

Digital Translation and Vocabulary Acquisition: Insights from Process-Oriented ELT Research

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Abstract

Vocabulary development in digitally mediated language learning remains a key challenge in contemporary English Language Teaching (ELT), particularly in understanding how learning actually occurs beyond measurable outcomes. Although translation and digital tools have been widely recognized for their pedagogical potential, little is known about the processes through which learners construct vocabulary knowledge during translation activities. Addressing this gap, this study investigates both the outcomes and processes of vocabulary acquisition through digital translation tasks. A sequential explanatory mixed-methods design was employed, involving pre-test and post-test to measure learners' gains in environmental terminology, alongside screen recording analysis to capture real-time translation behaviors. The findings indicate significant improvement in learners' vocabulary knowledge, accompanied by active engagement in searching, verifying, and refining lexical items. More importantly, vocabulary learning was found to occur through iterative and non-linear processes, reflecting learners' strategic interaction with digital resources. This study highlights the role of translation as a dynamic meaning-making activity rather than a product-oriented task. The findings contribute to ELT by providing process-oriented evidence of vocabulary learning and underscore the importance of integrating translation-based tasks and digital research skills to foster deeper learning, learner autonomy, and critical engagement in digitally mediated classrooms.

Keywords: Digital Translation; Vocabulary Acquisition; English Language Teaching (ELT); Translation-Based Learning; Translation Process Research

INTRODUCTION

Translation has increasingly been reconceptualized as a meaningful and pedagogically valuable practice in English Language Teaching (ELT), particularly within multilingual and digitally mediated learning environments. Rather than being viewed as a traditional or restrictive method, translation is now understood as a dynamic strategy that enables learners to negotiate meaning, connect their first language (L1) and target language (L2), and actively engage in language construction processes. This shift aligns with contemporary perspectives on language learning that emphasize the fluid and flexible use of linguistic resources, particularly through translanguaging practices (Cook, 2010; García & Wei, 2014). In digitally rich contexts, learners naturally rely on various tools such as online dictionaries, corpora, and machine translation systems, which further reinforce the relevance of translation as an authentic and contextually grounded learning activity (Godwin-Jones, 2018 ; Ducar & Schocket, 2018; Koehn, 2020)

Vocabulary acquisition remains a fundamental component of language proficiency and communicative competence. It involves not only the recognition of word meanings but also a

deeper understanding of usage, collocation, register, and contextual appropriateness. Learners with limited vocabulary knowledge often struggle to comprehend texts and express ideas effectively, which may hinder overall language development. Research has consistently shown that vocabulary learning is most effective when learners are actively involved in processing language and engaging in meaningful tasks rather than relying on rote memorization (Nation, 2013; Schmitt, 2010 ; Krashen, 1985; Zhang & Zou, 2022). In this regard, translation offers a powerful pedagogical approach, as it encourages learners to compare linguistic systems, evaluate meaning, and make informed lexical decisions. Such cognitive engagement has been linked to deeper processing and improved retention of vocabulary (Laufer & Hulstijn, 2001). In recent years, the integration of digital tools into translation activities has further expanded its pedagogical potential. Machine translation (MT), in particular, has become a widely used resource among language learners. Studies have demonstrated that when used critically, MT can support vocabulary development, enhance writing quality, and increase learner autonomy (Lee, 2020; Jolley & Maimone, 2022 ; Alhaisoni, 2021; Ducar & Schocket, 2018).

Additionally, research suggests that technology-enhanced translation tasks promote active interaction with lexical items and improve learners' ability to produce accurate and contextually appropriate language (Wang & Zhang, 2021; Tsai, 2023). However, despite these promising findings, much of the existing literature has primarily focused on measurable learning outcomes, such as test scores or writing performance, while paying limited attention to the underlying processes through which vocabulary acquisition occurs (Zhang & Zou, 2022). through which vocabulary acquisition occurs during translation activities.

This gap highlights the need for a process-oriented perspective that goes beyond product-based evaluation. Translation Process Research (TPR) provides a useful framework for understanding how learners engage cognitively and behaviorally during translation tasks. From this perspective, translation is viewed as a complex, non-linear, and problem-solving activity involving continuous cycles of reading, searching, evaluating, and revising (Angelone, 2018; Alves, 2020). In digitally mediated environments, these processes become even more visible and analyzable through tools such as screen recording, which allow researchers to capture learners' real-time interactions with digital resources. Such an approach offers valuable insights into how learners identify unfamiliar vocabulary, verify meanings, and refine lexical choices throughout the translation process.

Furthermore, vocabulary learning in translation contexts should be understood as a process of conceptual development rather than mere lexical accumulation. Learners do not simply acquire isolated words; instead, they construct meaning by interacting with language, context, and digital resources. This perspective aligns with the view that vocabulary knowledge is closely connected to content knowledge and domain-specific understanding (Nation, 2013; Schmitt, 2020). In the case of specialized terminology, such as environmental vocabulary, learners must engage in deeper levels of processing to accurately interpret and apply terms within appropriate contexts. Translation tasks, therefore, serve as a bridge between linguistic competence and conceptual understanding.

Despite the growing recognition of translation as a valuable pedagogical tool, there remains a lack of empirical research that systematically examines how vocabulary learning unfolds during translation processes in digital environments. Most studies tend to emphasize outcomes rather than exploring the dynamic and iterative nature of learning. As a result, there is still limited understanding of how learners interact with digital tools, what strategies they employ, and how these processes contribute to vocabulary development.

Addressing this gap, the present study adopts a process-oriented mixed-methods approach to investigate both the outcomes and processes of vocabulary acquisition through digital translation tasks. By combining pre-test and post-test measures with screen recording analysis, this study aims to provide a more comprehensive understanding of how learners engage with vocabulary in real time. Specifically, it focuses on how learners search for, verify, and refine lexical items while translating environmental texts in a digitally mediated context.

This study contributes to both theoretical and pedagogical domains. Theoretically, it extends current understandings of translation in ELT by emphasizing its role as an interactive, iterative, and meaning-making process. Pedagogically, it offers practical insights into how translation-based activities and digital research skills can be integrated to support vocabulary development, learner autonomy, and critical engagement in contemporary language classrooms. Accordingly, this study addresses the following research questions:

1. How do learners engage with vocabulary during translation tasks in a digital environment?
2. What strategies do learners use to understand and select vocabulary while translating?
3. How does the translation process contribute to learners' vocabulary development?

METHOD

Research Design

This study employed a sequential explanatory mixed-methods design, combining quantitative and qualitative data to examine both vocabulary learning outcomes and the processes underlying translation activities. The quantitative phase measured learners' gains in environmental terminology through pre-test and post-test, while the qualitative phase explored learners' real-time translation processes using screen recordings. To provide a clearer overview of the research procedure, the overall design of this study is illustrated in Figure 1, which presents the sequential stages of the mixed-methods approach.

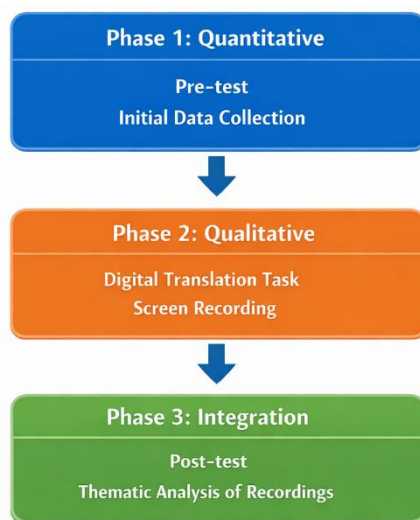


Figure 1. Research Design Flowchart

This design enables a comprehensive understanding of both results and learning behaviors (Creswell & Creswell, 2018).

Participants and Context

The study was conducted in an English Language Teaching (ELT) classroom within an undergraduate English Education program. This context was selected as it provides a relevant setting where students are accustomed to engaging with language learning activities, including translation tasks supported by digital tools. The participants consisted of undergraduate students who had prior experience with translation activities as part of their coursework.

Participants were selected using purposive sampling based on specific criteria, particularly their familiarity with translation tasks and digital tools such as online dictionaries and machine translation. This approach ensured that participants were able to engage effectively in the translation process without being limited by a lack of technical or procedural knowledge. Their prior experience also allowed the study to focus more on how vocabulary learning occurs rather than on basic task understanding.

Overall, the selected participants were considered suitable for the study as they possessed the necessary background in both translation practices and digital literacy. This ensured that they could meaningfully engage with translation activities involving specialized vocabulary and contribute reliable data to the investigation of vocabulary acquisition processes in a digital learning environment.

Instruments

Three instruments were used. First, a terminology test (pre-test and post-test) measured learners' understanding of environmental vocabulary. The test consisted of five items representing key concepts and was designed to assess depth of understanding and accuracy.

Second, digital linguistic resources, including a Term Base (TB) and glossary, were provided to support learners during translation.

Third, screen recording software was used to capture learners' on-screen activities, including their use of online dictionaries, corpora, and machine translation tools. Screen recording is widely used in Translation Process Research (TPR) to examine real-time cognitive and behavioral processes (Angelone, 2018).

Data Collection

Data were collected in two stages to examine both learners' vocabulary improvement and their translation processes. In the first stage, participants completed a pre-test to measure their initial understanding of environmental vocabulary. After that, they performed a translation task using environmental texts supported by digital tools such as online dictionaries and machine translation. During this activity, their translation processes were recorded using screen recording software to capture how they searched for, evaluated, and selected vocabulary.

In the second stage, participants completed a post-test to assess any changes in their vocabulary knowledge after the translation task. The comparison between the pre-test and post-test results was used to determine the extent of vocabulary improvement. This procedure allowed the study to capture both the learning outcomes and the processes involved in vocabulary acquisition in a digital translation context.

Data Analysis

Quantitative data from the pre-test and post-test were analyzed using mean score comparison to determine vocabulary gains (RQ1).

Qualitative data from screen recordings were analyzed using thematic coding, focusing on key activity categories: *searching*, *verification*, and *refining*. These categories were used to identify how learners engaged with vocabulary (RQ2) and the strategies they employed during translation (RQ3).

The integration of quantitative and qualitative findings provides a comprehensive explanation of vocabulary development during translation tasks.

Trustworthiness

To enhance the validity and credibility of the findings, data triangulation was applied by integrating quantitative data from the pre-test and post-test with qualitative data obtained from screen recording analysis. This combination of multiple data sources allowed for a more comprehensive understanding of both learning outcomes and the processes underlying vocabulary acquisition. In addition, all analytical procedures were documented systematically to ensure consistency, transparency, and replicability throughout the research process. This included clear coding procedures and organized data analysis steps, which helped minimize subjectivity and maintain the reliability of the findings (Creswell & Creswell, 2018).

RESULTS AND DISCUSSION

Results

This section presents the findings of the study by integrating quantitative and qualitative data to address the research questions. The quantitative data, obtained from the pre-test and post-test, provide evidence of learners' gains in environmental vocabulary (RQ1). The qualitative data, derived from screen recordings, offer insights into how learners engaged with vocabulary and the strategies they employed during the translation process (RQ2 and RQ3). By combining these two data sources, the results provide a comprehensive understanding of both the extent of vocabulary development and the processes through which it occurs during digital translation activities.

Improvement in Vocabulary Knowledge

The quantitative findings indicate a substantial improvement in learners' mastery of environmental terminology. The mean score increased significantly from 45.00 in the pre-test to 95.00 in the post-test, showing a gain of 50 points. To provide a clearer representation of learners' vocabulary improvement, the mean scores of the pre-test and post-test are presented in Table 1.

Table 1. Improvement in Learners' Vocabulary Knowledge

Assessment Type	Mean Score	Score Difference	Interpretation
Pre-test	45.00	—	Limited understanding
Post-test	95.00	+50	High mastery

This substantial gain may be influenced by the focused scope of terminology and the use of guided digital tools. As shown in Table 1, learners demonstrated a substantial improvement in vocabulary knowledge, indicating the effectiveness of digital translation activities in enhancing terminological mastery. This result suggests that the translation activity supported by digital tools had a strong positive effect on learners' vocabulary knowledge. Beyond numerical improvement, the results also show a qualitative change in learners' lexical performance. In the pre-test, learners tended to produce general or approximate translations, often lacking precision. In contrast, the post-test responses demonstrated more accurate and context-appropriate use of specialized terms. This indicates that learners developed a deeper understanding of vocabulary rather than relying on surface-level recognition.

Learners' Engagement During the Translation Process

The screen recording data reveal that the translation process was highly dynamic and non-linear. Instead of translating the text sequentially, learners frequently shifted between reading, drafting, and searching activities. This pattern suggests that translation functioned as an active problem-solving process, where learners continuously evaluated and refined their understanding of vocabulary. In terms of time distribution, approximately 45% of the total task

time was spent on digital research activities, including searching for meanings, verifying terminology, and comparing multiple sources. The distribution of learners’ activities during the translation process is summarized in Table 2.

Table 2. Distribution of Learners’ Activities During Translation Tasks

Activity Category	Description	Percentage	Learning Function
Digital Searching	Looking up meanings, terminology, and references	45%	Vocabulary discovery & expansion
Drafting Translation	Writing and constructing translated text	40%	Meaning construction
Reading & Comprehension	Understanding source text	15%	Contextual interpretation

Table 2 indicates that a significant portion of time was allocated to digital searching activities, highlighting the central role of research behavior in supporting vocabulary acquisition. Around 40% of the time was allocated to drafting the translation, while the remaining time was used for reading and comprehension. These findings highlight that vocabulary learning was strongly supported by learners’ interaction with digital resources. To provide a deeper understanding of the strategic behaviors captured during screen recording, the researchers categorized the specific cognitive actions taken by learners when encountering complex environmental terms. Table 3 illustrates the primary lexical verification strategies and their respective roles in the vocabulary acquisition process.

Table 3. Analysis of Learners’ Lexical Verification Strategies

Strategy Category	Digital Behavior Observed	Impact on Vocabulary Acquisition
Cross-Referencing	Comparing machine translation outputs with online bilingual dictionaries or specialized glossaries.	Enhances accuracy and ensures the selection of contextually appropriate terms.
Contextual Validation	Searching for the term within authentic English corpora or news articles to see how it functions in a sentence.	Shifts learner understanding from general expressions to domain-specific terminology.
Iterative Revision	Re-searching and modifying initial lexical choices after evaluating multiple digital sources.	Promotes deeper cognitive engagement and strengthens long-term retention.

The data in Table 3 confirms that learners did not merely accept the first available translation; instead, they engaged in a critical evaluation of lexical options. This systematic digital research behavior is a key driver in moving learners from surface-level recognition to a deeper conceptual mastery of specialized vocabulary.

Strategies Used in Vocabulary Learning

Further analysis shows that learners employed several strategies when dealing with unfamiliar vocabulary. Rather than relying on a single source, learners typically engaged in multi-step verification processes. This included using machine translation, consulting online dictionaries or glossaries, and revising their initial choices after comparing different sources .

This behavior reflects a shift from passive to active learning. Learners did not simply accept the first available translation but critically evaluated the accuracy and suitability of lexical

options. As a result, they developed greater control over their vocabulary choices and demonstrated increased autonomy during the task.

Development of Terminological Understanding

Another important finding is the transformation of learners' understanding of environmental terminology. At the beginning of the task, many learners produced generalized translations that did not fully capture the specific meaning of technical terms. However, through repeated searching and verification, these translations became more precise and contextually appropriate. This change suggests that vocabulary learning occurred through a process of conceptual development rather than simple memorization. Learners actively constructed meaning by interacting with digital tools and refining their understanding of terminology.

The Role of Digital Research Behavior

The findings also show that learners' use of digital tools played a key role in their vocabulary development. Learners who actively explored multiple sources and engaged in systematic verification produced more accurate translations. In contrast, those who relied on limited resources tended to produce less precise results.

This indicates that digital research behavior is closely related to learning outcomes. Effective use of digital tools supports deeper engagement with vocabulary and contributes to better translation performance.

Summary of Findings

Overall, the results demonstrate that digital translation activities support vocabulary acquisition through both measurable improvement and active learning processes. The significant increase in test scores is closely linked to learners' engagement in searching, verifying, and refining vocabulary during the translation task. These findings suggest that vocabulary learning in this context is not only the result of exposure but also the outcome of strategic and process-driven engagement with language.

Discussion

The findings of this study indicate that vocabulary acquisition through digital translation activities should be understood as an active and cognitively engaging process rather than merely a measurable outcome. The substantial improvement in learners' terminological accuracy suggests that translation tasks, when supported by digital tools, facilitate deeper lexical processing and meaningful engagement with language. This interpretation aligns with previous studies emphasizing that translation can promote learner autonomy and enhance vocabulary learning when used critically (Jolley & Maimone, 2022; Lee, 2020; O'Neill, 2019; Alhaisoni, 2021). From this perspective, vocabulary learning is not limited to exposure but involves active meaning construction and negotiation.

A key insight from this study is the central role of digital research behavior in mediating vocabulary acquisition. Learners' frequent engagement in searching, verifying, and comparing lexical items reflects a strategic and reflective approach to learning. This finding supports the argument that the effectiveness of machine translation and digital tools depends largely on how learners interact with and evaluate their outputs (Tsai, 2023; Wang & Zhang, 2021; Ducar & Schocket, 2018; Koehn, 2020). Similarly, Bowker and Buitrago-Ciro (2019) highlight that digital tools can enhance language learning when learners adopt a critical stance rather than relying on them uncritically. Therefore, vocabulary development in this context is closely tied to learners' ability to engage with digital resources in an analytical and purposeful manner.

The non-linear and iterative nature of the translation process further reinforces the view that learning occurs through continuous cycles of meaning negotiation. Based on these findings, vocabulary learning in this study can be conceptualized as an iterative and non-linear process involving continuous cycles of searching, verification, refining, and drafting, as illustrated in Figure 2.

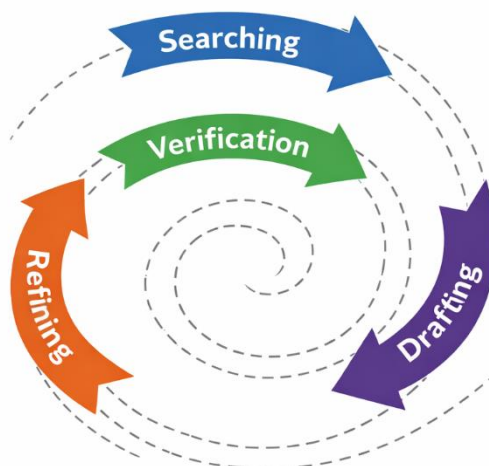


Figure 2. The Iterative Vocabulary Acquisition Model

This model illustrates how learners continuously move between different cognitive and digital activities, highlighting that vocabulary acquisition emerges through recursive and dynamic engagement rather than linear progression. Learners' movement between reading, drafting, and revising demonstrates that translation is not a linear activity but a recursive process involving monitoring, evaluation, and revision. This interpretation is consistent with Translation Process Research (TPR), which conceptualizes translation as a dynamic and problem-solving activity (Angelone, 2018; Alves, 2020). Through this iterative engagement, learners are able to refine their vocabulary knowledge at both semantic and conceptual levels, leading to more accurate and contextually appropriate language use.

Another important interpretation concerns the transformation of learners' vocabulary use from general expressions to more precise and domain-specific terminology. This shift suggests that vocabulary acquisition involves conceptual development, where learners progressively build a deeper understanding of specialized terms. In this sense, learners are not only acquiring new lexical items but also developing domain knowledge through interaction with language. This finding supports the view that vocabulary learning is closely connected to content knowledge and contextual understanding (Nation, 2013; Schmitt, 2020). Translation tasks, therefore, function as a bridge between linguistic competence and conceptual understanding.

The findings also highlight the pedagogical potential of integrating digital translation activities into ELT classrooms. Translation, when combined with digital tools, creates opportunities for learners to engage in meaningful, reflective, and autonomous learning. This supports previous research suggesting that guided use of machine translation can enhance both linguistic competence and digital literacy (Jolley & Maimone, 2022; Tsai, 2023; O'Neill, 2019). Consequently, translation should be reconceptualized not as a traditional or outdated method but as a relevant and dynamic instructional strategy that aligns with the needs of digitally mediated learning environments (Bruton, 2009; Pym, 2010).

In addition, this study underscores the importance of developing learners' digital research competence as part of language education. The ability to search, evaluate, and synthesize information from multiple sources emerges as a key factor in successful vocabulary acquisition. This finding suggests that language instruction should incorporate explicit training in digital literacy and research strategies, enabling learners to become more autonomous and effective language users in the digital era.

Despite these contributions, several limitations should be acknowledged. The study was conducted within a specific context focusing on environmental terminology, which may limit the generalizability of the findings. Furthermore, the relatively small number of test items, although designed to measure depth of understanding, may not fully capture the complexity of vocabulary development across broader contexts. These limitations suggest the need for further investigation in more diverse settings.

Future research is recommended to extend this line of inquiry by examining translation-based learning across different domains, such as academic or professional contexts. Longitudinal studies could provide insights into the long-term impact of digital translation activities on vocabulary retention. In addition, exploring individual learner differences, including digital literacy levels and learning strategies, may offer a more nuanced understanding of how learners engage with translation tasks in various contexts.

CONCLUSION

Understanding vocabulary acquisition in digitally mediated learning environments has become increasingly important in contemporary ELT. This study shows that digital translation activities effectively support vocabulary development, particularly in mastering environmental terminology. The findings indicate that vocabulary learning is not merely the result of exposure, but occurs through active processes such as searching, verifying, and evaluating lexical items during translation tasks. Learners who actively engaged in these processes demonstrated more accurate and contextually appropriate vocabulary use, reflecting a shift from surface-level understanding to deeper conceptual knowledge. This study contributes by combining both product- and process-oriented perspectives, linking measurable vocabulary gains with insights into learners' real-time cognitive and digital behaviors through screen recording analysis. From a pedagogical perspective, the findings suggest that integrating translation-based tasks and digital research activities can enhance learner autonomy, critical thinking, and strategic language use. However, this study is limited to a specific context and set of terminology. Future research is recommended to explore broader contexts, examine long-term effects, and consider individual learner differences such as digital literacy and learning strategies.

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