanwhile, Enkin & Mejías-Bikandi (2016) emphasized the metalinguistic value of MT in promoting grammar awareness through pre- and post-editing strategies. Case (2015) provided insights into teacher beliefs, revealing ambivalence rooted in concerns over communicative competence. Finally, Almusharraf & Bailey (2023) highlighted ethical dilemmas and a growing demand for digital literacy training to ensure responsible MT integration. These studies form a foundational base for the present review, which seeks to synthesize their implications within a broader pedagogical framework.

The present article aims to systematically review recent empirical studies on the pedagogical implementation of machine translation in ESL classrooms, focusing on student and teacher perceptions, learning outcomes, and ethical considerations. By analyzing peer-reviewed articles from 2019 to 2024, this review synthesizes findings on how MT supports or hinders ESL learners' writing and learning. Unlike prior reviews that treated MT as a uniform tool, this study offers a thematically organized synthesis of its pedagogical roles, challenges, and emerging best practices, thereby advancing the discourse on integrating MT responsibly in language education.

Table 1. Previous research.

No	Title	Reference
1	Free online machine translation: Use and perceptions by Spanish students and instructors	Jolley & Maimone (2015)
2	The impact of using machine translation on EFL students' writing	Lee (2020)
3	Using online translators in the second language classroom: Ideas for advanced-level Spanish	Enkin & Mejías-Bikandi (2016)
4	Machine translation and the disruption of foreign language learning activities	Case (2015)
5	Machine translation in language acquisition: A study on EFL students' perceptions and practices in Saudi Arabia and South Korea	Almusharraf & Bailey (2023)

2. Literature Review

2.1. The Emergence of MT in Language Education

Machine translation (MT) has undergone significant transformation over the past two decades, transitioning from rule-based systems to neural machine translation (NMT) models capable of producing increasingly natural output (Almusharraf & Bailey, 2023; Case, 2015). Tools such as Google Translate and DeepL are no longer peripheral aids but have become central to how learners engage with second language content. Their ubiquity in informal and academic learning spaces has prompted scholars to reconsider the role of MT in ESL pedagogy (Lee, 2020; Niño, 2020). Research indicates that students often turn to MT for writing support, vocabulary enhancement, and reading comprehension, raising both pedagogical opportunities and ethical questions (Enkin & Mejías-Bikandi, 2016; Jolley & Maimone, 2015).

2.2. Student and Teacher Perceptions of MT Use

Learner perceptions of MT use in ESL classrooms are largely positive. Many students report increased writing confidence, reduced anxiety, and faster task completion when using MT tools (Clifford et al., 2013; Lee, 2020). However, some also express concern over grammatical inaccuracies, idiomatic misinterpretations, and a lack of deep learning when relying on raw MT output (Almusharraf & Bailey, 2023; White & Heidrich, 2013). From the teacher's perspective, reactions are mixed. While some acknowledge MT's inevitability and seek strategies for guided use (Case, 2015; Merschel & Munné, 2022), others worry it diminishes communicative competence and fosters academic dishonesty. These perceptions reveal a pedagogical gap between technological accessibility and instructional readiness.

2.3. MT and Digital Literacy Development

A critical yet often overlooked dimension in MT research is its potential to cultivate digital literacy. As students interact with AI-driven platforms, they develop skills in evaluating machine output, recognizing error patterns, and engaging in post-editing

practices (Zhang & Torres-Hostench, 2022). These activities, when scaffolded appropriately, foster metacognitive awareness and critical language engagement (Lee, 2020). Digital literacy, in this sense, is not limited to technical know-how but includes ethical awareness and strategic tool use, an area that is increasingly vital in AI-mediated learning environments (Enkin & Mejías-Bikandi, 2016).

2.4. Toward a Pedagogical Integration Framework

Figure 1 illustrates a pedagogical model for integrating machine translation (MT) in ESL classrooms through a balanced, scaffolded instructional approach. Drawing from prior studies (Correa, 2014; Merschel & Munné, 2022; Niño, 2020), the model consists of three core stages: (1) student access to MT platforms, (2) guided MT activities such as pre- and post-editing tasks, and (3) reflective editing involving peer review and teacher feedback. These stages are interconnected by three critical pedagogical pillars, digital literacy, error awareness, and teacher scaffolding, which collectively support informed and strategic MT use. Rather than enforcing a binary stance of prohibition or permissiveness, the model advocates for deliberate integration of MT within learning tasks that encourage linguistic analysis, metacognitive reflection, and increased autonomy. This framework positions MT not as a threat, but as a teachable tool embedded in language learning processes.

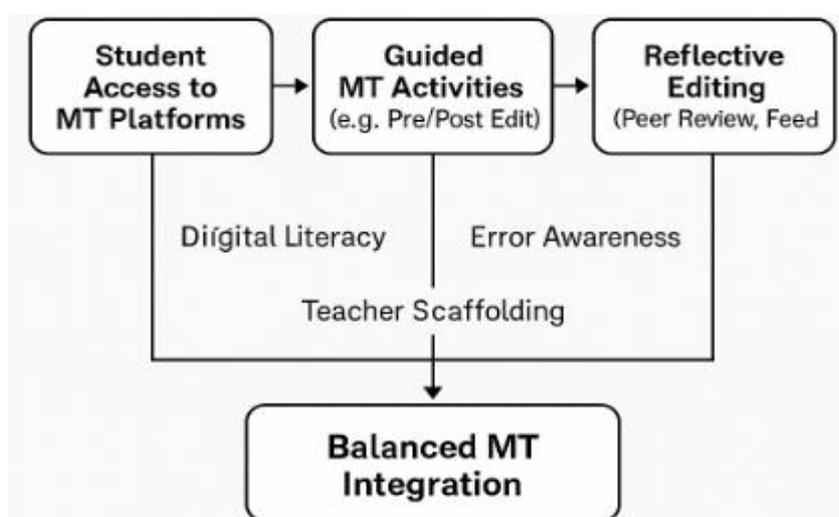


Figure 1. Pedagogical integration model for machine translation in ESL.

3. Research Method

This study employed a qualitative systematic literature review (SLR) design, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to identify, screen, and synthesize relevant studies on machine translation (MT) in ESL education. Searches were conducted in four databases Scopus, Web of Science, ERIC, and Google Scholar—using the keywords “machine translation” OR “Google Translate” AND (“ESL” OR “EFL”) AND (“writing” OR “learning” OR “pedagogy” OR “assessment”). The search was restricted to peer-reviewed articles published in English between 2020 and 2024. To be included, studies had to report empirical findings (qualitative, quantitative, or mixed methods), focus on MT in ESL/EFL contexts, and address pedagogical practices, language learning outcomes, or student-teacher perceptions. Excluded were articles unrelated to language learning (e.g., translation studies or STEM), conceptual papers without data, duplicates, and non-English publications.

The screening process is summarized in Figure 2. From 212 initial records, 94 were selected for full-text assessment after removing duplicates and irrelevant titles. Ten articles that met all inclusion criteria were included in the final synthesis. Data were extracted and analyzed thematically using Braun & Clarke's (2006) framework, focusing on four themes: perceptions of MT use, its role in writing development, ethical and assessment considerations, and digital literacy integration. Findings were compared across contexts to identify patterns, gaps, and implications for pedagogical integration.

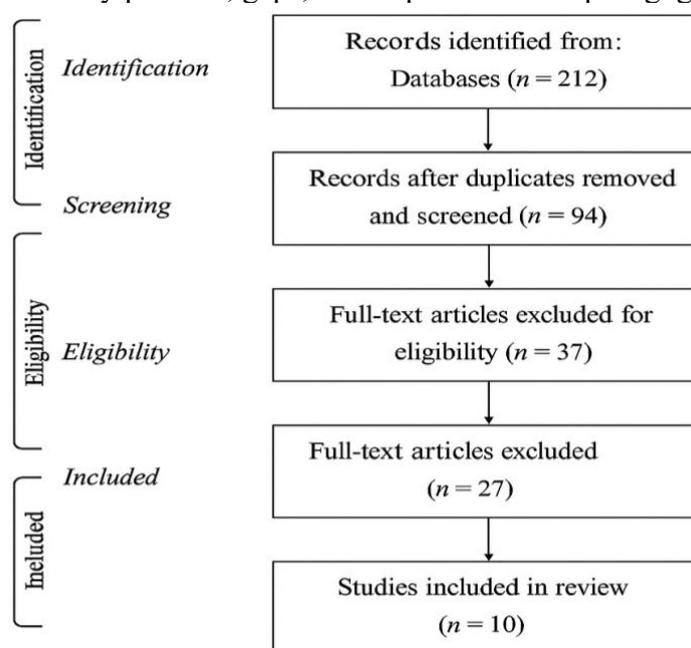


Figure 2. PRISMA flow diagram.

4. Results and Discussion

4.1. Studies on Machine Translation in ESL Education

To map the current research landscape on e-portfolio use in EFL education, Table 2 summarizes ten selected studies that reflect diverse contexts, learner levels, and methodological approaches. Most studies were conducted at the university level in Asian and African contexts, using both conventional and social-media-based platforms. Focus areas ranged from writing and vocabulary development to learner autonomy and reflective pedagogy. This synthesis confirms the pedagogical relevance of e-portfolios in supporting language acquisition, feedback cycles, and student engagement while highlighting gaps in speaking, grammar, and long-term retention. These themes are elaborated in the subsequent sections.

Table 2. Overview of reviewed studies on machine translation in ESL education.

No	Author(s) & Year	Context	Focus Area	Method	Key Finding
1	Jolley & Maimone (2015)	Spanish	Student perception & ethics	Survey	Mixed student responses on usefulness; concerns over academic honesty
2	Lee (2020)	Korea	MT use for revision	Experiment	MT helped learners improve writing fluency and confidence
3	Niño (2020)	Spain	MT writing vs. oral use	Survey	MT was more effective for writing tasks than for oral communication
4	Case (2015)	Japan	Teacher	Interview	Teachers expressed both support

			attitudes		and skepticism; called for training
5	Enkin & Mejías-Bikandi (2016)	Spain	Post-editing tasks	Case study	Post-editing promoted grammar awareness and deeper language reflection
6	Clifford et al. (2013)	USA	Perception and frequency	Survey	High disapproval among teachers; usage varies by context
7	Merschel & Munné (2022)	USA (K–12)	MT policy & pedagogy	Survey	Teachers apply both punitive and preventive strategies for MT use
8	Almusharraf & Bailey (2023)	Saudi Arabia	Ethics & digital literacy	Mixed	Students lacked clarity on ethical boundaries; training needed
9	Zhang & Torres-Hostench (2022)	Spain	MT training and awareness	Experiment	MT training improved learner awareness and self-editing
10	Correa (2014)	USA	Post-editing, writing improvement	Classroom-based	Students improved writing accuracy through guided MT activities

4.2. Perceptions and Attitudes

Student and teacher perceptions toward the use of machine translation (MT) in ESL education are notably varied and reflect both enthusiasm and caution. On the one hand, many students report feeling empowered by MT tools, particularly in writing tasks where they experience increased confidence, reduced anxiety, and quicker text production ([Lee, 2020](#); [Niño, 2020](#)). These tools are often viewed as accessible and nonjudgmental linguistic aids that offer learners immediate feedback and correction opportunities. However, some learners also acknowledge potential drawbacks, such as superficial learning or uncritical copying of MT output, raising questions about overreliance and academic honesty ([Almusharraf & Bailey, 2023](#); [Jolley & Maimone, 2015](#)).

From the teacher perspective, reactions to MT are often more critical. Teachers express concern that students may bypass essential cognitive processes in writing and translation, leading to diminished language acquisition ([Case, 2015](#); [Clifford et al., 2013](#)). While some educators see potential in using MT as a teaching tool, particularly when integrated with reflective editing activities others remain skeptical, emphasizing the need for pedagogical training and institutional guidance ([Merschel & Munné, 2022](#)). These divergent perspectives underscore the necessity of balancing student autonomy with instructional scaffolding to ensure responsible and effective use of MT in language learning environments.

4.3. Writing Development and Learning Outcomes

Several studies have highlighted the potential of machine translation (MT) to support ESL learners' writing development. In particular, MT tools have been shown to enhance writing fluency, lexical variety, and grammatical accuracy when used as part of a guided revision process. For instance, [Lee \(2020\)](#) and [Correa \(2014\)](#) reported that learners who engaged in post-editing tasks using MT outputs developed stronger control over sentence structure and demonstrated greater confidence in text production. These findings suggest that MT, when properly scaffolded, can function as a form of indirect corrective feedback that facilitates language awareness and revision skills.

Furthermore, studies by Niño (2020) and Enkin & Mejías-Bikandi (2016) emphasize the value of MT in promoting metalinguistic reflection. Learners who critically compared MT-generated texts with their own drafts or class models were more likely to notice errors and refine their language choices. This aligns with pedagogical perspectives that position MT as a springboard for analytical thinking rather than a shortcut for task completion. However, as Clifford et al. (2013) caution, the effectiveness of MT in fostering learning depends largely on instructional design. Without explicit reflection, students may accept machine-generated language as authoritative, potentially reinforcing fossilized errors or overlooking contextual nuance.

4.4. Ethical Tensions and Assessment Concerns

As machine translation (MT) becomes more embedded in language education, ethical concerns surrounding its use in assessment and academic integrity have intensified. A recurring issue is the ambiguity students feel about whether using MT constitutes cheating, especially in contexts where institutional policies are unclear or inconsistently enforced (Almusharraf & Bailey, 2023; Jolley & Maimone, 2015). This ethical tension is particularly pronounced in writing assessments, where the line between digital assistance and unauthorized aid is often blurred. Some students report guilt or confusion, while others view MT as a legitimate extension of available learning tools.

From the educator's standpoint, concerns about fairness, originality, and learning authenticity dominate the discourse. Clifford et al. (2013) and Case (2015) highlight that many teachers discourage MT use outright, fearing it undermines language production and critical thinking. Others argue for a more pragmatic approach, integrating MT literacy into assessment practices through open policies and reflective assignments. Merschel & Munné (2022) propose that punitive-only responses to MT use are no longer sustainable; instead, they advocate for preventive strategies, such as transparency, guided tasks, and clear learning objectives that align MT use with pedagogical intent. This shift calls for institutions to redefine assessment frameworks to accommodate the realities of AI-enhanced learning.

4.5. Pedagogical Integration and Digital Literacy

Effective use of machine translation (MT) in ESL instruction depends largely on how well it is embedded into pedagogical design and how it contributes to students' digital literacy. Rather than banning MT or allowing unrestricted use, several studies argue for guided integration through structured tasks such as pre-editing, post-editing, and MT output evaluation (Correa, 2014; Zhang & Torres-Hostench, 2022). These activities not only support language learning but also promote critical engagement with digital tools, helping students to identify errors, reflect on language choices, and improve their editing practices.

A recurring theme in recent research is the need for MT-related digital literacy defined as learners' ability to navigate, evaluate, and ethically use AI-based tools in academic contexts (Almusharraf & Bailey, 2023). Instruction that incorporates MT literacy not only enhances students' linguistic autonomy but also prepares them for real-world multilingual environments where translation technologies are commonplace. Zhang & Torres-Hostench (2022) found that even brief MT training sessions significantly improved learners' metacognitive strategies, editing awareness, and understanding of the tool's limitations. As such, MT should not be seen as a shortcut, but rather as a learning object in itself, one that requires teacher mediation, curricular support, and digital ethics awareness.

5. Conclusion

This systematic review examined recent empirical studies on the integration of machine translation (MT) in ESL education, focusing on four key themes: perceptions and attitudes, writing development, ethical concerns, and pedagogical integration. Findings reveal that while students generally view MT tools as empowering, teachers remain divided some perceiving them as supportive aids, others as threats to authentic learning. When strategically embedded in instruction, MT can enhance learners' writing skills, grammar awareness, and digital literacy. However, uncritical or unguided use may lead to ethical dilemmas, overdependence, and missed opportunities for language acquisition. The review underscores the importance of reframing MT not as an external disruption, but as a pedagogical tool that when used critically can foster reflective learning, metacognition, and digital competence. As AI technologies continue to shape educational practice, ESL educators and institutions must move toward pedagogically informed integration supported by clear guidelines, training, and ethical frameworks. Future research is needed to explore the long-term impacts of MT use on language proficiency, as well as to develop models for MT literacy across diverse educational contexts.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions

Yani: Conceptualization, initial draft writing; Bagus: Methodology, data collection; Ikra: Editing, and revision.

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