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RESEARCH TIMELINE

Machine translation and language teaching and learning

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1. Introduction

Decades before educators were forced to confront the disruption posed by widely accessible generative artificial intelligence (AI) tools such as ChatGPT, language learners, instructors, and researchers began dealing with its game-changing predecessor: machine translation (MT). Researchers began assessing MT systems and proposing language teaching applications for them as soon as universities and schools gained access to them in the mid-1980s (*Anderson, 1995*; Ball, 1989*; Corness, 1985; French 1991; Lewis, 1997; Richmond, 1994*). These inquiries accelerated in the early 2000s, when internet-enabled computer labs and increasingly smarter devices put free online MT services such as Babel Fish and Google Translate (GT) at students' fingertips, triggering concerns over output quality, academic dishonesty, and the short-circuiting of actual learning. In recent years, there has been a veritable explosion of research on MT's role in and impact on language teaching and learning, with many dozens of peer-reviewed articles published in the past five years alone, as documented in a handful of comprehensive literatures reviews (Gokgoz-Kurt, 2023; Jiang et al., 2024; Jolley & Maimone, 2022; Klimova et al., 2023; Lee, 2023). The present article provides a timeline of this rapidly expanding research domain.

Hutchins and Somers (1992) define MT as "computerised systems responsible for the production of translations from one natural language into another, with or without human assistance" (p. 3). A detailed account of the history and evolution of MT technology, capabilities, and applications is beyond the scope of this timeline and available elsewhere (Garg & Agarwal, 2019; Hutchins, 2010; Németh, 2019; Pestov, 2018). However, given the impact of MT's evolving functionality on research in the domain in question, familiarization with its major developmental milestones is important. Hutchins (2010) dates MT's origins to the late 1940s, coinciding with the invention of computers. During the 1950s and 1960s, the Cold War tech race and advances in computational linguistics fueled developments. By the 1980s, early commercial systems, such as SYSTRAN, Logos, and METAL, previously available only on mainframes in government or military facilities, could be installed on home computers and desktop workstations in schools and universities. SYSTRAN's Babel Fish, generally considered the first free online MT tool, was launched as a website in 1997, nine years before GT debuted in 2006. In the years since, advances in smartphone technology and network coverage have connected billions of people to MT and generative AI apps that translate just as well.

MT capabilities and quality have increased in step with these advances in accessibility. The earliest MT systems relied on technology known as rule-based MT, whereby automated transfer operations are executed using one-to-one lexical substitutions and preprogrammed morphosyntactic rules. By the 1990s, this rudimentary approach had largely been replaced by more sophisticated databank- and corpus-based approaches that target phrase-level equivalents, such as example-based MT, which identifies analogous phrases from aligned parallel text databanks, and statistical MT, which analyzes patterns in bilingual corpora and calculates probabilities to determine optimal word combinations and sequences. The most recent major advance in MT technology happened in 2016, when GT switched

*Indicates that the full reference is available in the subsequent timeline.

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its underlying architecture to a neural machine translation (NMT) model. A powerful form of machine learning, NMT uses artificial neural networks to analyze large datasets, training itself to predict the most likely sequences of words in sentences. NMT has been shown to be substantially more accurate than previous systems. For example, Wu et al. (2016) found that NMT-powered GT (GNMT) commits 60% fewer errors than the previous phrase-based model and approaches the accuracy levels of experienced human translators. Recent assessments of the translation capabilities of large language models (LLMs) have demonstrated that they are also highly accurate (Moslem et al., 2023), with some suggesting that LLMs are the new paradigm for MT development (Xu et al., 2024).

As the most recent stages outlined in this MT history overview unfolded, four clearly discernible strands or subdomains of the research into MT and language education have emerged. Research in this field rests on foundational articles that describe the history and capabilities of the first MT systems available in instructional settings, often suggesting potential applications in translator training and language programs (Anderson, 1995*; Ball, 1989*; Corness, 1985; French, 1991; Hutchins & Somers, 1992; Lewis, 1997; Richmond, 1994*; Somers, 2001). A second clearly identifiable strand involves a cluster of survey-based studies designed to gauge how often, in what ways, and for what reasons students use MT in their language learning activities, as well as the perceptions, beliefs, and attitudes learners and instructors hold regarding various aspects of MT, including specific kinds of uses (Case, 2015*; Clifford et al., 2013*; Farzi, 2016*; Hellmich & Vinall, 2023*; Jolley & Maimone, 2015*; Knowles, 2016*; Larson-Guenette, 2013*; Niño, 2009*; *O'Neill, 2019a*; and White & Heidrich, 2013*, among others). This research relates to a third strand, which centers around questions of academic dishonesty. Many publications in this strand argue that unauthorized MT use is, in fact, cheating and should be discouraged through detection and prevention strategies (Correa, 2011, 2014*; Harris, 2010; Luton, 2003; McCarthy, 2004; Steding, 2009*). As a corollary to this line of thought, a handful of empirical studies have sought to determine whether instructors are able to reliably detect MT use and to identify the telltale signs of MT as compared with unassisted translation or direct second language (L2) writing (Innes, 2019*; Maimone & Jolley, 2023*; O'Neill, 2012*; Somers et al., 2006*; Stapleton & Leung, 2019*). Finally, the bulk of publications in this research field may be categorized as pertaining to a strand focused on the uses of and implications for MT in formal language learning contexts. These articles discuss ways in which MT may be or has been used to support language learning, as well as its impact on performance (particularly on L2 writing output), and often discuss pedagogical implications (Ducar & Schocket, 2018*; Garcia & Pena, 2011*; Fredholm 2015*, 2019*; Lee, 2020*; Niño, 2004*, 2008*, O'Neill, 2012*, 2019b*; Vold, 2018*; and Williams, 2006*, among others), including the importance of MT literacy (Bowker, 2020; Loock et al., 2022*; Pellet & Meyers, 2022*). Individual learner differences, such as proficiency level (Chung, 2020*; Chung & Ahn, 2021*; Lee, 2022*; Mujtaba et al., 2022*; Shin & Chon, 2023*), learner strategies (Lee, 2020*; Ryu et al., 2022*; White & Heidrich, 2013*), and motivation (Tsai & Liao, 2021), as well as the role of MT and translation more broadly in supporting translanguaging approaches (Beiler & Dewilde, 2020; Hell et al., 2022*; Heugh et al., 2022; Jiang et al., 2024; Kelly & Hou, 2021*; Rowe, 2022; Zhou et al., 2022), are also frequent themes in this strand. Overall, the studies in this timeline suggest many practical applications for MT in language teaching, even if findings have been somewhat contradictory (Lee, 2022*), and more studies investigating whether MT use actually supports language development or durable proficiency gains are needed (Jolley & Maimone, 2022).

The present timeline includes 63 publications. One challenge in providing a representative sampling of notable articles from each of the subdomains summarized above is that many empirical studies in this field are relatively recent. As a whole, this domain has seen a gradual progression from articles grounded in personal perspectives or anecdotal observations to small-scale exploratory experiments to more rigorous empirical studies. In selecting articles for inclusion, we prioritized empirical studies published after the advent of GT. However, we also opted to include a handful of earlier and non-empirical articles that have been especially influential or that propose systematically designed pedagogical uses for MT. We elected to consider influential doctoral dissertations but to exclude master's theses. To maintain a focus on research with an explicit emphasis on the intersection of MT and language teaching and learning, we disregarded studies more narrowly focused on translator training.

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We also excluded non-English sources. The publications included in this timeline are categorized according to the following themes:

A. Use of and perceptions about MT and language learning
1. Learner use: frequency, types, and reasons
2. Learner perceptions of MT: accuracy, usefulness, appropriateness, etc.
3. Instructor use: frequency, types, and reasons
4. Instructor perceptions of MT: accuracy, usefulness, appropriateness, etc.

B. MT and academic dishonesty
1. Belief that unauthorized use of MT is a form of cheating
2. Detection: emphasis on detection or instructor ability to detect MT use
3. Signs: textual features characteristic of MT use
4. Response to unauthorized use of MT (resist vs. accept, policies, etc.)

C. Instructional applications of MT to promote leaning
1. Proposal of or report on MT-enhanced learning activity
2. Use of pre-editing or post-editing activities to raise linguistic awareness
3. Proposal of or report on MT-enhanced pedagogical strategies or model
4. Focus on MT training or MT literacy
5. Other pedagogical implications or recommended bast practices

D. Impact of MT on L2 writing (products, process, overall quality, textual features, etc.)

E. Contributions of MT use to language development or proficiency gains

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Year	References	Annotations	Theme
1989	Ball, R. V. (1989). Computer-assisted translation and the modern languages curriculum. *The CTISS File*, *8*, 52–55.	In the first publication to propose specific instructional applications for MT, **Ball** explores the use of the MicroCAT MT system in a French degree program. He suggests two MT-enhanced activities (correction and reconstruction) beneficial for language learners. Additionally, three modes of applying MT are discussed: learning about a foreign language, introducing learners to MT concepts, and evaluating specific system capabilities.	**C1, C2**
1994	Richmond, I. M. (1994). Doing it backwards: Using translation software to teach target-language grammaticality. *Computer Assisted Language Learning*, *7*(1), 65–78.	**Richmond** proposes an MT-enhanced activity in which students pre-edit first language (L1) input as a way of raising awareness of L2 "grammaticality," a process he likens to processing instruction. Richmond argues that such pre-editing activities support acquisition by increasing learners' awareness of their L1 and the target language (TL) and that this "backwards translation" method is a complex cognitive activity that emphasizes linguistic processes and input over forms and output.	**C1, C2**
1995	Anderson, D. (1995). Machine translation as a tool in second language learning. *CALICO Journal*, *13*(1), 68–97.	**Anderson** argues that despite the overall poor performance of the MT systems of the day, MT output can be leveraged to enhance L2 learning. He proposes an MT output correction activity for the Targumatik MT system (Hebrew to English) in which learners apply a multi-step set of analysis and correction procedures he calls the "learning algorithm" to repair errors in the output, guided by a reference translation. Anderson asserts that this process raises awareness of L1 and TL features.	**C1, C2**
2004	Niño, A. (2004). Recycling MT: A course on foreign language writing via MT post-editing. *Proceedings of 7th Annual CLUK Research Colloquium* (pp. 179–187). University of Birmingham, Centre for Computing & Computer Science.	In the first empirical turn in this research domain, **Niño** reports results from two exploratory studies designed to gauge the potential for MT post-editing as a resource in L2 writing instruction. In the first study, L2 learners of Spanish who post-edited committed more grammatical errors but fewer lexical errors than the MT system. In the second experiment, participants using MT post-editing had a lower error percentage that learners who translated directly into their L2. Niño recommended integrating MT post-editing into the classroom to enhance the L2 writing process.	**C1, C2, C5, D**

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Note. Authors' names are shown in small capitals when the study referred to appears in this timeline.

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Year	References	Annotations	Theme
2006	Somers, H., Gaspari, F., & Niño, A. (2006). Detecting inappropriate use of free online machine-translation by language students: A special case of plagiarism detection. *Proceedings of the 11th Annual Conference of the European Association for Machine Translation* (pp. 41–48). European Association for Machine Translation.	This study is the first to explore the question of detecting unauthorized MT use empirically. Using measures drawn from computational stylometry, the authors compared lexical and syntactic characteristics of two groups of texts created by university language learners, direct L2 translations and lightly post-edited Babel Fish (MT) versions, to determine whether they differed significantly and how similar they were to raw MT output. All measures showed clear distinctions between "honest" and derived texts, supporting the potential of automated plagiarism detection.	**B1, B2, B3**
2006	Williams, L. (2006). Web-based machine translation as a tool for promoting electronic literacy and language awareness. *Foreign Language Annals*, *39*(4), 565–578. https://doi.org/10.1111/j.1944-9720.2006.tb02276.x	In the first publication to explicitly focus on MT literacy or training, **Williams** approaches the issue of MT as a significant opportunity to promote electronic and informational literacy. He presents a detailed pedagogical plan for introducing web-based MT (WBMT) to language students, arguing that although WBMT is far from perfect, learners need to be familiar with its strengths and weaknesses and understand how it might be used or misused in various linguistic, social, and educational contexts.	**C3, C4**
2008	Niño, A. (2008). Evaluating the use of machine translation post-editing in the foreign language class. *Computer Assisted Language Learning*, *21*(1), 29–49. https://doi.org/10.1080/09588220701865482	**Niño** used computer-aided error analysis to investigate the error patterns. Analyses of texts produced by participants in a post-editing group and in a direct translation group revealed no significant differences in terms of the lexical, grammatical, and discursive errors between the groups. Citing these results, Niño claims that raw MT output can serve as meaningful input when teaching L2 writing processes and that post-editing may enhance L2 accuracy by promoting focus on form and negotiation of meaning.	**C1, C2, C5, D**
2009	Abraham, L. B. (2009). Web-based translation for promoting language awareness: Evidence from Spanish. In L. B. Abraham & L. Williams (Eds.), *Electronic discourse in language learning and language teaching* (pp. 65–83). John Benjamins. https://doi.org/10.1075/lllt.25.06abrl	This study reports the results of an experiment designed to understand the potential for MT-mediated translation tasks in promoting L2 learners' awareness of lexical and grammatical features. **Abraham** analyzed recorded dialogues in which intermediate university learners of Spanish discussed MT-generated Spanish versions of English sentences, evaluating them for correctness and repairing errors. Findings indicated that discussing MT-generated translations promoted linguistic awareness among participants, consistent with post-editing benefits cited by Niño (2008), and Abraham advocates for the kind of MT literacy training recommended by Williams (2006).	**C1, C2, C4**

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2009	Niño, A. (2009). Machine translation in foreign language learning: language learners' and tutors' perceptions of its advantages and disadvantages. *ReCALL*, *21*(2), 241–258. https://doi.org/10.1017/S0958344009000172	This article summarizes four pedagogical uses of MT and reports results from a survey of language tutors and L2 Spanish learners regarding the usefulness of MT in language teaching and learning, one of the first of its kind. Tutors expressed concerns about MT output quality and focus on forms applications (as opposed to communicative strategies), while 75% of students said MT is a helpful tool, and 81% felt MT use had helped them in their learning of Spanish.	**A1, A2, A3, A4, C1, C2, C5**
2009	Steding, S. (2009). Machine translation in the German classroom: Detection, reaction, prevention. *DieUnterrichtspraxis*, *42*(2), 178–189. https://doi.org/10.1111/j.1756-1221.2009.00052.x	In this influential essay, **Steding** proposes a comprehensive approach to unauthorized MT use that identifies three tasks for educators: detecting MT use, responding to MT use, and preventing MT use. In emphasizing the importance that instructors know their students and the technology, Steding explores key differences between L2 learner writing and MT output, identifying a number of telltale signs. He also proposes strategies for reacting to and preventing cases of cheating, including clear MT policies and so-called smart assignments.	**B1, B2, B3, B4**
2011	Garcia, I., & Pena, M. I. (2011). Machine translation-assisted language learning: writing for beginners *Computer Assisted Language Learning*, 24(5), 471–487. https://doi.org/10.1080/09588221.2011.582687	In this influential study on the effects of MT on L2 writing performance, **Garcia and Pena** used screen recordings, grader markings, and survey questions to investigate whether MT helps develop L2 writing skills in beginning and early intermediate learners of Spanish. Results indicated that MT assistance helped participants produce texts that were longer, marginally better in overall quality, and written with less effort. Learners reported that they were able to express themselves better with MT assistance but held mixed views regarding whether MT actually facilitated their language learning. This study's design influenced most subsequent research focused on L2 writing performance (e.g., Cancino & Panes, 2021; Chung & Ahn, 2021; Fredolhm, 2015; Kol et al., 2018; Lee, 2020; Mutjaba et al., 2022; O'Neill, 2012; and Wang & Ke, 2022).	**A1, A2, D**
2012	O'Neill, E. M. (2012). *The effect of online translators on L2 writing in French* (Publication No. 3600901) [Doctoral dissertation, University of Illinois at Urbana-Champaign]. ProQuest Dissertations Publishing.	In his dissertation, **O'Neill** used rater grading, keystroke tracking, and questionnaires to examine the impact of trained and untrained MT use on the L2 writing products of university French students, to determine whether raters could detect MT use, and to ascertain learner beliefs about MT use. In terms of quality, results indicated no effect for training, but participants with access to MT performed significantly better on measures for comprehensibility, grammar, and spelling than the non-MT group. Raters were able to successfully judge whether compositions were written with or without MT help in 70.7% of instances. Students who used MT reported using it most frequently to look up individual words and short phrases but also for help with spelling, grammar, and syntax. Overall, they emphasized positive	**A1, A2, B2, B3, B4, C4, C5, D**

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		aspects of MT assistance. In addition to influencing L2 writing studies such as those mentioned in previous entry, this study's focus on MT use detection was a precursor to Maimone & Jolley (2023), which had similar findings.	
2013	Clifford, J., Merschel, L., & Munné, J. (2013). Surveying the landscape: What is the role of machine translation in language learning? *@tic Revista d'Innovació Educativa*, *10*(5), 108–121.	This pioneering perceptions study surveyed university L2 learners and instructors of Romance languages about their uses of and perceptions about MT in instructed language learning contexts. Most students reported using MT (88%), with 71% using it sometimes or often, most frequently to translate individual words and short phrases. Most students said MT facilitated their language learning, and 78% believed it to be reasonably accurate. They also identified several acceptable uses. In contrast, instructor views were largely negative, with 43% equating MT use with cheating and 77% disapproving or strongly disapproving of student use. Expanding upon Niño (2009), this study and Jolley & Maimone (2015) are touchstones for subsequent perceptions studies, many of which report similar results (see Ata & Debreli, 2021; Case, 2015; Hellmich & Vinall, 2023; Knowles, 2016; O'Neill, 2019a; and Xu, 2021).	**A1, A2, A3, A4, B1, B4, C5**
2013	Larson-Guenette, J. (2013). "It's just reflex now": German language learners' use of online resources. *Die Unterrichtspraxis*, *46*(1), 62–74. https://doi.org/10.1111/tger.10129	**Larson-Guenette** reports findings from surveys and interviews focused on uses of and perceptions about online resources (dictionaries and MT) by university L2 German learners. Results indicated that students use these resources consistently to support their language learning, motivated primarily by time constraints and efficiency concerns. Some participants believed online resources are beneficial to their language learning, but others expressed conflicting views or uncertainty. For example, some advanced students felt overuse of online tools could lead to dependency and harmful effects on learning.	**A1, A2, C5**
2013	White K. D., & Heidrich, E. (2013). Our policies, their text: German language students' strategies with and beliefs about web-based machine translation. *Die Unterrichtspraxis*, *46*(2), 230–250. https://doi.org/10.1111/tger.10143	This research reports the results of a mixed methods study focused on learner strategies for using WBMT before and during a translation task and related views. Participants engaged in a task that involved direct L1 writing, pre-editing of that draft, generation of an MT version, and post-editing. During post-editing, students reduced structural and contextual errors, but introduced additional nominal and verbal errors, struggling with less familiar, more complex structures. As in Larson-Guenette (2013), students reported mixed views about MT use, noting that using it felt like cheating but that it helped them better organize their texts, find appropriate forms to use, and complete the task successfully.	**A1, A2, C5, D**

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2014	Correa, M. (2014). Leaving the "peer" out of peer-editing: Online translators as a pedagogical tool in the Spanish as a second language classroom. *Latin American Journal of Content and Language Integrated Learning*, *7*(1), 1–20.	In this influential essay, **Correa** emphasizes unauthorized MT use detection and prevention and provides a list of MT use signs gleaned from Niño (2009), Somers et al. (2006), and Williams (2006). She proposes introducing MT into the language classroom for two purposes: to discourage academic dishonesty and to raise metalinguistic awareness. She encourages using pre- and post-editing activities to raise awareness of L1 and TL forms and to show learners that they can outperform MT tools, a strategy designed to discourage cheating.	**B1, B2, B3, C1, C2**
2015	Case, M. (2015). Machine translation and the disruption of foreign language learning activities. *eLearning Papers*, *45*, 4–16.	**Case** reports the results of a survey designed to gauge instructor attitudes and beliefs about learner MT use, including beliefs about academic dishonesty. As with Niño (2008), this article offers a state-of-art perspective and thorough literature review. Most instructors (63%) believed that using MT for sentences or longer segments is cheating, and 77% said that that detecting MT use was easy. Case identified three themes in the instructor responses: (1) MT systems do not work as well for all language pairs, (2) the acceptability of use depends on the nature of the task and student level, and (3) MT is here to stay, and teachers need to adapt. See Knowles (2016) for an additional instructor perceptions study.	**A3, A4, B1, B2, C5**
2015	Fredholm, K. (2015). Online translation use in Spanish as a foreign language essay writing: Effects on fluency, complexity and accuracy. *Revista Nebrija de Lingüística Aplicada*, *9*(18), 7–24. https://doi.org/10.26378/rnlael918248	**Fredholm** investigated the effects of MT use on the grammatical and lexical complexity and accuracy in L2 writing by intermediate-level secondary L3 learners of Spanish in Sweden. Similar to Garcia & Pena (2011), students with access to online translation wrote more than the non-MT group. Results also indicated small but statistically significant effects for fluency and complexity, but not for accuracy. Fredholm speculates that the modest differences among groups may have more to do with proficiency level and technology savvy than with MT capabilities. Several subsequent L2 writing studies would integrate Fredholm's focus on CAF (complexity, accuracy, and fluency) measures (see Cancino & Panes, 2021; Chon & Shin, 2023; Chon et al., 2021, Chung & Ahn, 2021; Mujtaba et al., 2022; and Tsai, 2019).	**A1, C5, D**
2015	Groves, M., & Mundt, K. (2015). Friend or foe? Google Translate in language for academic purposes. *English for Specific Purposes*, *37*, 112–121. https://doi.org/10.1016/j.esp.2014.09.001	In this small-scale but often-cited study designed primarily to assess the capabilities of MT (GT), students composed essays in their L1 (Malaysian and Chinese), which were submitted to GT by the researchers and then subjected to an error typology analysis. The researchers concluded that the GT versions clearly showed the capacity of MT to translate lengthy stretches into clear, formal English, despite occasional breakdowns. They conclude with a substantial discussion of the implications of the likely continued improvement of MT systems for English for Academic Purposes (EAP) contexts, including academic dishonesty concerns.	**B4, C5, D**

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Year	References	Annotations	Theme
2015	Jolley, J., & Maimone, L. (2015). Free online machine translation: Use and perceptions by Spanish students and instructors. In A. J. Moeller (Ed.), *Learn languages, explore cultures, transform lives* (pp. 181–200). Central States Conference on the Teaching of Foreign Languages.	This study reports survey results regarding the uses of and beliefs about MT by university-level learners and instructors of Spanish. As in Clifford et al. (2013), results indicated that nearly all learners (96%) had used MT, with 36% indicating frequent use. Students reported using MT most frequently to translate individual words or short phrases. They expressed high degrees of confidence in the accuracy of MT (71.1% judging it to be accurate or somewhat accurate, compared with 64.1% of instructors), and 87% said that whether MT use equates to cheating depends on how it is used (compared with 82% of instructors with the same belief). Instructors overestimated the frequency with which students turn to MT. The authors provide several recommended best practices, highlighting the need for MT training for both groups and clear policies on online translators. See Ata & Debreli (2021) for a replication with Turkish English as a Foreign Language (EFL) learners and instructors.	**A1, A2, A3, A4, B1, B4, C4, C5**
2016	Farzi, R. (2016). *Taming translation technology for L2 writing: Documenting the use of free online translation tools by ESL Students in a writing course* [Unpublished doctoral dissertation]. University of Ottawa.	**Farzi's** dissertation reports a mixed-methods experiment (observations, writing task, self-reports) focused on how ESL students use free online MT (FOMT) when completing writing tasks, the effectiveness of such use, and learner beliefs and attitudes about MT. Findings on MT use were consistent with those of Clifford et al. (2013), and Jolley & Maimone (2015). MT use was judged effective for producing technically accurate and natural sounding English translations. A majority of participants found using MT helpful, but those that used it most frequently expressed lower levels of satisfaction.	**A1, A2, C2, D, C5**
2016	Knowles, C. L. (2016). *Investigating instructor perceptions of online machine translation and second language acquisition within most commonly taught language courses* (Publication No. 1029627) [Doctoral dissertation, The University of Memphis]. ProQuest Dissertations Publishing.	This dissertation reports a mixed-methods study focused on the effects of an instructional intervention on perceptions and attitudes of university language instructors about MT. After completing a series of MT familiarization modules, the percentage of instructors who agreed or strongly agreed that MT use can be beneficial for learners rose from 50% to 70%, and the percentage who believed that the benefits of MT use outweigh its barriers increased from 30% to 45%. Post-intervention, more participants were willing to integrate and assess student use of MT resources.	**A3, A4, B1, B4, C4, C5**
2017	Tight, D. G. (2017). Tool usage and effectiveness among L2 Spanish computer writers. *Estudios de Lingüística Inglesa Aplicada*, *17*, 157–182. https://doi.org/10.12795/elia.2017.i17.07	This small-scale study used screen recordings to track digital tool usage by intermediate university L2 learners of Spanish engaged in low stakes writing tasks. Results indicated that GT was the most frequently consulted tool, used mostly for single words and short phrases, consistent with O'Neill (2012), Clifford et al. (2013) and	**A1, C2, C4, D**

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		Jolley & Maimone (2015). GT was less successful than Wordreference.com, Spanishdict.com, and Microsoft Word's built-in spelling and grammar check features at facilitating accuracy.	
2018	Deifell, E. D. (2018). *Dynamic intertextuality and emergent second language microdevelopment in digital space* [Doctoral dissertation, University of Iowa]. Iowa Research Online.	Using a multiple case study approach, this dissertation investigated how students in a university Spanish literature course used textual resources to support naturalistic L2 writing and whether intertextual activity contributed to linguistic development. Findings indicated that participants employed numerous strategies and accessed a variety of resources (online dictionaries, MT tools, translated texts, etc.). From a dynamic systems theory perspective, **Deifell** found emerging evidence of word and strategy learning.	**A1, C1, C5, D, E**
2018	Ducar, C., & Schocket, D. H. (2018). Machine translation and the L2 classroom: Pedagogical solutions for making peace with Google Translate. *Foreign Language Annals*, *51*(4), 779–795. https://doi.org/10.1111/flan.12366	This wide-ranging state-of-the-art piece begins by recognizing that MT and its use by students are inescapable realities in language teaching and learning. The authors then summarize existing research on MT, analyze the strengths and weaknesses of GT, document telltale signs of MT use, and propose pedagogical strategies language instructors should explore to responsibly integrate MT and more reliable alternatives into their teaching.	**B1, B3, B4, C4, C5**
2018	Kol, S., Schcolnik, M., & Spector-Cohen, E. (2018). Google Translate in academic writing courses? *The EuroCALL Review*, *26*(2), 50–57. https://doi.org/10.4995/eurocall.2018.10140	The authors designed experiments to measure intermediate- and advanced-level EAP students' ability to correct errors in MT output and to determine whether use of GT on writing tasks improved the quantity and quality of L2 writing. Advanced students were able to identify and correct more errors than intermediate learners. Participants in the GT group wrote longer texts with richer vocabulary and significantly higher readability levels than the non-MT group, shoring up the claims of Goves & Mundt (2015).	**C1, C2, C5, D**
2018	Vold, E. T. (2018). Using machine translated texts to generate L3 learners' metalinguistic talk. In Å. Haukås, C. Bjørke, & M. Dypedahl (Eds.), *Metacognition in language learning and teaching* (pp. 67–97). Routledge. https://doi.org/10.4324/9781351049146	**Vold** reports a small-scale study in which Norwegian secondary third language (L3) learners of French analyzed and critiqued two MT-produced versions of a brief text. Analyses of participant discussions indicated that comments tended to be quite general and that learners paid more attention to vocabulary than to grammar. The author concludes that MT output analysis has potential to enhance language awareness but requires training and scaffolding techniques. The idea that output analysis facilitates awareness of language features connects this research to proposals made by Richmond (1994), Anderson (1995), and Niño (2004).	**C1, C2, C5**
2019	Fredholm, K. (2019). Effects of Google Translate on lexical diversity: Vocabulary development among learners of Spanish as a foreign language. *Revista Nebrija de Lingüística Aplicada a la Enseñanza de Lenguas*, *13*(26), 98–117. https://doi.org/10.26378/rnlael1326300	This reports a longitudinal study focused on vocabulary development, wherein two groups of students completed a number of L3 writing tasks in Spanish, one with access to GT, the other allowed to use conventional dictionaries only. Results indicated that GT use	**C1, C5, D, E**

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Year	References	Annotations	Theme
		promoted greater lexical diversity, but gains evaporated when access was removed, suggesting no lasting effect. A novel feature of this study is that it sought to verify whether MT-related gains in lexical diversity persisted over time (see O'Neill, 2019, for an additional study addressing language development).	
2019	Innes, A. R. B. (2019). Differentiating between translation and student translation: Red flags and salient lexicogrammatical features. *Lublin Studies in Modern Languages and Literature*, *34*(4), 1–13. https://doi.org/10.17951/lsmll.2019.43.4.1-13	**Innes** reports an experiment in which texts translated into English by advanced Japanese learners were compared with GT-generated versions by native-speaking English teachers to determine whether they could reliably detect MT use and what signs they associated with both modes. The percentage of raters making the correct identification varied by text set from 59% to 94%, with a mean score of 74%, results in line with other human MT detection studies (see also O'Neill, 2012, and Maimone & Jolley, 2023).	**B1, B2, B3**
2019	Murphy Odo, D. (2019). Learner perceptions of using machine translation tools in the EFL classroom. *The SNU Journal of Education Research*, *28*(2), 63–83.	**Murphy Odo** studied Korean student perceptions about the usefulness of MT in supporting reading comprehension in EAP contexts. Students received orientation regarding MT tool use and were encouraged to use MT to facilitate their reading during a 16-week course before responding to a questionnaire. Learners believed that MT tools were helpful overall, particularly for L2 reading comprehension, but also for enhancing L2 writing skills and confidence.	**A1, A2, C1, C4, C5**
2019	O'Neill, E. M. (2019a). Online translator, dictionary, and search engine use among L2 students. *Computer-Assisted Language Learning Electronic Journal*, *20*(1), 154–177.	This study investigated student use of and beliefs about online dictionaries, FOMT, and search engines by university learners of Spanish and French with a focus on graded and non-graded contexts. Results indicated that 87.7% of participants use online translators frequently for graded work (versus 82.3% for non-graded), even when they are prohibited by policy. Learners expressed mixed opinions about MT tools, but 76% viewed them positively. Types of use reported were consistent with those in Clifford, et al. (2013) and Jolley & Maimone (2015).	**A1, A2, C5**
2019	O'Neill, E. M. (2019b). Training students to use online translators and dictionaries: The impact on second language writing scores. *International Journal of Research Studies in Language Learning*. *8*(2): 47–65. https://doi.org/10.5861/ijrsll.2019.4002	This large-scale study with implications for the capacity for MT to facilitate language development investigated whether the use of MT or online dictionaries (with and without training) had immediate and lasting effects on L2 writing performance. Results indicated that the groups who used online tools with training significantly outperformed participants using the tools without training and the control group (no tools). However, the MT training group performed worse than three of the other groups on the posttest, and there were no significant differences among groups on the delayed posttest, leading **O'Neill** to	**C1, C5, D, E**

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		conclude that higher composition scores may not indicate increased learning.	
2019	Stapleton, P., & Leung, K. K. B. (2019). Assessing the accuracy and teacher's impressions of Google Translate: A study of primary L2 writers in Hong Kong. *English for Specific Purposes*, *56*, 18–34. https://doi.org/10.1016/j.esp.2019.07.001	**Stapleton and Leung** asked EFL instructors to grade a mix of essays written directly in English by Chinese primary school learners of EFL and GT-generated samples. GT-generated texts were rated significantly better in grammar, higher in vocabulary (though significantly so), and comparable in terms of comprehensibility. The researchers found that raters were unable to distinguish the GT-generated texts from the direct L2 samples (only two mentioned suspecting it), attributing this to GNMT's improved quality. This finding differs from the high degrees of detection accuracy reported in Innes (2019), Maimone & Jolley (2023), and O'Neill (2012).	**A4, B2, C1, C5, D**
2019	Tsai, S.-C. (2019). Using Google Translate in EFL drafts: A preliminary investigation. *Computer Assisted Language Learning*, *32*(5–6), 510–526. https://doi.org/10.1080/09588221.2018.1527361	In this study, Chinese EFL learners wrote texts in Chinese that were translated by GNMT and compared with English essays they produced through direct L2 writing. In line with Garcia & Pena (2011), computational assessments determined that the GNMT-generated texts scored higher than self-written texts on measures of length, vocabulary density, and grammatical accuracy (in contrast to results found by Fredholm, 2015). Participants judged GNMT to be useful for EFL writing, particularly with vocabulary selection and content improvement.	**A2, C1, D**
2020	Chung, E. S. (2020). The effect of L2 proficiency on post-editing machine translated texts. *The Journal of Asia TEFL*, *17*(1), 182–193. https://doi.org/10.18823/asiatefl.2020.17.1.11.182	**Chung** examined the effects of L2 proficiency level on Korean EFL learners' ability to assess the accuracy of and post-edit MT-generated texts in English. Results demonstrated that L2 proficiency has a significant effect on the ability to post-edit MT output, as measured by the number of corrections, and also correlates to recognizable differences in post-editing patterns, leading Chung to conclude that although post-editing supports language learning, as asserted by Niño (2008) and Correa (2014), the degree to which students can learn it depends on their proficiency level. (See also Lee, 2022, and Shin & Chon, 2023.)	**C1, C2, C5, D**
2020	Lee, S.-M. (2020). The impact of using machine translation on EFL students' writing. *Computer Assisted Language Learning*, *33*(3), 157–175. https://doi.org/10.1080/09588221.2018.1553186	**Lee** studied the effects of using MT output to guide revisions to self-written texts on the L2 writing performance of Korean learners of EFL. Students referred to MT-generated texts to revise English compositions they produced by translating texts they had written in their L1. Data from textual analyses, interviews, and reflection papers showed that MT helped to decrease lexicogrammatical errors, positively affected writing strategies, and helped learners think about writing as a process.	**A2, C1, C2, C5, D**

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Year	References	Annotations	Theme
2020	Niño, A. (2020). Exploring the use of online machine translation for independent language learning. *Research in Learning and Technology*, *28*, 1–32. https://doi.org/10.25304/rlt.v28.2402	**Niño** investigated the use of MT and post-editing on several translation-based independent language learning (ILL) tasks and asked advanced-level university learners about their beliefs regarding the usefulness of MT for such tasks. A majority of participants found MT helpful for writing and listening and reading comprehension tasks, but not for spoken translation. Most believed that MT output is highly accurate, and 90.9% do not see it as a cheating-inducing resource and thus oppose policies to ban it.	**A2, B1, B4, C1, C3, C5**
2021	Ata, M., & Debreli, E. (2021). Machine translation in the language classroom: Turkish EFL learners' and instructors' perceptions and use. *IAFOR Journal of Education: Technology in Education*, *9*(4), 103–122. https://doi.org/10.22492/ije.9.4.06	In a large-scale replication of Jolley & Maimone (2015), this study reported MT uses and perceptions of EFL learners and instructors at a Turkish university. Results indicated that a vast majority of students used MT frequently, despite viewing it less reliably than instructors. Other findings were generally consistent with Clifford et al. (2013), Jolley & Maimone (2015), and O'Neill (2019a).	**A1, A2, A3, A4, C5**
2021	Cancino, M., & Panes, J. (2021). The impact of Google Translate on L2 writing quality measures: Evidence from Chilean EFL high school learners. *System*, *98*, 102464. https://doi.org/10.1016/j.system.2021.102464	Applying a methodology similar to O'Neill (2012), this study investigated differences in writing performance of secondary Chilean EFL learners under three conditions: MT-assisted with training, MT-assisted without training, and no access to MT. Participants in the MT-training group wrote more words and outscored the other groups on measures of syntactic complexity and accuracy, though differences between the MT-training and the MT-no-training groups were not statistically significant. Overall, these results confirm those of Garcia & Pena (2011) and Tsai (2019).	**C1, C5, D**
2021	Chon, Y. V., Shin, D., & Kim, G. E. (2021). Comparing L2 learners' writing against parallel machine-translated texts: Raters' assessment, linguistic complexity, and errors. *System*, *96*(2021), 102408. https://doi.org/10.1016/j.system.2020.102408	**Chon et al.** used human graders and computerized error analyses to compare the quality of direct, self-translated, and MT-generated modes of writing by Korean university EFL learners. Results indicated that MT use closed the skill gap between lower and higher skilled writers (see also Tsai, 2023), promoted more complex sentences, and facilitated use of lower frequency words. Texts produced with MT also had fewer grammatical errors, though they had more mistranslations and lexical choice errors.	**C4, C5, D**
2021	Chung, E. S., & Ahn, S. (2021). The effect of using machine translation on linguistic features in L2 writing across proficiency levels and text genres. *Computer Assisted Language Learning*, *35*(9), 1–26. https://doi.org/10.1080/09588221.2020.1871029	Human raters and automated tools were used to examine how MT use affected the L2 writing of Korean EFL leaners and whether proficiency level affected MT use. Results indicated that essays produced with the help of GT scored higher in accuracy, while gains in syntactic and lexical complexity were questionable. MT use helped low proficiency learners use more coordinating structures, while the high proficiency	**A2, C1, C5, D**

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		group saw gains in lexical variation. Learners expressed high degrees of satisfaction with MT and the intent to continue using it.	
2021	Hell, A., Godhe, A-L., & Wennås Brante, E. (2021). Young L2-learners' meaning-making in engaging in computer-assisted language learning. *The EuroCALL Review*, *29*(1), 2–18. https://doi.org/10.4995/eurocall.2021.12859	This ethnographic case study focused on digital meaning-making by newly arrived primary students learning Swedish as a second language. Learners were observed using GT and other digital tools to enable peer collaboration and facilitate multimodal communication. Researchers found that providing access to GT and other digital tools gives learners agency in constructing meaning on their terms, creates translanguaging spaces, and supports learning by creating and re-creation.	**A1, C3, C5**
2021	Kelly, R., & Hou, H. (2021). Empowering learners of English as an additional language: Translanguaging with machine translation. *Language and Education*, *1*(16), 2–16. https://doi.org/10.1080/09500782.2021.1958834	This study explored, from a translanguaging perspective, learner and instructor perceptions about and uses of MT in an English as an Additional Language (EAL) program in Northern Ireland. Three stages of MT use were identified: as a survival tool in initial stages, exploratory use as learners reach the intermediate stage, and controlled use in advanced students. Recommendations for MT integration into translanguaging pedagogies are offered.	**A1, A2, A3, A4, C5**
2021	Mirzaeian, V. R. (2021). The effect of editing techniques on machine translation-informed academic foreign language writing. *The EuroCALL Review*, *29*(2), 33–43. https://doi.org/10.4995/eurocall.2021.12930	This mixed-methods study explored the effect of training in MT pre- and post-editing techniques on specific L2 skills and the perceptions of Iranian EFL university students. Data from post-tests indicated that the MT editing sessions led to statistically significant gains in determiner use accuracy, with lesser gains in paraphrasing and collocation use. The post-treatment survey revealed that participants believed that MT editing training improved their text revision skills and their L2 writing in general.	**A1, A2, C1, C2, C4, D**
2021	Vinall, K., & Hellmich, E. A. (2021). Down the rabbit hole: Machine Translation, metaphor, and instructor identity and agency. *Second Language Research & Practice*, *2*(1), 99–118. https://doi.org/10125/69860	Looking beyond issues of acceptability explored by Case (2015), Clifford et al. (2013), and Jolley & Maimone (2015), this study applied an ecological framework to elicit and analyze the metaphors university instructors use when describing how MT relates to questions of identity and agency in the language classroom. Analysis of the metaphors invoked by participants revealed three relationships (MT as destructive, MT as supportive, and MT as transformative) indicative of significant tensions at the intersection of MT and postsecondary language teaching and learning.	**A4, B4, C5**
2021	Xu, J. (2021). Google Translate for writing in a Japanese class: What students do and think. *JNCOLCTL*, *30*, 136–182.	In a study that follows Lee's (2020) design, **Xu** explored how university students of Japanese used MT output to edit self-written compositions and their perceptions of using MT for this purpose. Unfamiliar lexical items (words/phrases) were the targets of most revisions. Most participants believed MT-supported editing helped	**A2, C2, D**

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Year	References	Annotations	Theme
		with content, organization, and vocabulary, but were unsure if it improved quality or grammar usage and also expressed concerns about overdependence and academic integrity.	
2022	Brown, A., Bennett, C., Bulman, G., Giannini, S., Habib, R., & Ticio Quesada, M. E. (2021). Machine translation: An enduring chasm between language students and teachers. *CALR Linguistics Journal*, (12), 1–30. https://doi.org/10.60149/JAAC4117	This study asked university students and instructors about their uses of and perceptions about MT in language learning contexts (see also, Clifford et al., 2013, and Jolley & Maimone, 2015). Results revealed diverging views, with students holding mostly positive perceptions of MT and varied views on its implications for academic integrity, while instructors had negative impressions and clearer views on academic integrity issues, which held steady after the shift to online teaching during the pandemic.	**A1, A2, A3, A4, B1, B2, C5**
2022	Carré, A., Kenny, D., Rossi, C., Sanchez-Gijón, P., & Torres-Hostench, O. (2022). Machine translation for language learners. In D. Kenny (Ed.), *Machine translation for everyone: Empowering users in the age of artificial intelligence* (pp. 187–207). Language Science Press. https://doi.org/10.5281/zenodo.6653406	In a continuation and updating of Ducar & Schocket (2018), this essay offers concrete recommendations for the successful integration of MT into language teaching by surveying the literature on the role of MT in language learning, MT use acceptability, contexts for appropriate use, and alternative digital resources (online corpora and dictionaries). Practical examples of activities that integrate MT into learning contexts are provided.	**B1, B4, C2, C4, C5, E**
2022	Knowles, C. L. (2022). Using an ADAPT approach to integrate Google Translate into the second language classroom. *L2 Journal*, *14*(1), 195–236. https://doi.org/10.5070/L214151690	In this action research study, **Knowles** outlines five research-informed steps in ADAPT, a pedagogical approach to integrating GT into language teaching: amending assignments, discussing GT, assessing with GT in mind, practicing integrity, and training students to use GT. A survey of students in two online classes found they held mixed views on MT and that ADAPT did not substantially alter their perceptions or usage. Knowles argues that learner perceptions should inform approaches to MT integration.	**A1, A2, C3, C4**
2022	Lee, S.-M. (2022). Different effects of machine translation on L2 revisions across students' L2 writing proficiency levels. *Language Learning & Technology*, *26*(1), 1–21. https://doi.org/10125/73490	**Lee** designed a study to investigate whether the L2 writing proficiency levels of Korean university EFL learners would influence the quantity and quality of revisions made with the assistance of MT. Following the same basic design as Lee (2020), students used MT renderings of L1 texts they wrote to revise their own self-written English versions. Results indicated that although using MT led to improvements for all levels, higher-proficiency participants made more and better revisions and used MT more critically than their low-proficiency counterparts.	**C1, C2, C5, D**
2022	Loock, R., Lechauguette, S., & Holt, B. (2022). Dealing with the elephant in the classroom: Developing language students' machine translation	After summarizing earlier findings on student use of MT (e.g., Clifford et al., 2013; Jolley & Maimone, 2015), the authors of this essay discuss several components instructors should consider when designing MT	**A1, A2, C4**

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	literacy. *Australian Journal of Applied Linguistics*, *5*(3), 118–134. https://doi.org/10.29140/ajal.v5n3.53si2	literacy training programs for language learners. These include technical and ethical considerations, as well as skills such as the ability to critically evaluate and effectively repair MT output. The issue of MT literacy assessment is also addressed.	
2022	Merschel, L., & Munné, J. (2022). Perceptions and practices of machine translation among 6th–12th Grade World language teachers. *L2 Journal*, *14*(1), 60–76. https://doi.org/10.5070/L214154165	**Merschel and Munné** surveyed grade 6–12 language educators about their perceptions of and engagement with MT, how they handle learner use, and ways in which they adapt their assignments and assessments. Findings indicated that these instructors used MT infrequently or rarely and that most disapproved or strongly disapproved of student use. A lack of consensus regarding consequences for such use was noted, and a majority of respondents reported modifying assignments because of MT. Pedagogical implications are discussed at length.	**A1, A3, A4, B1, B4, C4, C5**
2022	Mujtaba, S. M., Parkash, R., & Reynolds, B. L. (2022). The effects of language proficiency and online translator training on second language writing complexity, accuracy, fluency, and lexical complexity. *Computer Assisted Language Learning Electronic Journal*, *23*(1), 150–167.	Building on O'Neill (2012), Cancino & Panes (2021), and Chung & Ahn (2021), this study investigated how proficiency and MT use (with or without training) affected L2 writing performance by university Pakistani EFL students in terms of complexity, accuracy, fluency, and lexical complexity (CAFL). At both proficiency levels, the training groups outperformed the non-training and control (no MT) groups, with high-proficiency leaners scoring better in fluency and syntactic and lexical complexity and low-learners scoring higher on accuracy.	C5, D
2022	Pellet, S., & Myers, L. (2022). What's wrong with "What is your name?">"Quel est votre nom?": Teaching responsible use of MT through discursive competence and metalanguage awareness. *L2 Journal*, *14*(1), 166–194. https://doi.org/10.5070/L214151739	In response to Ducar & Schocket's (2018) call for pedagogical solutions addressing the evolving capabilities of MT, **Pellet and Myers** propose a learner-centered integration model informed by SLA research on interaction and meaning negotiation. The proposed "meta-translation feedback circuit" involves the use of input from MT and bilingual dictionaries to support form-function mapping in authentic level-appropriate speech activities. They claim that these interventions support noticing and increase saliency of language forms.	**C3, C4, C5**
2022	Ryu, J., Kim, Y. A., Park, S., Eum, S., Chun, S., & Yang, S. (2022). Exploring foreign language students' perceptions of the guided use of machine translation (GUMT) model for Korean writing. *L2 Journal*, *14*(1), 136–165. https://doi.org/10.5070/L214151759	This study reports the implementation of a guided use of MT (GUMT) model in a university Korean language course, as well as beginner- and intermediate-level student perceptions about the model. Over a semester, students used the GUMT model on writing tasks, wrote reflections, and received continuous feedback on their MT use. Surveys and reflections indicated that the GUMT model played a role in shaping participants' MT use strategies and improved their confidence and L2 writing fluency perceptions.	**A1, A2, C3, C4, D**

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Year	References	Annotations	Theme
2022	van Lieshout, C., & Cardoso, W. (2022). Google Translate as a tool for self-directed language learning. *Language Learning & Technology*, *26*(1), 1–19. https://doi.org/10125/73460	This study explored the potential for GT's text-to-speech (TTS) and automatic speech recognitions (ASR) features to help self-directed learners of Dutch improve vocabulary acquisition and pronunciation. Participants used these functions to learn phrases and practice their pronunciation in a one-hour session. Findings indicated that learners made short-term gains in vocabulary acquisition and pronunciation, although vocabulary retention declined significantly in a delayed posttest (not conducted for pronunciation), adding to evidence from Fredholm (2019) and O' Neill (2019b) that suggests that MT's effects on learning may be short-lived.	**C1, C5, E**
2022	Wang, J., & Ke, X. (2022), Integrating machine translation into EFL writing instruction: Process, product, and perception. *Journal of Language Teaching and Research*, *13*(1), 125–137. https://doi.org/10.17507/jltr.1301.15	**Wang and Ke** explored the impact of MT on the L2 writing processes, products, and perceptions of university Chinese EFL students following Lee's (2020) design of using MT drafts to revise self-written essays. Key findings were that MT group participants made more lexical and grammatical revisions than non-MT learners, that MT users produced higher quality texts, and that learners held positive views of integrating MT into L2 writing instruction.	**A2, C2, D**
2022	Zhang, H., & Torres-Hostench, O. (2022). Training in machine translation post-editing for foreign language students. *Language Learning & Technology*, *26*(1), 1–17. https://doi.org/10125/73466	This study evaluates the effectiveness of an MT post-editing training program developed to help Chinese L2 Spanish learners detect and repair common MT mistakes. Data from the pretest/posttest design indicated that participants in the trained experimental group were able to identify and correct mistakes more frequently, more effectively, and with fewer pauses than the control group. The researchers conclude that level-appropriate post-editing training works and is a good way to teach students how to use MT responsibly.	**C1, C2, C4**
2023	ELEbyary, K. (2023). The impact of online machine translation (OMT) on vocabulary learning and translation ability. *CDELT Occasional Papers in the Development of English Education*, *84*(1), 281–315. https://doi.org/10.21608/opde.2023.337479	**ELEbyary** investigated MT uses and perceptions, as well as the impact of using GT to post-edit self-translated texts on vocabulary acquisition, among Egyptian EFL students. Data from questionnaires indicated that most learners believed MT is helpful for language learning tasks, supports language development, and provides output that is acceptable after editing. Vocabulary posttest results indicated that GT-assisted L1-L2 translation aided vocabulary learning.	**A1, A2, C1, C2, C5**

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2023	Hellmich, E. A., & Vinall, K. (2023). Student use and instructor beliefs: Machine translation in language education. *Language Learning & Technology*, *27*(1), 1–27. https://doi.org/10125/73525	This research recorded MT use by university Spanish and French learners completing L2 writing tasks and compared observations with instructor perceptions, noting areas of alignment and divergence. Student usage patterns mirrored instructor beliefs in terms of segment length lookup frequency (e.g., word, phrase, sentence), while output revision strategies suggested instructors underestimate student engagement. The influence of instructor policies and other pedagogical implications are discussed.	**A1, A4, B4, C5**
2023	Maimone, L., & Jolley, J. (2023). Looks like Google to me: Instructor ability to detect machine translation in L2 Spanish writing. *Foreign Language Annals*, *56*(3), 627–644. https://doi.org/10.1111/flan.12690	This study investigated the ability of human raters to detect the use of MT in L2 writing by intermediate university Spanish students, which signs they associated with MT use, and whether text genre or teaching experience affect detection rates. Results indicated an overall accuracy rate of 73%, confirming the findings of O'Neill (2012) and Innes (2019). The most frequently cited sign of MT use were linguistic features assumed to be beyond learners' levels. Text type and instructor experience did not significantly affect results.	**B1, B2, B3, B4, C5, D**
2023	Shin, D., & Chon, Y. V. (2023). Second language learners' post-editing strategies for machine translation errors. *Language Learning & Technology*, *27*(1), 1–25. https://doi.org/10125/73523	**Shin and Chon** explored Korean EFL learners' abilities to use MT post-editing strategies to repair lexical and grammatical errors they detect during L2 writing and whether proficiency level affects the strategies adopted and the success of such strategies. They found that higher proficiency learners deployed post-editing strategies more frequently and more successfully than lower proficiency participants, concluding that L2 proficiency facilitates higher levels of error detection and repair ability.	**C2, C4, C5, D**
2023	Tsai, S.-C. (2023). Interactive academic EFL writing assisted by Google Translate for Chinese non-English major students. In J. Qin, & P. Stapleton (Eds.), *Advances in composing, translation, writing pedagogy and data-driven learning* (pp. 10–27). Routledge. https://doi.org/10.4324/9781003279358-2	This study adapts the designs of Tsai (2019) and Lee (2020) to explore whether GNMT helps Chinese non-English majors improve their academic writing in English. Results indicated that GT-translated and GT-assisted revised texts scored higher than direct L2 writing samples, with more pronounced gains for low-proficiency learners. Students found GT helpful to the L2 writing process and believed that it helped them identify strengths and weaknesses in their English writing.	**A2, C2, D**