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Theorizing the Role of Machine Translation in L2 Reading Comprehension: Validating the Theory and Exploring the Learning Potential through MT Use*

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ABSTRACT

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This study investigates the theoretical dimensions of how machine translation (MT) plays a role in relation to L1 reading competence in L2 reading comprehension. Leveraging Kintsch's Construction-Integration (CI) model for L2 reading proposed by Oh (2014), our research posits that MT mediation enhances the textbase by alleviating constraints related to L2 proficiency. This, in turn, facilitates a more effective utilization of L1 reading resources, contributing to an enriched situation model. To explore this hypothesis, we conducted an empirical study with 89 college students enrolled in a general English course at a South Korean university. Participants engaged in reading activities under two conditions: a pre-MT (reading without MT) and a post-MT (reading with MT). The comprehensive model, incorporating a textbase indicated by L2 vocabulary, grammar, and sentence parsing, and a situation model represented by L1 reading competence, was examined through structural equation modelling across these conditions. Additionally, we analyzed learning potential scores (LPS)—reflecting the difference between the two conditions—using hierarchical multiple regression to identify significant predictors of enhanced comprehension with MT use. Our findings confirm the validity of the models, demonstrating the textbase as a key mechanism through which MT influences reading comprehension. The results also underscore the significance of L1 reading competence and L2 parsing ability as key predictors for LPS. These findings are discussed within the context of the changing multiliteracies landscape, contributing to the broader discourse on language education and technology integration.

KEYWORDS

machine translation, CI model, L2 reading, L1 reading, learning potential, translanguaging

1. Introduction

The rapid advancement of information and communication technology (ICT) has fundamentally reshaped the communication landscape in our increasingly globalized world. Traditional concepts of literacy, which were once primarily centered around printed text, have proven inadequate for navigating the diverse modes of technology-enhanced communication in contemporary society. In response, new literacies—such as pluriliteracies (Coyle and Meyer 2021) and multiliteracies (New London Group 1996)—have emerged to address the complexities of technology-mediated communication within multimodal contexts.

Amid these transformative technologies, translation technology has become a crucial tool for the vast population of second language (L2) users. The ubiquity of online Machine Translation (MT) in everyday life, with its varied applications, underscores its pivotal role in today's communication landscape. MT's most prevalent use is for reading texts or documents in different languages, followed by applications for entertainment, internet browsing, language learning, social media engagement, messaging, and in-person communication typed via MT (Vieira et al. 2023).

While MT has established its presence in society, its role in L2 education is still evolving. The use of MT in L2 classrooms has long been a subject of controversy due to potential interference with L2 learning and ethical concerns. However, recent studies focusing on its positive effects on L2 learning have also surged, reflecting its prevalent use by L2 students (Chung 2020, Chung and Ahn 2022, Lee and Briggs 2021, S. M. Lee 2020, Y. J. Lee 2021, Tsai 2019).

Despite this growing body of work, two significant gaps in the research literature need to be noted: first, the lack of theorizing the precise character of MT use, and second, the primary focus on writing, despite MT's most extensive use being in reading (Vieira et al. 2023). Although extensive research has been conducted on the use of technology in education and the outcomes of various interventions, there is a conspicuous absence of theories specifically addressing L2 reading comprehension mediated by MT. The precise mechanism through which MT comes into play during the comprehension process remains unclear in existing research, despite indirect insights from research on the effects of L1 on L2 reading (Cohen 2011, Kern 1994, Kwon and Schallert 2016, Upton and Lee-Thompson 2001). Current research and pedagogical practices lack a structural approach to effectively integrate MT in L2 reading comprehension.

This study seeks to address these gaps by applying the Construction-Integration (CI) model (Kintsch 1998). The CI model is one of the major theories that have substantially shaped L1 literacy research and instructional practices over the years (Unrau et al. 2019). The CI model has provided alternative explanations for L1 reading comprehension that surpass the mainstream schema theory by involving two main processes: the construction process for creating the textbase and an integration process for forming the situation model by integrating the textbase to prior knowledge. L2 researchers have demonstrated that this L1 model can be applied to L2 reading comprehension (Nassaji 2007, Oh 2014). The establishment of the textbase is shown to be contingent upon L2 proficiency, whereas the construction of the situation model is attributed to L1 reading competence (Oh 2014). This study attempts to apply the CI model to the even more complex process of L2 reading with the use of MT. Our hypothesis is that this model, with its key constructs of textbase and situation model, is well-suited to delineate the roles of L2 proficiency, L1 reading competence, and MT use in L2 reading comprehension.

This study also applies sociocultural theory's core interrelated constructs of mediation, cognitive scaffoldings, learning potential, and zone of proximal development. It aims to explain the differences between two reading conditions: Pre-MT (L2 reading without the use of MT, or independent L2 reading), and Post-MT (L2 reading with the mediation of MT). This study views MT as a cognitive scaffold for L2 readers to realize their full

potential in literacy across L1, L2, and technology. This research is integral to a larger ongoing study (Oh 2022a, Oh in press, Kim and Oh 2023) aimed at developing an English curriculum with a triad of pedagogical purposes: i) developing overall literacy and accessing diverse texts using all available semiotic scaffolds such as L1, L2, and technology, ii) enhancing English literacy with the use of technology with a carefully designed curriculum, and iii) fostering technological literacy, including the use of MT and emerging AI technology. The current study was specifically designed to theorize and validate the role of MT in reading as a crucial element in this proposed curriculum, thereby ensuring that MT-assisted learning is effectively integrated into pedagogical practices.

The primary purpose of this study is to integrate both independent L2 reading and MT-mediated, technology-enhanced L2 reading into a unified theoretical framework for L2 reading comprehension. To achieve this, the study first empirically tests the validity of the CI model for independent and MT-mediated L2 reading, using structural equation modeling. Subsequently, the study aims to elucidate the theorization of the interaction among the key variables, including L2 proficiency (encompassing vocabulary, grammar, and sentence parsing), L1 reading competence and MT use, through the CI model. Additionally, the study will investigate how MT use impacts reading competence by analyzing improvements in scores through hierarchical multiple regression, thereby identifying influential variables for instructional focus.

The following research questions are to be explored:

1) Does the specified CI model provide an appropriate characterization of the collective relationships among its variables in independent and MT-mediated L2 reading?
2) If so, what differences are observed in the two different reading conditions?
3) Which predictor variables significantly contribute to the improvement of MT-mediated L2 reading scores?

2. Literature Review

The use of MT inherently involves the utilization of L1 resources, and existing research on the influence of L1 on L2 reading provides valuable insights into MT's role in L2 reading comprehension. Therefore, this literature review first examines research on the role of L1 in L2 reading to contextualize its relevance. This background sets the stage for a subsequent discussion on how the CI model can be applied to theorize the role of MT in L2 reading.

2.1 The Role of L1 in L2 Reading: From Mental Translation to Translanguaging Practices

The role of L1 in L2 learning has engendered divergent perspectives concerning its impact on L2 usage, debating between exclusive use of L2 versus allowing L1 for L2 reading. Cohen (2011) summarizes this debate by posing the questions: “Is it beneficial for learners to attempt to think as much as possible in an L2 that they wish to learn or to improve their mastery of? Might it be detrimental to their learning if they limit their use of that L2 as a vehicle for thought?” (p. 234). Proponents of the former perspective adhered to the "English only" principle in language classrooms, a foundational element of prevalent L2 learning methodologies from the 1970s to the 1990s. In contrast, critics of this principle contend that it is detrimental, arguing that students with limited L2 proficiency cannot effectively engage in cognitive processes in the new language, thereby depriving them of opportunities for meaningful learning. From this latter viewpoint, two distinct research traditions have emerged concerning the role

of L1 in L2 reading comprehension: mental translation and translanguaging.

Early research on the role of L1 in L2 reading was investigated within the “mental translation” framework. Based on the analyses of verbal report interviews, Kern (1994) summarized the functional benefits of mental translation from L2 to L1 and the conditions for its use. The primary functional advantage of L1 translation, as inferred from subjects' retrospective comments, was that it aided semantic processing and allowed for the consolidation of meaning, which would otherwise remain fragmented if represented in L2. L2 readers reported that they frequently used translation as a strategy to understand L2 text, particularly in response to specific comprehension obstacles. A shift to bottom-up processing, through translation, was a noticeable observation that when L2 readers encountered sentence syntax that they perceived as different from their L1, they adopted a translation strategy. Other studies employing think-aloud protocols in L1 and L2 reading conditions (Davis and Bistodeau 1993, Horiba 1990) confirmed the use of mental translation as a strategy during L2 comprehension breakdowns. L2 readers reported significantly more frequent use of bottom-up processing strategies that check on the meaning of unknown words and complex sentences in their L2 reading compared to their L1 reading.

Upton and Lee-Thompson (2001) conducted an in-depth examination of the evolution of L1 mental translation strategies in L2 reading as L2 proficiency improves. Their analysis of think-aloud protocols and immediate retrospective interviews with L2 readers revealed that intermediate ESL students relied on their L1 (either entirely or partially) 61% of the time when employing reading strategies. In contrast, advanced ESL students used their L1 43% of the time, while post-ESL students relied on their L1 only 15% of the time. These findings align with the general intuition that L1 use in L2 reading decreases as L2 proficiency increases, due to more direct access to semantic information in the L2.

However, it is important to interpret the gradual reduction of mental translation as L2 proficiency increases with caution. This decrease does not necessarily justify the "English only" principle. The benefits of mental translation, as reported in Kern (1994) and other studies, contribute to effective L2 acquisition and naturally lead to its gradual decline in use as proficiency improves.

Cohen (2011) argued for reconsidering "the oft-heard taboo against mental translation" (p. 255) due to its benefits for L2 reading, such as efficiency in chunking material into semantic clusters in the target language, creating a network of associations, and clarifying grammatical roles. He, however, also emphasized the need to "distinguish a genuine need for translation from a perceived need," cautioning against focusing solely on text comprehension "without necessarily learning much of the L2 in the process" (p. 269). This issue of balancing the importance of content comprehension and language learning through reading poses a particularly complex challenge for emergent bilinguals whose L1 competence is not yet fully established. This context has given rise to another line of research.

The framework adopted in more recent studies on the role of L1 in L2 reading is translanguaging. Translanguaging is defined as "using one language to reinforce the other in order to increase understanding and augment the pupil’s ability in both languages" (Lewis, Jones and Baker 2012) and involves varying degrees of L1 use. Compared to the mental translation perspective, translanguaging offers a much more dynamic relationship between L1 and L2, positioning these languages, along with other available semiotic resources, as mediating tools for human cognition and literacy[1]. Kwon and Schallert (2016) analyzed advanced Korean adult readers' verbal reports collected via think-aloud protocols for reading English and Korean texts. They identified seven common translanguaging practices associated with cognitive strategies use among three groups with different

[1] Radical perspectives even challenge the boundaries between languages (García et al. 2017), though we follow the perspective of separating L1 and L2.

translanguaging patterns: one that predominantly used L1 Korean, one that matched the text language, and one that mixed the two languages. The seven identified cognitive strategies commonly adopted in L1 and L2 both types of reading are planning and goal setting, evaluating, forming interpretations, reflecting/relating, summarizing, monitoring, and asking questions. For example, the readers in the first group articulated reading goals using L1 Korean syntactic structures with embedded English words, while the readers in the second group summarized the basic gist of the text in the text language. They concluded that translanguaging practices were not mere random occurrences, but deliberate responses shaped by contextual factors such as the text's nature, the purpose of reading, and anticipated future applications.

Several other studies have adopted translanguaging as a pedagogical strategy for teaching L2 reading. For example, Vaish and Subhan (2015) investigated the impact of translanguaging in teacher talk on second graders' learning of academic content. Pacheco et al. (2019) also explored how a third-grade teacher's strategic use of translingual practices influenced the meaningful engagement of emerging bilingual students with texts. In a tertiary setting, Hungwe (2019) applied translanguaging to a paraphrasing strategy for reading academic texts, highlighting the comprehension-enhancing effect of paraphrasing noted by Fisk and Hurst (2003).

In summary, the role of L1 in L2 reading has been studied primarily as mental translation and then expanded into its strategic use within the framework of translanguaging to improve comprehension of L2 text for both readers and teachers. However, what is missing in the literature is a theory that explains the mechanisms by which L1 plays a role in L2 reading and how it interacts in MT-mediated L2 reading.

2.2 Theorizing the Role of L1 and MT in L2 Reading

The CI model proposed by Kintsch (1998, 2019) is one of the key theories of reading comprehension. It posits that readers engage with text by employing construction and integration processes, which facilitate the creation of mental representations of the text at various levels: surface structure, textbase, and situation model. Construction starts with surface-level processing of linguistic elements; it involves recognizing words, retrieving meaning of such words, and parsing the given text. The semantic representation occurs at both the sentence-level microstructures, described by Kintsch (2019) as an interrelated network of propositions, and the discourse-level macrostructures, which relate to the overall organization of ideas leading to a gist of a given text. Microstructures are formed as readers identify units of text-based meaning (propositions) and the connections between them within and across sentences through iterative cyclical processes (Kintsch 1998, 2019). Macrostructures are constructed as semantic relations between larger text units are recognized and categorized into topics and subtopics. Together, microstructures and macrostructures constitute the reader's textbase model of reading comprehension. During the integration process, readers incorporate relevant background knowledge activated by the textbase via inferencing to form a coherent mental representation of the text, resulting in the situation model. The CI model, categorized as an information/cognitive processing model of reading (Unrau et al. 2019), is pertinent to the theorization of MT-mediated reading because it identifies specific processes and strategies involved in comprehension, allowing for a detailed delineation of the roles that the key variables of interest play during L2 reading.

The critical distinction between L1 and L2 reading lies in the quantity and quality of linguistic knowledge accessible during the reading process. L2 readers with limited language proficiency often lack the necessary breadth and depth of vocabulary and syntactic understanding required to fully comprehend a given text. Furthermore, their limited linguistic knowledge is frequently not sufficiently automatized to facilitate efficient L2 reading (Elgort and Warren 2014, Suzuki 2024). Consequently, L2 readers struggle to build a robust textbase for a given text due to their lack of linguistic knowledge and inefficacy in its application. However, this weak textbase

can be enhanced by drawing upon their background knowledge and supported through the application of higher-order cognitive skills. Previous research (Bernhardt and Kamil 1995, McLeod and McLaughlin 1986) strongly supports the use of higher-order cognitive strategies among readers with lower L2 proficiency. These processes are anticipated to occur in the reader's L1 among non-proficient L2 readers, as their existing background knowledge and cognitive processes are predominantly anchored in L1. In contrast, for readers with higher levels of L2 proficiency, characterized by a more developed and efficient semantic network in L2 for comprehension (Li and Clariana 2019), these processes are likely to manifest in L2, resulting in thinking in L2.

Thus, the establishment of the textbase, which heavily relies on the reader's linguistic knowledge for propositional computation, is proposed to be contingent upon L2 proficiency, whereas the construction of the situation model, which leverages background knowledge and inferencing skills for coherence building, is attributed to L1 reading competence (Oh 2014). This theorization is advocated by Nassaji (2007), who argued that text comprehension involving various levels of representation can be explained by the CI model that distinguishes between different levels of mental representation: "some generated from the linguistic input and the learner's processing of lower-level lexical and syntactic content of the text (e.g., the textbase), and others from higher-level processes involving the integration of that content with the reader's conceptual and prior knowledge (e.g., situation model)" (Nassaji 2007, p. 101). This theorizing, however, is more relevant for L2 readers whose L1 reading competence has already attained a satisfactory level of maturity, as observed in the context of tertiary EFL education, rather than for young ESL learners whose L1 literacy and academic competence are still emerging.

Cohen (2011) reported findings from Hawras (1996) that indirectly illustrate how the textbase and situation model interact in L2 reading via retrospective interviews after reading. In a study involving 27 college students in the U.S. learning Spanish as a foreign language, participants were given a reading task consisting of two paragraphs on European culture and were interviewed using Fillmore and Kay's (1983) text interview procedure. One beginning student's response to the text interview revealed the challenges an L2 reader faces when encountering difficulty in constructing a textbase and how strategic thinking in L1 occurs to deal with such comprehension challenges: "*Instead of seeing chunks, I see a long list of words I need to go through … Maybe, maybe it's saying something like, 'Culture are gonna be different until there's no more isolation.' (ha ha ha) or something like that. It does sound like a very logical thought, but …*" (Hawras 1996, p. 58, cited in Cohen 2011). The textbase for this reader consists of a long list of words without semantic associations among them, but his/her situation model is created as a conjecture of semantic associations of the words based on his/her world knowledge available in L1. In addition, strategic L1 use was also observed among advanced learners when verifying comprehension. One advanced learner reported reading the L2 text and understanding it directly without initially resorting to L1, but later verifying her comprehension by mentally translating: "*OK, this one I pretty much got the first time through, but then I went back to make sure … and, uhm, … you know, I went back and kind of translated it as I went along to make sure that I had it. I don't think I did that the first time*" (Hawras 1996, p. 60, cited in Cohen 2011). This response shows that she elaborated the textbase in L1 when the reader perceived it as insecure and integrated it into her situation model, thereby reducing lingering insecurity about her comprehension.

The impact of limited L2 proficiency on reading can be likened to a processing bottleneck. In L1 reading research, it is well-established that inefficient processing speed due to slow word reading constrains the amount of information available for complex cognitive engagement, creating a point of congestion for cognitive engagement (Peng et al. 2022). In the context of L2 reading, this bottleneck phenomenon arises not only from slow word reading but also from varying levels of insufficient word and syntactic knowledge. An impoverished textbase with numerous breaks in the propositional networks of a given text fails to provide L2 readers with sufficient information to make inferences and draw upon their background knowledge. This bottleneck effect, resulting from

limited L2 proficiency, hinders L2 readers from utilizing broader comprehension mechanisms that involve various forms of L1 resources for accurate understanding. As demonstrated in Hawras's (1996) study of beginning L2 readers, the poor quality of textbase due to limited L2 knowledge can lead to inferences in L1 that may not yield accurate comprehension but rather conjectures fraught with lingering insecurity. This suggests that the situation model created from an impoverished textbase, characterized by numerous breaks in the semantic network, results in insecure situation model filled with conjectures and questions.

Extending this line of reasoning, the role of MT in L2 reading can be explained as a tool conducive to mitigating this bottleneck effect stemming from limited linguistic knowledge. The benefits of MT in L2 reading have been primarily observed in linguistic aspects, such as aiding comprehension of unfamiliar words and intricate sentences (Oh 2022b), aligning with intuitive expectations. This underscores the role of MT in L2 reading as an enhancer of the textbase quality that L2 readers construct, consequently leading to improved representations of textual propositions. This more complete textbase, wherein the bottleneck effect of limited linguistic knowledge is alleviated, enables L2 readers to harness their L1 resources extensively, facilitating the creation of a more comprehensive and accurately integrated situation model. Based on this rationale, it is postulated that MT mediation holds the potential to elevate the quality of the textbase, allowing L2 readers to transcend the bottleneck effect caused by their limited linguistic knowledge. This, in turn, creates more opportunities for the full utilization of L1 reading competence, empowering L2 readers to engage with agency in the given L2 materials.

2.3 MT Mediation as Learning Potential

The differences between independent reading and MT-mediated reading are framed as a form of learning potential in our study. Sociocultural theory (Lantolf 2000), rooted in Vygotsky's theory of the mind (1962, 1978, 1987), provides a coherent framework for understanding the ability to use MT for reading authentic English texts as learning potential. The core principles of the theory encompass mediation, internalization, and the zone of proximal development (ZPD). Vygotsky (1978, p. 86) defined ZPD as "the gap between the current developmental level achieved through independent problem-solving and the potential developmental level achieved through problem-solving under adult guidance or in collaboration with more proficient peers." When MT serves as a form of adult guidance or represents more proficient peers, the gap between independent reading and reading with MT mediation indeed mirrors the zone of proximal development in terms of L2 reading comprehension.

The adept application of MT in L2 reading is expected to significantly enhance MT-mediated L2 reading comprehension. It facilitates the construction of a more complete textbase, compensating for readers' limited linguistic knowledge and enabling them to effectively utilize cognitive resources in their L1. Consistent and effective MT use in L2 reading is envisaged to gradually reduce the ZPD over time as readers advance in their L2 proficiency through appropriate MT application for both comprehension and language acquisition purposes. This progressive refinement, characterized by the gradual narrowing of the ZPD, is anticipated to occur through several mechanisms, including the optimization of MT strategies, the augmentation of L2 proficiency, effective higher-order cognitive strategies and a synergistic combination of all approaches. Crucially, achieving this developmental trajectory is expected to necessitate sustained and lifelong dedication from the majority of L2 readers.

Given this rationale, pedagogical interventions in L2 classrooms aimed at fostering MT literacy should also prioritize factors that significantly enhance scores in MT-mediated reading. Within the framework of the CI model for MT-mediated L2 reading, our hypothesis posits a substantial influence of L1 reading competence on Learning Potential Scores (LPS), defined here as the difference between independent reading scores and those derived from MT-mediated reading. This proposition stems from the premise that the enhanced textual propositions facilitated

by MT use are likely to be represented in the readers' L1, thereby relying on L1 reading competence to construct a more enriched and accurate situation model. Consequently, L1 reading competence is presumed pivotal in clarifying and fully harnessing the learning potential inherent in MT-mediated reading experiences within L2 instructional settings.

Another critical factor in MT-mediated reading is hypothesized to be the ability to parse sentences. The most evident benefit of MT use lies in the availability of lexical knowledge that is otherwise inaccessible for L2 readers. L2 readers, however, still need to comprehend how words, phrases, and clauses are chunked together to derive the intended meaning of a given text if they are to effectively utilize English text as language learning resources when engaged in MT-mediated reading. Those with better chunking or parsing abilities are likely to benefit more from MT mediation. There is empirical evidence suggesting a positive correlation between enhanced chunking proficiency and increased efficiency in online cognitive processing at a sentence level, which is observed not only in native speakers (McCauley and Christiansen 2015, McCauley et al. 2017) but also among non-native speakers (Pulido and Lopez-Beltran 2023).

One pedagogical strategy conducive to the cultivation of students' sensitivity towards chunking involves the implementation of exercises aimed at identifying sentence types, such as simple, complex, compound, or complex-compound sentences. Effective chunking requires an ability to distinguish layers of propositions such as predicates, modifications and connectives (Turner and Greene 1977) and entails a comprehensive understanding of how these elements interrelate, including considerations of subordination, coordination, and modification. Consequently, the current study posits that the ability to chunk will account for variations in LPS following MT-mediated reading.

In summary, while the role of L1 in L2 reading has been studied to some extent, there remains a gap in the literature regarding the specific mechanisms through which MT influences L2 reading comprehension. Previous research has highlighted the importance of L1 reading competence in L2 contexts, yet it has not explored how MT can be integrated into this framework. This study addresses these gaps by applying the CI model to both independent and MT-mediated L2 reading. By empirically testing this model, the research aims to elucidate the role of MT in the reading process and explore its potential to enhance reading competence. Additionally, the study will investigate how MT use affects learning to holistically enhance outcomes and explore the variables contributing to this enhanced learning, providing insights into the practical implications for L2 instruction and curriculum development.

3. Method

3.1 Participants

The study sample consisted of 89 freshmen students from a university in Seoul, South Korea. Participants were drawn from a range of academic majors, including theology (n = 9, 10.1%), social welfare (n = 15, 16.9%), early childhood education (n = 13, 14.6%), computer software (n = 17, 19.1%), and nursing (n = 35, 39.3%). The gender distribution among the participants was 75.3% female (n = 67) and 24.7% male (n = 22).

These participants were categorized into different language proficiency levels based on their diagnostic test results administered prior to the start of the semester. Specifically, the participant distribution across the proficiency levels was as follows: 74 students were assigned to level 1, 30 students to level 2, and 17 students to level 3. The classification of these levels was determined by considering the participants' mock Test of English for International Communication (TOEIC) scores. Students with mock TOEIC scores in the 300s were categorized as

level 1, those with scores in the 400s were assigned to level 2, and participants with scores in the 500s or higher were placed in level 3. It's noteworthy that the total sample size was initially larger, but after excluding cases with missing data, the final participant count was eighty-nine.

The background survey revealed that 87.5% of the participants have experiences using MT, while 12.5% do not. Regarding their self-efficacy in using MT for language learning, the responses were distributed as follows: 12.5% rated their self-efficacy as very high, 36.3% as high, 41.3% as neutral, 7.5% as low, and 2.5% as very low.

3.2 Data Collection

3.2.1 Measures

To address the research questions, a variety of instruments were employed, including tests assessing L2 reading comprehension, vocabulary, grammar, parsing, and L1 reading competence, and interrelated aspects of L2 proficiency indicated by vocabulary, grammar, and sentence parsing.

L2 Reading Comprehension

To evaluate individual differences in L2 reading comprehension, 40 questions were extracted from the Part 7 sections of mock TOEIC exams. The provided passages included various text types such as magazine and newspaper articles, e-mails, and instant messages. Each passage was followed by a set of questions designed to gauge comprehension. The reliability of the pretest, which assessed independent reading, was measured using Cronbach's alpha, yielding a value of .732. The posttest, which assessed MT-mediated reading, demonstrated a reliability of .764.

L2 Vocabulary

To assess participants' vocabulary knowledge, 40 words were drawn from the L2 reading test, accounting for different proficiency levels among the participants. Respondents were instructed to provide the Korean translation of each given word. In scoring, a correct translation with an incorrect part of speech was awarded half a point. The Cronbach's alpha reliability for the vocabulary test was calculated as .930. Sample items of the test are provided in Appendices.

L2 Grammar

The grammar assessment included two distinct types of tests: error correction and sentence completion. Fifteen questions in the error correction category addressed grammar points such as subject-verb agreement, voice, tense, and pronoun agreement. Additionally, 15 sentence completion questions required participants to fill in blanks within phrases and clauses across various grammatical positions, including noun, verb, adverb, and adjective. The Cronbach's alpha coefficient for the grammar test was determined to be .879. Sample items of the test are provided in Appendices.

L2 Parsing

To explore participants' understanding of sentence structures and parsing ability, 20 questions were dedicated to identifying different sentence types: simple, complex, compound, and complex-compound sentences. These questions were extracted from summary passages generated by ChatGPT based on two video scripts used in the class as course materials. The participants were familiar with the content of these sentences from the course. The sentence type test exhibited a reliability coefficient of .819. Sample items of the test are provided in Appendices.

L1 Reading Competence

To account for potential topic familiarity influences between L1 and L2 reading, passages from Part 7 of the mock TOEIC were translated into Korean. This L1 reading test comprised 20 short passages and 35 multiple-

choice questions. The Cronbach's alpha reliability coefficient for the L1 reading test was calculated as .805.

3.2.2 Procedure

Week 1: L1 Reading Test (Korean Reading Comprehension, KRC) (30 minutes)
The L1 reading test was administered during the first week of the course. This session, lasting for thirty minutes, took place after the course orientation, where participants were acquainted with the course overview, syllabus, materials, and expectations and learning outcomes. Prior to the test, the participants were given a thorough explanation of the study's objectives and protocols as outlined in the Institutional Review Board (IRB) consent form, and they provided their informed consent.
Week 13: Comprehensive Assessments
In the thirteenth week of the course, a comprehensive set of assessments was conducted in the following sequence:

1. Vocabulary Test (VOCA) (10 minutes): Participants engaged in a vocabulary assessment, lasting approximately ten minutes. This segment focused on evaluating their lexical knowledge in the form of Korean translation.
2. Grammar Test (GRAM) (15 minutes): Following the vocabulary test, participants progressed to the grammar assessment, which lasted for about fifteen minutes. The aim of this test was to appraise participants' grasp of English grammar through error correction and sentence completion tasks.
3. Independent L2 Reading Test (PRE) (30 minutes): Subsequently, participants undertook the L2 reading pretest, which lasted for thirty minutes. The test involved reading passages and answering questions related to comprehension and interpretation of the provided texts.
4. MT-Mediated L2 Reading Test (POST) (20 minutes): Finally, participants engaged in an L2 reading session facilitated by MT tools in their cell phones. Participants were allowed to use MT as they saw fit, but Tthe use of image-based translation was not allowed because the image will only show translated L1 on screens and not show L2 to prevent the translation of the entire text into L1. This segment lasted approximately twenty minutes, during which participants read the same passages from the pretest while employing MT tools.

Week 15: Final Exam – Sentence Type Assessment (ST) (15 minutes)
During the final week of the course, as part of the final exam, participants underwent an assessment to determine their understanding of sentence types, which was then used as an indicator of parsing ability.

3.3 Data Analysis

Quantitative data analyses were conducted employing Mplus8 (Muthén and Muthén 1998-2017) for the first and second research questions, and IBM SPSS Statistics 21 for the third research question. Addressing the first two research questions necessitated the use of structural equation modelling, given that the CI model's two specified constructs are latent variables indicated by measured variables. Specifically, the textbase was indicated by VOCA, GRAM, and ST, while the situation model was indicated by KRC. Latent constructs for KRC, Pre-MT, and Post-MT were formulated through the item parcelling strategy; the even and odd-numbered items of KRC, Pre-MT, and Post-MT were parcelled and subsequently loaded into their respective latent constructs. While not entirely absent of disagreements, the practice of item parcelling is widely acknowledged and embraced when the objective is to comprehend the connections between constructs, as is the case in the current study (Bandalos and Finney 2001, Cho et al. 2019, Little et al. 2002).

To address the third research question, a hierarchical multiple regression analysis was undertaken. The dependent variable chosen was LPS, derived from the difference between Pre-MT and Post-MT scores, reflecting the capacity to apply MT. Pre-MT was used as a control variable by entering it at Step1, and the remaining variables were entered, using a stepwise method.

4. Results

The descriptive statistics of the tested variables are presented in Table 1. The skewness values ranged from -0.89 to 0.79, and the kurtosis values ranged from -0.74 to 1.27, all falling within acceptable limits. Skewness is considered acceptable within the range of -3 to +3, and for kurtosis, a suitable range is -10 to +10 when employing SEM (Kline 2005). Prior to undertaking the analysis of the structural model, an assessment of the measurement models for Pre-MT and Post-MT was conducted as suggested in Bollen (1989); in the tables and figures, "PRE" and "POST" were used in place of "Pre-MT" and "Post-MT" to accommodate space constraints. The results of this assessment demonstrated good model fit; for detailed statistical information, please refer to the tables and figures presented in the Appendices.

Table 1. Descriptive Statistics of the Tested Variables (*N* = 89)

Variables	Means (SD)	Min	Max	Skewness	Kurtosis	Cronbach's alpha
VOCA	25.77 (8.72)	1	39	-.87	.16	.930
GRAM	20.11 (6.02)	6	30	-.35	-.74	.879
ST	13.40 (4.01)	3	20	-.56	-.43	.819
PRE	13.88 (5.39)	4	31	.79	.94	.732
POST	19.57 (5.98)	9	40	.86	1.00	.764
KRC	25.15 (4.55)	8	33	-.89	1.27	.805
LPS	5.70 (5.94)	-2	28	-	-	-

Note. PRE refers to independent L2 reading, while POST refers to MT-mediated L2 reading.

4.1 The Validity of the Model

The model posits the quality of the textbase as a function of L2 proficiency and the quality of the situation model as L1 reading competence. The indexes of absolute fit, comparative fit and parsimonious fit are used to assess how well the theoretical model aligns with the observed data. Table 2 presents a comprehensive overview of these goodness-of-fit indexes for the structural models. The Chi-square values associated with Pre-MT and Post-MT, which serve as indicators of absolute fit, produced *p*-values of .783 and .635, respectively. These *p*-values surpass the 0.05 threshold, suggesting that the models effectively conform to the data; non-significant *p*-values are indicative of a strong model fit. Furthermore, SRMR was utilized to gauge the disparities between the observed correlations and the correlations inferred by the model. For PRE, the SRMR was calculated at 0.025, and for POST, it was .030. Both these values fall below the threshold of 0.08, confirming the goodness of fit of the models. Assessment of comparative fit involved CFI and TLI, which determine the model's fidelity relative to a baseline model. Both Pre-MT and Post-MT exhibited CFI and TLI values of 1.000, exceeding the recommended threshold of 0.95. In terms of parsimonious fit, RMSEA was employed. The RMSEA value for Pre-MT was calculated as .000, and for Post-MT, it was also .000. Both these values are below the critical threshold of 0.10, demonstrating

a strong alignment between the models and the data. Given that the presented indexes collectively endorse the idea of a robust fit for both structural models to the observed data, the CI model for L2 reading, which posits the quality of the textbase as a function of L2 proficiency and the quality of the situation model as L1 reading competence, is deemed to be a viable and acceptable model not only for the independent reading but also for the MT-mediated reading.

Table 2. Goodness of Fit Indexes for the Structural Model

Indexes		Observed values		Acceptable values
		PRE	POST	
Absolute fit	Chi-square	7.199 (p = .783) with 11 dfs	8.854 (p = .635) with 11 dfs	p > .05
	SRMR (standardized root mean square residual)	.025	.030	$p \leq .08$
Comparative fit	CFI (comparative fit index)	1.000	1.000	$p \geq .95$
	TLI (Tucker-Lewis index)	1.000	1.000	$p \geq .95$
Parsimonious fit	RMSEA (root mean square error of approximation)	.000 (90 percent CI, .000:.075)	.000 (90 percent CI, .000:.093)	$p \leq .10$

Note. The goodness-of-fit indexes of the measurement models and structural models were identical.

4.2 Changes between the Two Conditions

The result of a paired samples *t*-test indicated that there was a significant difference between Pre-MT (M = 13.876, SD = 5.387) and Post-MT (M = 19.573, SD = 5.975), $t(88) = 10.891$, p = .000. The changes in explanatory power observed in the textbase and situation model subsequent to MT-mediated reading offer insights into the proposed role of MT as a catalyst for enhancing the textbase. Table 3 displays the coefficients of the relationships between the exogenous and endogenous variables, along with associated statistical metrics. Regarding the textbase's contribution, a coefficient of .741* is identified for the association between textbase and Pre-MT. This indicates a statistically significant and positive influence of the textbase on Pre-MT. In a similar vein, the association between the textbase and Post-MT displays a coefficient of .521*, suggesting a significant and positive effect of textbase on Post-MT. One of the differences observed between the two reading conditions shows that the impact of L2 proficiency decreased after MT-mediated reading from .741 to .521. The influence of individual differences in constructing the textbase was alleviated through the aid of MT, facilitating the development of an enhanced textbase. Consequently, the prominence of L2 proficiency's role became less pronounced in MT-mediated reading. These results show that learners with lower Pre-MT scores (lower-level reading competence) often had big potentials that were not manifested, and when scaffolded by MT, they could use their full reading competence, resulting in higher scores in Post-MT. At the same time, the use of MT does not mean no need for L2 competence; higher L2 proficiency does still have positive contribution to MT-assisted reading.

As far as the changes involved in the situation model are concerned, the coefficient of the situation model for Pre-MT is .091, which is not statistically significant. In contrast, the relationship between the situation model and Post-MT reveals a significant coefficient of .399*, implying a substantial influence of the situation model on Post-MT. In other words, the effect of the situation model, represented by L1 reading competence, exhibits a noticeable increase during MT-mediated reading. This indicates that the bottleneck effects deriving from limited L2 proficiency have been mitigated, thereby creating an expanded avenue for the influence of L1 reading competence

to emerge. This effect, manifested in the more elaborated situation model thanks to a more complete textbase facilitated by MT use, culminated in a significant improvement on Post-MT. The changes in explanatory power of exogenous variables are graphically presented in Figure 1 and Figure 2.

Table 3. The Relationships between the Exogenous and Endogenous Variables and R^2 of the Pre-MT and Post-MT Models

Exogenous variable	Endogenous variable	*β*	*B*	*SE*	R^2
Textbase	PRE	.741*	.253	.088	
	POST	.521*	.199	.100	
Situation Model	PRE	.091$^{N.S.}$	.139	.116	
	POST	.399*	.647	.111	
Total	PRE				.599
	POST				.557

Figure 1. The Structural Model of Pre-MT with Standardized Loadings

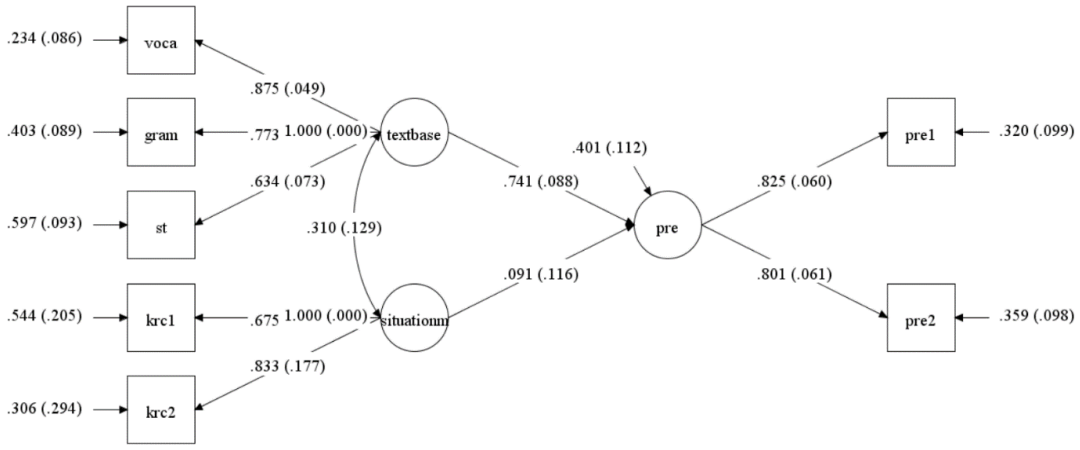
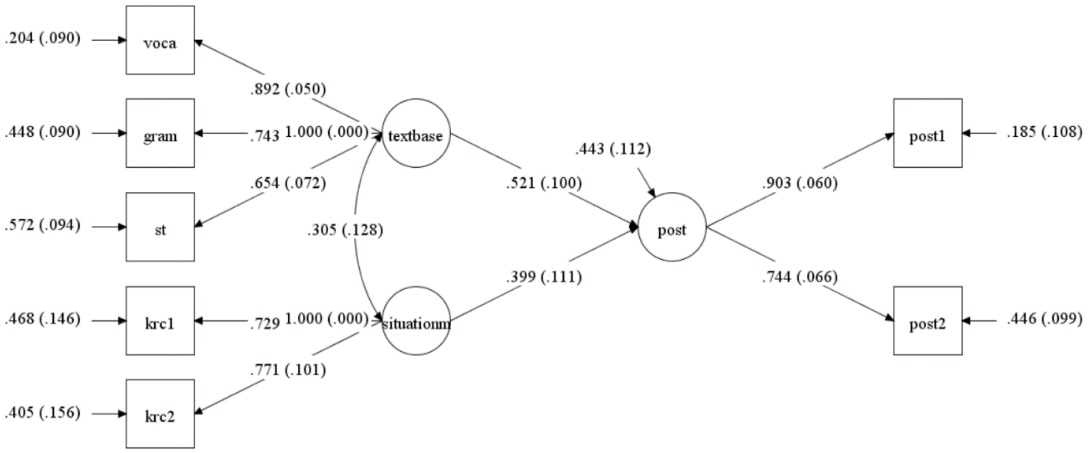


Figure 2. The Structural Model of Post-MT with Standardized Loadings



4.3 Significant Predictor Variables for Learning Potential Scores

Table 4 displays a correlation matrix that illustrates the relationships among the examined variables, including LPS. As expected, significant correlations are observed between VOCA, GRAM, and ST, reflecting their connection to L2 linguistic knowledge. Additionally, Pre-MT and Post-MT scores reveal robust positive correlations with VOCA, GRAM, and ST. Notably, KRC is significantly positively correlated with GRAM (.270), Pre-MT (.243), Post-MT (.407), and LPS (.228). The focal point, LPS, exhibits noteworthy correlations. Specifically, LPS shows a significant positive correlation with KRC (.228) and Post-MT (.526), while demonstrating a significant negative correlation with Pre-MT (-.332).

Table 4. The Correlations of the Tested Variables with Means and Standard Deviations

	VOCA	GRAM	ST	KRC	PRE	POST	LPS
VOCA	1						
GRAM	.675**	1					
ST	.588**	.430**	1				
KRC	.202	.270*	.166	1			
PRE	.579**	.574**	.431**	.243*	1		
POST	.505**	.436**	.452**	.407**	.627**	1	
LPS	-.021	-.098	.077	.228*	-.332**	.526**	1
Mean	25.775	20.112	13.404	25.146	13.876	19.573	5.697
SD	8.717	6.020	4.008	4.554	5.387	5.975	4.935

A hierarchical multiple regression analysis was conducted to ascertain variables that significantly predict LPS, while controlling for the influence of Pre-MT. The analysis was conducted in three steps, each involving distinct sets of predictors. The results are presented in Table 5. In Step 1, the control variable, Pre-MT, was entered, revealing a significant negative relationship with LPS (β = -.332***, p < .001), accounting for a significant change in R^2 (ΔR^2 = .110, p < .001). This significant negative relationship aligns with general reasoning, suggesting that lower Pre-MT scores allow for greater potential increase in Post-MT scores and, subsequently, a more substantial increase in LPS, which aligns with the findings of Oh (2022b).

Table 5. Hierarchical Multiple Regression Analyses Predicting LPS after Controlling for Pre-MT

Predictor	LPS	
	ΔR^2	β
Step1	.110***	
Control Variable		-.332***
Step2	.101***	
KRC		.328***
Step3	.049*	
ST		.247*
Total R^2	.261***	
N	89	

Note. Step2 and Step 3 indicate the result of a stepwise analysis when VOCA, GRAM, KRC, and ST were entered together.

The next steps of analyses, Step 2 and Step 3, were conducted using a stepwise method. In Step 2, KRC emerged to have a significant positive relationship with LPS (β = .328***, p < .001), resulting in a significant increase in ΔR^2 of .101 (p < .001). ST was added alongside the previously entered predictors in Step3. ST displayed a

significant positive association with LPS (β = .247*, p < .05), leading to a smaller but still significant increase in ΔR^2 of .049 (p < .05). The cumulative model, accounting for the effects of VOCA, GRAM, KRC, and ST, resulted in a R^2 of .261 (p < .001), signifying the proportion of variance in LPS explained by the predictors collectively.

In summary, the proposed CI model for L2 reading, which theorizes the roles of L1 reading competence and L2 proficiency in both Pre-MT (independent L2 reading) and Post-MT (MT-assisted L2 reading), was validated. This validation is supported by the various goodness of fit indices presented in Table 1. The hypothesis that the textbase is indicated by L2 linguistic knowledge and the situation model by L1 reading competence was empirically confirmed for both reading conditions. The model elucidates the mechanism through which MT facilitates L2 reading comprehension, demonstrating that MT reduces dependency on individual differences in constructing the textbase, thereby allowing greater influence of individual differences in the situation model. This facilitation is achieved through MT's provision of a more complete textbase. Additionally, LPS was found to be best predicted by L1 reading competence, followed by parsing ability, as indicated by participants' proficiency in identifying sentence types such as simple, complex, compound, and compound-complex.

5. Discussion and Conclusion

The primary objectives of this study were to theorize the role of MT in L2 reading comprehension using the CI model and to empirically assess its viability in explaining L2 reading comprehension, both independently and in the context of MT utilization. The study examined changes in explanatory power within the textbase and situation model following MT-mediated reading to determine how MT contributes to L2 reading comprehension. Additionally, the investigation aimed to identify specific predictor variables that substantially impact variances in enhanced scores subsequent to MT, referred to as LPS. Our findings confirm the validity of the models, demonstrating the textbase as a key mechanism through which MT influences reading comprehension. The results also underscore the significance of L1 reading competence and L2 parsing ability as key predictors for LPS.

The empirical validation of the CI model for L2 reading incorporating MT use holds significant implications for several reasons. Primarily, a structured approach is crucial in both research and pedagogy within the domain of L2 reading comprehension. The presence of dual languages during L2 reading not only increases the intricacy of reading comprehension but also underscores its multidimensional character (Koda 2007). The introduction of MT as a moderating factor further complicates matters, emphasizing the heightened need for a systematic approach in L2 reading pedagogy.

Building up on the findings from the previous research on the role of L1 in L2 reading (Cohen 2011, Kern 1994, Kwon and Schallert 2016, Upton and Lee-Thompson 2001), the integration of MT can also be conceptualized within a translanguaging framework. Translanguaging is defined as "the dynamic process whereby multilingual language users mediate complex social and cognitive activities through strategic employment of multiple semiotic resources to act, to know, and to be" (García and Wei 2014, p. 12). As a critical semiotic resource readily available to contemporary L2 readers, MT should now be regarded as a constant in L2 reading research, underscoring the need for the development of a comprehensive theory of comprehension.

In this context, the present study, which theorizes and validates the roles of L1, MT, and L2 proficiency in L2 reading, is particularly timely given the rapid spread of AI technology and its growing applications in education. It offers specific guidelines for future research and instructional practices in technology- and AI-assisted language learning. The existing Pluriliteracies Teaching for Deeper Learning (PTDL) framework (Coyle and Meyer, 2021), designed for Content and Language Integrated Learning (CLIL), primarily addresses the digital dimension for

deep learning in content knowledge. The PTDL framework effectively highlights the role of educational technologies in creating a supportive learning environment that fosters knowledge construction, online assistance, practice, knowledge sharing, student autonomy, motivation, and reflective feedback (p. 123).

While the PTDL framework offers foundational guidelines for research and instructional design, the CI model for L2 reading enables systemic positioning of MT based on cognitive theory and a more nuanced approach to understanding language learning processes, particularly in the area of comprehension. The CI model underscores the importance of constructing a robust textbase of L2 linguistic input as a critical first step in facilitating deeper content learning. Within this model, the role of technology and L1 or translanguaging is not merely supportive but essential in enhancing the textbase, thereby enabling students to build a comprehensive situation model where deeper learning of content knowledge can be more effectively realized. This enhancement of the PTDL framework through the CI model offers a more detailed pathway for integrating AI and other technologies into L2 reading instruction, ensuring that learners attain a more profound and holistic understanding of both content and language development.

Additionally, L2 learners' translanguaging practices can be classified into two distinct functions: textbase enhancement and situation model enhancement. This simplified classification aids in clarifying the objectives in both research and instructional activities by pinpointing sources of difficulties and identifying specific areas that need to be addressed. By distinguishing these functions, researchers and educators can more precisely target their goals, thereby improving the construct validity and fidelity of the instruments and methods used in language research and teaching. These implications are consistent with Koda's (2005) assertion that "a clear understanding of variations in competencies and their direct effect on reading performance can enable practitioners to identify which skills to emphasize with greater accuracy" (p. 181).

One noteworthy aspect in this study is the conceptualization of the differences between scores in independent reading and MT-mediated reading as an indicator of learning potential. Through a hierarchical multiple regression analysis, specific predictors influencing variances in enhanced scores subsequent to MT were delineated, controlling for independent reading. L1 reading competence emerged as a significant positive predictor, affirming its substantial contribution to the enhanced scores, aligning with the CI model for L2 reading's hypothesis. Additionally, parsing ability, operationalized through knowledge of sentence types, showed a significant positive correlation with enhanced scores, emphasizing its pivotal role in the MT-mediated reading process. These findings imply that MT use does not preclude L2 ability; rather, they show that learners with better L1 competence and L2 proficiency will benefit more from technology assistance. They offer practical guidelines for teachers and learners on what should be prioritized in technology- or AI-assisted language teaching and learning.

With the use of MT as a constant for scaffolding L2 reading, innovative diagnostic tools and assessments can be explored within the dynamic assessment framework (Poehner and Lantolf 2013). As exemplified by Yang and Qian (2020, 2023) and Meng and Fu (2023) in their computerized dynamic assessments, L2 learners can be trained to engage in higher-order cognitive processes, such as inferencing, based on their needs step by step. Conceptualizing MT as a textbase enhancer allows for the development of a more systematic instructional and formative assessment model. This approach has the potential to assist educators in identifying L2 readers' strengths and weaknesses by clarifying the use of a broader array of components available in their L1, as well as L2-related factors, thereby facilitating more targeted interventions. Consequently, these advancements contribute to the improvement of teaching practices, enabling educators to embrace a more informed and evidence-based approach to L2 learning.

The recent advent of ChatGPT introduces new dimensions to the L2 reading landscape. The identification of L1 reading competence and parsing ability as influential predictors for LPS in MT-mediated reading is a promising

start for further explorations using ChatGPT. The expected role of ChatGPT, akin to a translator, mirrors the function of MT in L2 reading by aiding in the construction of the textbase. However, ChatGPT's versatile affordances extend beyond enhancing textbase construction to assume various roles in integrating different kinds of knowledge for a more robust situation model. This scenario necessitates the utilization of readers' higher-order thinking skills and strategic competences, predominantly honed in their L1. Illustrated by Kim (2023), who demonstrated the efficacy of ChatGPT as an instructional intervention for enhancing cognitive reading strategies among Korean high school students, there is potential for proficiency in using MT and/or ChatGPT to foster self-regulated and self-directed learning among students. Such technologies as cognitive scaffolds can empower L2 learners to actively engage with authentic English materials throughout their lifelong learning journey, and the findings of our study can lay a foundation for further research in this area.

The evolving concepts of the multilingual turn (Conteh and Meier 2014), translanguaging (García and Wei 2014), sociocultural theory (SCT) (Lantolf 2000), multiliteracy (New London Group 1996) and PTDL (Coyle and Meyer 2021) mark a departure from the previously dominant prescriptive English-only approach. Instead, they signal a shift towards embracing enhanced human cognition mediated by diverse meaning-making resources. These concepts embody the perspective that the “designing of meaning” (New London Group 1996), and consequently the “designing of social futures” (New London Group 1996), transcends the boundaries of a single language. It is a dynamic process involving the assembly of multiple languages, literacies, modes, technologies, and the utilization of any available resources for the purpose of human cognition and communication (García and Wei 2014). Mediated performance has the potential to expand our learning potential (Lantolf 2000), and transformative ICTs can bridge the cognitive-linguistic gaps of mature L2 users. Within this framework of multiliteracy, the integration of MT or ChatGPT into L2 pedagogy can be appropriately theorized as cognitive mediation, nurturing autonomous L2 readers who can avail themselves of authentic reading materials online worldwide.

As for the limitations of this study, the interpretation of the proposed model should be confined to adult L2 learners who have already achieved cognitive maturity in their L1 literacy, particularly within an EFL context. The model may manifest differently for students whose L1 literacy is at varying developmental stages, due to the complex interplay of additional variables. Therefore, the generalizability of this theory should be approached with caution.

Furthermore, the type and purpose of reading in this study should be taken into account. The reading passages for both L1 and L2 reading were sourced from mock TOEIC reading tests, which may not fully represent real-life reading situations. As Kwon and Schallert (2016) highlighted, contextual factors such as the nature of the text, the purpose of reading, and the anticipated future applications significantly influence translanguaging practices. The specific ways in which these practices manifest in MT- or Chat-GPT mediated reading may differ depending on the type of reading and its intended purpose.

In this regard, further research is needed to explore MT- or ChatGPT-mediated reading across different contexts, for various purposes, and with diverse anticipated applications. Such studies would provide a more comprehensive understanding of how these technologies function in varied linguistic and situational settings. Additionally, qualitative studies employing think-aloud protocols during MT- or ChatGPT-mediated reading could offer detailed insights into how more proficient and less proficient users navigate these technological tools. This understanding is urgently needed to develop instructional models that are effective in both classroom and out-of-class settings.

References

Bandalos, D. J. and S. J. Finney. 2001. Item parcelling issues in structural equation modelling. In G. A. Marcoulides and R. E. Schumacker, eds., *New Developments and Techniques in Structural Equation Modelling*, 269-296. Mahwah, NJ: Lawrence Erlbaum.

Bernhardt, E. B. and M. L. Kamil. 1995. Interpreting relationships between L1 and L2 reading: Consolidating the linguistic threshold and the linguistic interdependence hypotheses. *Applied Linguistics* 16, 15-34.

Bollen, K.A. 1989. *Structural Equations with Latent Variables*. New York: John Wiley and Sons.

Cho, E., P. Capin, G. Roberts, G. J. Roberts. and S. Vaughn. 2019. Examining sources and mechanisms of reading comprehension difficulties: Comparing English learners and non-English learners within the simple view of reading. *Journal of Educational Psychology* 111(6), 982-1000.

Chung, E. S. 2020. The effect of L2 proficiency on post-editing machine translated texts. *Journal of Asia TEFL* 17(1), 182-193.

Chung, E. S. and S. Ahn. 2022. The effect of using machine translation on linguistic features in L2 writing across proficiency levels and text genres.*Computer Assisted Language Learning* 35(9), 2239-2264.

Cohen, A. D. 2011. *Strategies in Learning and Using a Second Language*. New York: Routledge.

Conteh, J. and G. Meier. 2014. *The Multilingual Turn in Languages Education: Opportunities and Challenges.* Bristol: Multilingual Matters.

Coyle, D. and O. Meyer. 2021. *Beyond CLIL: Pluriliteracies Teaching for Deeper Learning.* Cambridge: Cambridge University Press.

Davis, J. N. and L. Bistodeau. 1993. How do L1 and L2 reading differ? Evidence from think aloud protocols. *The Modern Language Journal* 77(4), 459-472.

Elgort, I. and P. Warren. 2014. L2 vocabulary learning from reading: Explicit and tacit lexical knowledge and the role of learner and item variables. *Language Learning* 64(2), 365-414.

Fillmore, C. and P. Kay. 1983. Text semantic analysis of reading comprehension tests. *Final report to National Institute of Education*. Berkeley, CA: Institute of Human Learning, University of California.

Fisk, C. and B. Hurst. 2003. Paraphrasing for comprehension. *The Reading Teacher* 57(2), 182-185.

García, O. and L. Wei. 2014. *Translanguaging: Language, Bilingualism and Education.* Basingstoke: Palgrave Macmillan.

García, O., N. Flores and M. Spotti. 2017. Language and society: A critical poststructuralist perspective. In O. García, N. Flores and M. Spotti, eds., *The Oxford Handbook of Language and Society,* 1-16. Oxford: Oxford University Press.

Hawras, S. 1996. Towards describing bilingual and multilingual behavior: Implications for SEL instruction. Unpublished thesis, University of Minnesota.

Horiba, Y. 1990. Narrative comprehension processes: A study of native and non-native readers of Japanese. *The Modern Language Journal* 74(2), 188-202.

Hungwe, V. 2019. Using a translanguaging approach in teaching paraphrasing to enhance reading comprehension in first-year students. *Reading and Writing-Journal of the Reading Association of South Africa* 10(1), 1-9.

Kern, R. G. 1994. The role of mental translation in second language reading. *Studies in second language acquisition* 16(4), 441-461.

Kim, E. Y. and E. J. Oh. 2023. Machine translation use as translanguaging in content and language integrated learning: A case study in a general English course for global citizenship. *English Teaching* 78(4), 59-82.

Kim, R. 2023. Effects of ChatGPT on the cognitive processing of K-CSAT English reading tasks by Korean high

school learners: A preliminary study. *Secondary English Education* 16(2), 179-205.

Kintsch, W. 1998. *Comprehension: A Paradigm for Cognition.* New York: Cambridge University Press.

Kintsch, W. 2019. Revisiting the construction-integration model of text comprehension and its implications for instruction. In D. E. Alvermann, N. J. Unrau and R. B. Ruddell, eds., *Theoretical Models and Processes of Reading*, 178-203. New York: Routledge.

Kline, R. B. 2005. *Principles and Practice of Structural Equation Modelling*. New York: The Guildford Press.

Koda, K., 2005. *Insights into Second Language Reading: A Cross-Linguistic Approach*. Cambridge University Press.

Koda, K. 2007. Reading and language learning: Crosslinguistic constraints on second language reading development. *Language Learning* 57, 1-44.

Kwon, H. J. and D. L. Schallert. 2016. Understanding translanguaging practices through a biliteracy continua framework: Adult biliterates reading academic texts in their two languages. *Bilingual Research Journal* 39(2), 138-151.

Lantolf, J. P. 2000. Introducing sociocultural theory. *Sociocultural theory and second language learning* 1, 1-26.

Lee, S. M. 2020. The impact of using machine translation on EFL students' writing. *Computer Assisted Language Learning* 33(3), 157-175.

Lee, S. M. and N. Briggs. 2021. Effects of using machine translation to mediate the revision process of Korean university students' academic writing. *ReCALL* 33(1), 18-33.

Lee, Y. J. 2021. Still taboo? Using machine translation for low-level EFL writers. *ELT Journal* 75(4), 432-441.

Lewis, G., B. Jones and C. Baker. 2012. Translanguaging: Origins and development from school to street and beyond. *Educational research and evaluation* 18(7), 641-654.

Li, P. and R. B. Clariana. 2019. Reading comprehension in L1 and L2: An integrative approach. *Journal of Neurolinguistics 50*, 94-105.

Little, T. D., W. A. Cunningham, G. Shahar and K. F. Widaman. 2002. To parcel or not to parcel: Exploring the question, weighing the merits. *Structural equation modelling* 9(2), 151-173.

McCauley, S. M. and M. H. Christiansen. 2015. Individual differences in chunking ability predict on-line sentence processing individual differences in chunking ability predict on-line sentence processing. In *Proceedings of the 37th Annual Conference of the Cognitive Science Society*, 1553-1558.

McCauley, S. M., E. S. Isbilen and M. H. Christiansen. 2017. Chunking ability shapes sentence processing at multiple levels of abstraction. In *Proceedings of the 39th Annual Meeting of the Cognitive Science Society: Computational Foundations of Cognition*, 2681-2686.

McLeod, B. and B. McLaughlin. 1986. Restructuring or automaticity? Reading in a second language. *Language learning* 36(2), 109-123.

Meng, Y. and H. Fu. 2023. Modelling mediation in the dynamic assessment of listening ability from the cognitive diagnostic perspective. *The Modern Language Journal* 107(S1), 137-160.

Muthén, L. K. and B. O. Muthén. 1998-2017. *Mplus User's Guide. Eighth Edition*. Los Angeles, CA: Muthén & Muthén.

Nassaji, H. 2007. Schema theory and knowledge-based processes in second language reading comprehension: A need for alternative perspectives. *Language Learning* 57, 79-113.

New London Group. 1996. A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review* 66(1), 60-93.

Oh, E. J. 2014. Exploring a theory-based model of L2 reading comprehension: CI model for L2 reading comprehension. *Korean Journal of Applied Linguistics* 30(3), 151-177.

Oh, E. J. 2022a. Integrating global citizenship and global competence into a general English course: A case study. *Journal of Education for International Understanding* 17(1), 93-156.

Oh, E. J. 2022b. Exploratory study on the use of machine translation for reading in college English classes. *Multimedia-Assisted Language Learning* 25(4), 66-92.

Oh, E. J. In press. A case study of an AI-assisted CLIL approach: A college English course for global citizenship and global competence in an EFL setting. In S. L. Ju, H. Reinders and J. K. Park, eds., *Innovation in Language Learning and Teaching: The Case of South Korea*. Palgrave Macmillan.

Pacheco, M. B., S. M. Daniel, L. C. Pray and R. T. Jiménez. 2019. Translingual practice, strategic participation, and meaning-making. *Journal of Literacy Research* 51(1), 75-99.

Peng, P., Z. Zhang, W. Wang, K. Lee, T. Wang, C. Wang, J. Luo and J. Lin. 2022. A meta-analytic review of cognition and reading difficulties: Individual differences, moderation, and language mediation mechanisms. *Psychological Bulletin* 148(3-4), 227.

Poehner, M. E. and J. P. Lantolf, 2013. Bringing the ZPD into the equation: Capturing L2 development during computerized dynamic assessment (C-DA). *Language Teaching Research* 17(3), 323-342.

Pulido, M. F. and P. López-Beltrán. 2023. When native speakers are not "native-like:" Chunking ability predicts (lack of) sensitivity to gender agreement during online processing. *Cognitive Science* 47(10), e13366.

Suzuki, Y. 2024. *Practice and Automatization in Second Language Research: Perspectives from Skill Acquisition Theory and Cognitive Psychology*. New York: Routledge.

Tsai, S. C. 2019. Using Google Translate in EFL drafts: A preliminary investigation. *Computer Assisted Language Learning* 32(5-6), 510-526.

Turner, A. and E. Greene. 1977. *The Construction of a Propositional Text Base* (Tech. Rep. No. 63). Boulder: University of Colorado Press.

Unrau, N. J., D. E. Alvermann and M. Sailors. 2019. Literacies and their investigation through theories and models. In E. Alvermann, N. J. Unrau, M. Sailtors and R. B. Ruddel, eds., *Theoretical models and processes of literacy*, 3-34. New York: Routledge.

Upton, T. A. and L. C. Lee-Thompson. 2001. The role of the first language in second language reading. *Studies in Second Language Acquisition* 23(4), 469-495.

Vaish, V. and A. Subhan. 2015. Translanguaging in a reading class. *International Journal of Multilingualism* 12(3), 338-357.

Vieira, L. N., C. O'Sullivan, X. Zhang and M. O'Hagan. 2023. Machine translation in society: insights from UK users. *Language Resources and Evaluation* 57(2), 893-914.

Vygotsky, L. S. 1962. *Thought and Language*. Cambridge: MIT Press.

Vygotsky, L. S. 1978. *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Vygotsky, L. S. 1987. *The Collected Works of L. S. Vygotsky. Vol. 1: Problems of General Psychology*. New York: Plenum Press.

Yang, Y. and D. D. Qian. 2020. Promoting L2 English learners' reading proficiency through computerized dynamic assessment. *Computer Assisted Language Learning* 33(5-6), 628-652.

Yang, Y. and D. D. Qian. 2023. Enhancing EFL learners' reading proficiency through dynamic assessment. *Language Assessment Quarterly* 20(1), 20-43.

APPENDICES

Sample Test Items for the Vocabulary, Grammar, and Parsing Tests

Sample test items for the vocabulary test out of 40
Translate the given word into Korean.

	한국어 뜻
affect (v)	
entire (adj)	
sincere (adj)	
reimbursement (n)	

Sample test items for the grammar test out of 30
Error correction: Choose the incorrect part.

1. Paul (A)works in the city, (B)but once a month he (C)visited (D)his mother, who lives in the country.
2. (A)Generally speaking, Korean students (B)doesn't have (C)much free (D)time.
3. I must (A)reading a few lengthy (B)books for (C)my literature (D)class.

Sentence Completion: Choose the appropriate expression to fill in the blank.

1. ____ is my job.
   (A) Teach science
   (B) Teaching science
   (C) To teaching science
   (D) Science taught
2. _____, we can't buy a car.
   (A) Since we don't have enough money
   (B) Why we don't have enough money
   (C) Because we not having enough money
   (D) When we does not have enough money

Sample test items for the parsing test out of 20
Identify a type of sentence; simple sentence, complex sentence, compound sentence, or complex-compound sentence.

1. The World We Live In1 discusses the interconnectedness and interdependence of the world in the context of globalization.
2. These themes are introduced via the video titled “Web of Life” and emphasized with a quote of Dr. Martin Luther King, Jr.
3. The video further explores how our daily actions and routines are connected to others around the world.

Table 1. Correlations of Indicators with Means and Standard Deviations in the Pre-MT and Post-MT Measurement Models

	VOCA	GRAM	ST	KRC1	KRC2	PRE1	PRE2	POST1	POST2
VOCA	1.000								
GRAM	.675**	1.000							
ST	.588**	.430**	1.000						
KRC1	.154	.229*	.137	1.000					
KRC2	.201	.248*	.156	.562**	1.000				
PRE1	.538**	.546**	.371**	.199	.198	1.000			
PRE2	.517**	.498**	.417**	.142	.243*	.660**	1.000		
POST1	.481**	.461**	.458**	.362**	.399**	-	-	1.000	
POST2	.435**	.315**	.391**	.317**	.288**	-	-	671**	1.000
MEAN	25.770	20.112	13.404	11.989	13.157	7.416	6.461	10.607	8.910
SD	8.717	6.020	4.008	2.511	2.641	3.154	2.755	3.291	3.172

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Standardized and Unstandardized Coefficients for the Measurement Model

Observed Variables	Latent Construct	*β*		*B*		*SE*	
		PRE	POST	PRE	POST	PRE	POST
VOCA		.875	.892	1.000	1.000	-	-
GRAM	Textbase	.773	.743	.610	.575	.083	.080
ST		.634	.654	.333	.337	.053	.055
KRC1	Situation	.675	.729	1.000	1.000	-	-
KRC2	Model	.833	.771	1.297	1.112	.560	.289
PRE1	PRE	.825		1.000		-	
PRE2		.801		.848		.128	
POST1	POST	.903		1.000		-	
POST2		.744		.794		.126	

Table 3. Goodness of Fit Indexes for the Measurement Model

Indexes		Observed values		Acceptable values
		PRE	POST	
Absolute fit	Chi-square	7.199 (p = .783) with 11 dfs	8.854 (p = .635) with 11 dfs	p > .05
	SRMR (standardized root mean square residual)	.025	.030	$p \leq .08$
Comparative fit	CFI (comparative fit index)	1.000	1.000	$p \geq .95$
	TLI (Tucker-Lewis index)	1.000	1.000	$p \geq .95$
Parsimonious fit	RMSEA (root mean square error of approximation)	.000 (90 percent CI, .000:.075)	.000 (90 percent CI, .000:.093)	$p \leq .10$

Figure 1. Graphic Representation of the Pre-MT Measurement Model with Standardized Coefficients

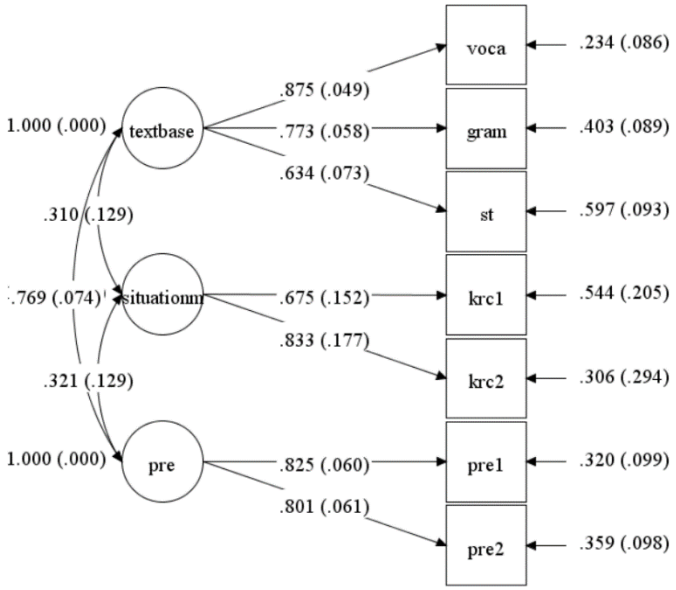
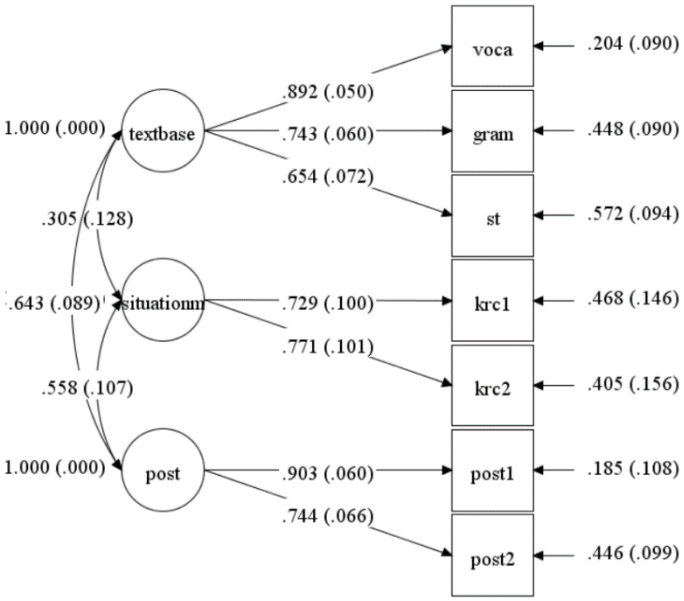


Figure 2. Graphic Representation of the Post-MT Measurement Model with Standardized Coefficients



Examples in: English
Applicable Languages: English
Applicable Level: Tertiary