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The Impact of Vocabulary, Inferencing, and Metacognitive Strategies on Second Language Reading Comprehension*

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This study aims to explore exploring the predictive factors of second language (L2) reading comprehension scores, specifically focusing on L2 vocabulary knowledge, first language (L1) syllogistic inferencing, L1 reading comprehension, and L2 reading metacognitive strategy use. The study involved 90 Korean EFL university students. Their L2 vocabulary knowledge, L1 syllogistic inferencing, L1 reading comprehension, L2 metacognitive reading strategy use scores were collected and analyzed for their influence on L2 reading comprehension scores. A path analysis was conducted for data analysis. The findings revealed that both L2 linguistic knowledge and proficiency in L1 reading comprehension had a positive impact on L2 reading comprehension scores, underscoring the significance of language-specific and cross-linguistic factors, respectively, in the comprehension of L2 reading. The results also indicated an indirect effect of L1 syllogistic inferencing skills on L2 reading comprehension through L1 reading comprehension. This implies that L1 syllogistic inferencing may boost L1 reading comprehension, subsequently benefiting L2 reading comprehension. Furthermore, the study brought to light the potential adverse effects of L2 support reading strategies on L2 reading comprehension. Overall, this study adds to our comprehensive understanding of L2 reading comprehension by shedding light on the intricate interplay of linguistic, cross-linguistic, and metacognitive factors.

[L2 reading comprehension/L2 vocabulary knowledge/L1 reading comprehension/inferencing skills/L2 metacognitive reading strategy]

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I. INTRODUCTION

In second language (L2) classrooms, the process of learning and teaching L2 reading holds paramount significance, as reading stands as a vital component of communicative competence.[1] Nonetheless, the endeavor to cultivate proficiency in L2 reading, broadly defined as the cognitive ability to extract meaning from text (Perfetti & Adlof, 2012), is indeed a challenging one. Becoming proficient L2 readers necessitates the acquisition of a robust foundation in L2 vocabulary knowledge (Jeon & Yamashita, 2014), the cultivation of a well-established L1 reading proficiency that can be positively transferred during L2 reading endeavors (Cummins, 1979), and the development of L2 reading strategies, which include not only knowing which strategies to employ but also understanding when, where, and how to apply them effectively (Mokhtari & Reichard, 2002).

Cognitive models of reading concur that the goal of reading comprehension is to establish a coherent and accurate mental representation of the text (Graesser et al., 1994; Khalifa & Weir, 2009; Kintsch, 1998; Perfetti & Adlof, 2012). This process entails the creation of two primary levels of representations: a lower level and a higher level. At the lower level of mental text representation, surface information is deciphered to generate text-based propositions and comprehend the explicit meaning contained within the text. This involves leveraging linguistic knowledge for accessing vocabulary and parsing sentence structure. At the upper level of mental representation, the initial explicit propositions undergo processes of inference, allowing for the interpretation of implicit meaning that is not overtly expressed in the text. Furthermore, a situational model is developed by amalgamating the information derived from the text with the reader's pertinent knowledge and objectives (Graesser et al., 1994; Perfetti & Adlof, 2012).

The process of constructing mental representations of text becomes considerably more intricate when applied to L2 reading. Learning to read in an L2 environment differs significantly from learning to read in a first language (L1) context, encompassing various aspects such as potential L1 influences and the utilization of L2 metacognitive strategies (Bernhardt, 2011). One noteworthy distinction between L1 and L2 reading is associated with the linguistic interdependence hypothesis, which posits that L2 learners are likely to employ reading and writing skills they have acquired in their L1 during L2 reading tasks (Cummins, 1979). In other words, unlike L1 readers, especially adult L2 readers who have already mastered their L1, rely on resources and skills cultivated in their L1. Furthermore, L2 reading often involves a higher degree of metacognitive awareness compared to L1 reading, underscoring the importance of L2 learners effectively employing metacognitive

[1] In this study, "L2" referred to languages other than the individuals' first language, encompassing both L2s and foreign languages. Also, the terms "reading" and "reading comprehension" were used interchangeably.

reading strategies (Grabe & Stoller, 2011).

Given the importance of establishing a cohesive mental representation of text at both lower and higher levels, as well as the unique characteristics of L2 reading processes, including L1 influence and the use of L2 metacognitive reading strategies, the present study focuses on four key elements in L2 reading comprehension: L2 vocabulary knowledge, situated at the lower level of reading processes; inferencing skills, situated at the higher level of reading processes; L1 reading comprehension proficiency; and the utilization of L2 metacognitive reading strategies. Specifically, greater levels of L2 vocabulary knowledge (Stæhr, 2008), L1 inferencing skills (Kim, 2022), L1 comprehension proficiency (Kim & Pae, 2023), and metacognitive strategy use (Guo, 2018; Jung, 2020) may enhance L2 reading comprehension. The selection of these four elements was deliberate, as each component has been shown to enhance L2 reading comprehension. However, there is a scarcity of studies that have explored their combined impact within a single study. Hence, the primary purpose of this study is to examinethe extent to which L2 reading comprehension scores can be predicted by L2 vocabulary knowledge, L1 syllogistic inferencing skills, L1 reading comprehension, and the use of L2 reading metacognitive strategies. The pursuit of this goal would enable us to delve deeper into the intricate dimensions of L2 reading comprehension and potentially pinpoint the specific elements related to L2 reading comprehension that require increased instructional emphasis in L2 reading classrooms.

II. LITERATURE REVIEW

1. L2 Vocabulary Knowledge and L2 Reading Comprehension

From a theoretical perspective, the acquisition of L2 vocabulary knowledge is regarded as a fundamental prerequisite for lower-level processes of L2 reading comprehension, as it enables the processing of semantic propositions and the construction of situational mental models (Kintsch, 1998; Koda, 2005; Perfetti & Adlof, 2012). L2 vocabulary knowledge also plays a crucial role in Bachman and Palmer's (2010) model of language knowledge, which encompasses "grammatical knowledge" consisting of vocabulary, syntax, and morphology. Numerous previous empirical studies have consistently highlighted the vital role of L2 vocabulary knowledge in L2 reading (Jeon & Yamashita, 2014; Stæhr, 2008; van Gelderen et al., 2007).

For example, Stæhr (2008) observed strong associations between L2 vocabulary knowledge, assessed through a receptive vocabulary size test, and L2 reading comprehension, evaluated using a researcher-developed reading assessment, with a

correlation coefficient of .83. In a long-term study, van Gelderen et al. (2007) discovered that English (L2) vocabulary knowledge, as measured by a researcher-designed vocabulary test based on L1 translations, significantly predicted L2 reading comprehension as measured by a researcher-made reading test, over a three-year period, spanning from the eighth grade to the tenth grade, for Dutch (L1) adolescents. In a comprehensive meta-analysis involving 58 studies encompassing 9,491 participants across different age groups and proficiency levels, Jeon and Yamashita (2014) determined that L2 vocabulary knowledge, with a correlation coefficient of .79, consistently emerges as a strong indicator of L2 reading comprehension. In summary, the fundamental role of L2 vocabulary knowledge in L2 reading is undeniably clear.

2. Inferencing and L2 Reading Comprehension

Inferencing is commonly defined as "the ability to connect what is in the text with what is in the mind to create an educated guess" (Beers, 2003, pp. 61-62). Inferences are deemed essential in the higher-level processes of reading comprehension because understanding the text heavily relies on inferential processes that go beyond surface-level information. These processes involve recognizing references, filling in gaps that are not explicitly mentioned in the text, and establishing connections between substantial portions of the text to construct a coherent textual structure (Kintsch, 1998).

Within their theory of constructing inferences, Graesser et al. (2001) outlined two distinct types of inferences. The first category, termed explanation-based inferences, spontaneously arise during comprehension to offer explanations for actions and events. The second category, elaborative inferences, are intentionally crafted and do not occur as part of routine comprehension. The latter group of inferences encompasses causal consequence inferences, involving predicting future events, and syllogistic inferences, entailing drawing conclusions based on two or more premises. For example, in syllogistic inferencing, if the premise is that teachers have a degree in education, and it is true that John is a teacher, it logically follows that John has a degree in education.

Among various types of inferences, this study specifically delves into syllogistic inferencing, a process in which conclusions are inferred from two or more premises. This choice to focus on syllogistic inferencing is grounded in the notion that both L2 reading and syllogistic inferencing share the common feature of requiring the skill to establish explicit relationships that are only implied in the given input (for reading comprehension) and the premises (for syllogistic inferencing). Additionally, both tasks involve creating mental representations of the provided information, whether it is constructing discourse for reading comprehension or forming conclusions for syllogistic problems. Consequently, enhanced syllogistic inferencing skills are expected to positively impact reading

comprehension. Notably, research in L1 reading has shown that improved syllogistic inferencing skills are predictive of enhanced reading comprehension (Segers & Verhoeven, 2016; Stanovich & West, 2000).

In the context of L2 reading, a recent study (Kim, 2022) investigated the influence of L1 (Korean) syllogistic inferencing skills on L2 (English) reading comprehension in Korean EFL ninth-grade learners. The findings indicated that enhanced L1 syllogistic inferencing skills were conducive to improved L2 inferential reading comprehension, particularly for L2 learners with limited working memory capacity and lower L2 linguistic knowledge. Nevertheless, further investigation into the potential impact of syllogistic inferencing skills on L2 reading comprehension is worthy of exploration.

3. L1 and L2 Reading Comprehension

The connection between L1 and L2 reading comprehension has a rich research history (Carrell, 1991). The linguistic interdependence hypothesis, referred to as the common underlying proficiency hypothesis, posits that the level of L2 proficiency achieved by L2 learners is greatly influenced by their L1 proficiency, emphasizing a shared and mutually reliant relationship between L1 and L2 skills (Cummins, 1979). Furthermore, this hypothesis assumes that language processes, such as reading comprehension, are transferrable and interconnected (Bernhardt & Kamil, 1995).

In the realm of L2 reading research, numerous studies have provided support for the linguistic interdependence hypotheses (Jeon & Yamashita, 2014; Kim & Pae, 2023; van Gelderen et al., 2007). For example, Jeon and Yamashita (2014) conducted a meta-analysis, revealing a moderate mean correlation between L1 and L2 reading comprehension (r = 50). Similarly, van Gelderen et al. (2007) explored the relationships between reading comprehension in L1 (Dutch) and L2 (English) using researcher-designed comparable tests in Dutch adolescents. The results demonstrated the substantial role of L1 reading in predicting L2 reading, reporting a strong correlation between the two (r = .84). Similarly, Kim and Pae (2023) examined the connections between L1 (Korean) and L2 (English) reading comprehension using researcher-designed comparable tests among Korean adolescent learners of English. They reported a strong correlation between the two (r = .56 – .79), demonstrating that L1 reading comprehension ability was a significant predictor of L2 reading comprehension ability. In brief, these studies have confirmed the linguistic interdependence hypothesis.

4. L2 Metacognitive Reading Strategy and L2 Reading Comprehension

L2 reading strategies, commonly identified as purposeful, goal-driven actions initiated or

directed by the reader, are involved in improving L2 reading comprehension (Koda, 2005). Among various types of L2 reading strategies, metacognitive strategies are held in high regard for their role in regulating cognitive processes. They come into play when readers monitor comprehension, resolve issues, navigate through misunderstandings, and fulfill their reading objectives (Grabe & Stoller, 2011).

Despite the importance of the use of metacognitive strategies during L2 reading, previous research has reported mixed findings. On one hand, much previous research underscores the close link between the utilization of L2 metacognitive strategies and L2 reading comprehension (Guo, 2018; Kim, 2017; Phakiti, 2003). For instance, in Guo's study (2018), the role of metacognitive strategy in L2 (English) reading comprehension was investigated among Chinese (L1) university-level English learners, revealing its positive impact on predicting improved L2 reading comprehension performance. Similarly, Kim's study (2017) stressed the predictive potential of L2 (English) metacognitive strategy use, specifically the utilization of strategies linked to the comprehensive analysis of text (i.e., global reading strategies), in elucidating enhanced L2 reading comprehension among Korean adolescent L2 learners.

Conversely, certain studies have indicated a constrained or negligible influence of metacognitive strategy utilization on L2 reading performance (Ham, 2002), with the role of such strategies appearing to depend on factors such as L2 proficiency levels and the types of tests employed (Joh, 2013; Malcolm, 2009; Park, 2013). For example, Jeon (2013) examined the relationship between L2 (English) reading strategy use and L2 reading performance measured by two tests (reading comprehension test and summary test) in Korean university-level learners. The findings indicated that the mean metacognitive strategy use, as measured by a strategy questionnaire, exhibited no correlation with L2 reading performance measures. However, the L2 reading comprehension test displayed a positive relationship with the increased utilization of prior knowledge unrelated to L1, whereas summary quality was positively associated with greater reliance on self-regulation and problem-solving strategies. In a study by Park (2013) involving Korean university-level learners of English, it was suggested that learners with higher L2 proficiency tended to employ certain strategies, such as reading carefully and translating into their L1, to a lesser extent than those with lower L2 proficiency.

In short, a wealth of prior research has explored the impact of L2 linguistic knowledge, L1 reading comprehension, and the utilization of L2 metacognitive reading strategies on L2 reading comprehension. However, the review of this existing research has identified several gaps, which served as the impetus for this study. First, despite the acknowledged significance of inferencing skills in reading comprehension, especially in L1 research (Kintsch, 1998; Segers & Verhoeven, 2016), the role of inferencing, including syllogistic inferencing, in relation to L2 reading comprehension has received relatively limited

examination. Second, the roles of L2 metacognitive strategy use in L2 reading comprehension have yielded conflicting findings, necessitating further investigation. Lastly, the combined effects of L2 linguistic knowledge, L1 syllogistic inferencing, L1 reading comprehension, and the use of L2 metacognitive reading strategies are a subject of limited knowledge. To address these gaps, this study was guided by the following research question: To what extent can L2 reading comprehension be predicted by L2 vocabulary knowledge, L1 syllogistic inferencing skills, L1 reading comprehension, and L2 reading metacognitive strategy use?

III. METHOD

1. Participants

The study involved 90 Korean EFL university freshmen (n = 50) and sophomores (n = 40), all of whom were native Korean speakers. Out of the participants, 59 students (65.56%) were female. The average age of the students was 19.27 years (SD = 1.16), and they commenced learning English at an average age of 8.29 (SD = 2.06). Among the 90 students, 44 majored in Korean Language Education, 29 in English Language Education, eight in History, seven in Archaeology, and one in Chemistry. In a self-evaluation of their general English language proficiency level, two participants reported being advanced, 12 reported upper-intermediate, 48 reported intermediate, 18 reported elementary, and 10 reported being beginners.

2. Data Collection

1) L2 Vocabulary Knowledge Test

The assessment of L2 vocabulary knowledge employed the New Vocabulary Levels Test (NVLT) (McLean & Kramer, 2015). This test package included five evaluations specifically crafted to measure one's receptive understanding of words drawn from the initial five 1,000-word frequency tiers, with the fifth test integrating words from the least frequent tier. The third and fourth tier tests were chosen based on pilot results, deeming them the most suitable for this study. Each test for these vocabulary levels consisted of 24 multiple-choice questions, resulting in a combined total of 48 questions for both tests. Each vocabulary test item was introduced both individually and within a sentence, featuring the target word in bold (**plunge**: It **plunged**). Participants were then required to choose one of the four options that most closely corresponded to the meaning of the provided word

(danced around, was made quiet, dropped suddenly, stayed still). Participants were allotted 10 minutes to complete the test. The Cronbach's alpha for the vocabulary test stood at .85.

2) L1 Syllogistic Inferencing Test

To assess inferencing skills, syllogistic problems were employed. These problems served as a means to evaluate logic-based inferencing skills, as they necessitate bridging gaps between given premises to derive a valid conclusion based on the provided information (Graesser et al., 2001). A set of 20 syllogistic problems from Segers and Verhoeven (2016) was used to measure syllogistic inferencing abilities. Each syllogistic problem consisted of two premises, followed by a conclusion presented in the form of a question. Participants were then required to indicate whether the answer to the question could be logically inferred from the premises, with three response choices available: "yes," "no," and "maybe." The English version from Segers and Verhoeven (2016) was translated into Korean by a bilingual individual proficient in both Korean and English. The test was conducted in Korean to avoid potential confusion between L2 proficiency and inferencing skills. Specifically, using English (L2) for the syllogism test might have made it challenging to discern whether lower performance on the inferencing test was a result of lower inferencing skills or lower L2 proficiency. The syllogistic problems were presented randomly. Each item was presented individually, and the students were restricted from navigating back and forth between the items.

All 20 items in this assessment began with a primary conditional premise: "If p" (the antecedent) "then q" (the consequent). Within this set of items, the first 10 were focused on fundamental reasoning skills, presenting straightforward and logical syllogisms. These 10 items comprised five modus ponens and five tollens questions. In the modus ponens items, the second premise affirmed the antecedent (*p*), and the conclusion was presented in the form of a question about the truth of the consequent (*q*). The correct responses for modus ponens items were "yes," as the affirmation of the antecedent (*p*) logically implies the truth of the consequent (*q*). In the tollens items, the second premise denied the consequent (*not q*), and the conclusion was framed as a question about the truth of the antecedent (*p*). In these cases, the correct answers were "no," as denying the consequent (*not q*) implies the falsity of the antecedent (*p*).

The remaining 10 items delved into more complex reasoning skills, presenting indeterminate syllogisms that required a "maybe" response. In five of these items, the second premise involved denying the antecedent (*not p*), and the conclusion was a question about the truth of the consequent (*q*). For these items, the correct answers were "maybe" because the denial of the antecedent (*not p*) can lead to either *q* being true or *not q* being true, making the conclusion uncertain. In the other five items, the second premise affirmed

the consequent (*q*), and the conclusion was presented as a question about the truth of the antecedent (*p*). In these cases, the correct responses were also "maybe" because affirming the consequent (*q*) can lead to either *p* being true or *not p* being true, resulting in an uncertain conclusion.

Table 1 provides an example of each of the four syllogisms using the primary statement "If it is raining (*p*), then the ground is wet (*q*)."

TABLE 1
Example of Four Types of Syllogisms

Type	Second premise	Conclusion as a question	Correct answer
Modus Ponens	It was raining yesterday (*p is true*).	Was the ground wet yesterday? (*Is q true?*)	Yes
Modus Tollens	The ground was not wet yesterday (*q is false*).	Was it raining yesterday? (*Is p true?*)	No
Denial of Antecedent	It was not raining yesterday (*p is not true*).	Was the ground wet yesterday ? (*Is q true?*)	Maybe
Affirmation of Consequent	The ground was wet yesterday (*q is true*).	Was it raining yesterday? (*Is p true?*)	Maybe

For scoring, in accordance with Segers and Verhoeven (2016), two sets of answers were scored separately: one for modus ponens and tollens items (k = 10), which assessed logical syllogisms, and the other for denial of the antecedent and affirmation of the consequent (k = 10), representing indeterminate syllogisms. The Cronbach's alpha for logical syllogisms was .66, while for indeterminate syllogisms, it was .80. The Cronbach's alpha for logical syllogisms, while relatively lower, was deemed acceptable due to the prior validation of this test in previous research (Segers & Verhoeven, 2016).

3) L1 Reading Comprehension Test

To evaluate overall L1 reading comprehension proficiency, a standardized Korean reading test developed by the Korean Broadcasting System (KBS) was employed. The KBS Korean Proficiency Test is designed to assess the general Korean language skills of native Korean speakers, encompassing grammar, listening comprehension, and reading comprehension. The reading comprehension section, which consisted of 30 multiple-choice questions, was employed in this study. The reading passages covered a wide range of domains, including literature (poems and novels), academic texts (expository texts), practical texts (terms of service, instructions, reports, and practice releases), as well as tables and graphs. Out of the 30 questions, two were related to vocabulary and were consequently excluded from subsequent analysis, ensuring that only items directly

assessing reading comprehension were included. Participants were given 35 minutes to complete the test. The Cronbach's alpha values were .58 for all items and .59 for items excluding those connected to vocabulary. Despite the relatively lower Cronbach's alpha values, they were considered acceptable, particularly given the standardized nature of the reading test. Additionally, it was not anticipated for there to be high internal consistency (i.e., item equivalence) given the wide variety of passage types, which included poems and graphs, all assessed within the same test (Taber, 2018).

4) L2 Metacognitive Reading Strategy Use Questionnaire

To gauge L2 metacognitive reading strategy usage, a validated strategy survey was implemented: the Metacognitive Awareness of Reading Strategies Inventory (MARSI; Mokhtari & Reichard, 2002). MARSI evaluated metacognitive awareness and the perceived application of reading strategies when engaging with academic or school-related materials. Participants were explicitly instructed to evaluate their utilization of English reading strategies on a 5-point Likert scale, ranging from 1 ("Seldom or almost never apply this") to 5 ("Frequently or almost always apply this"). The survey comprised 30 items, categorized into three groups: global reading strategies (k = 13), problem-solving strategies (k = 8), and support reading strategies (k = 9). Edited: The English version of the questionnaire from Mokhtari and Reichard (2002) was translated into Korean by a bilingual individual proficient in both Korean and English. The students were given the questionnaire items in both Korean and English.

Global reading strategy items encompassed a range of approaches for comprehensively analyzing text, exemplified by the item "I decide what to read closely and what to ignore." Problem-solving strategy items were designed to address challenges encountered when reading becomes complex, with an example item "When the text becomes difficult, I reread to increase my understanding." Support reading strategy items involved the use of external reference materials, note-taking, and practical strategies considered as functional or supportive, with an example item "I use reference materials such as dictionaries to help me understand what I read." The internal consistency of global reading strategies, problem-solving strategies, and support reading strategies, as measured by Cronbach's alpha, was .87, .87, and .80 respectively.

5) L2 Reading Comprehension Test

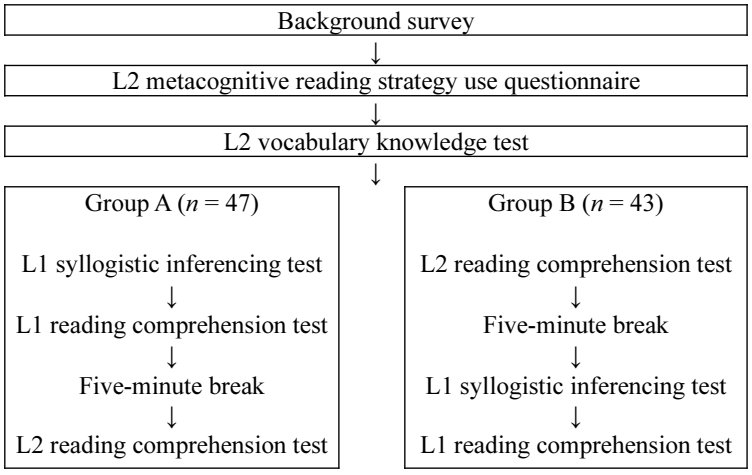
Participants' reading comprehension ability was measured using the Level 10/12 Gates-MacGinitie Reading Test (GMRT) Form S (MacGinitie et al., 2000). The test comprised 48 multiple-choice questions, with most passages being drawn from stories and expository

texts. Participants were given 35 minutes to complete the test. Of the 48 questions, six were tied to vocabulary and were excluded from subsequent analysis to prevent redundancy with the L2 vocabulary knowledge test. The Cronbach's alpha values were .77 for all items and .74 for items excluding those connected to vocabulary.

3. Data Collection Procedure

Participants attended a single session in a computer-equipped, internet-accessible classroom in their university, where they provided informed consent. The session began with the completion of a background survey to gather demographic information, including age, college year, gender, and major. Subsequently, they filled out the L2 metacognitive reading strategy use questionnaire and took an L2 vocabulary test. The order of L1 and L2 reading comprehension tests was counterbalanced; for approximately half of the participants (Group A; $n = 47$), the L1 reading comprehension test came before the L2 test, while for the other half ($n = 43$), the sequence was reversed. The L1 syllogistic inferencing test was administrated prior to the L1 reading comprehension test. A five-minute break was given between the L1 and L2 reading comprehension tests. Figure 1 illustrates the data collection procedure. The testsand the background survey were conducted through the online survey system Qualtrics (https://www.qualtrics.com). Participants received compensation for their participation.

FIGURE 1
Data Collection Procedure



4. Data Analysis

To address the research question, a path analysis, a form of multivariate analysis, was performed. Path analysis utilizes a covariance matrix as input and predicts regression weights. Path coefficients not only convey the directions of expected effects but also offer insights into the magnitudes of these effects. To assess the relative strength of these paths, standardized path coefficients (β) are compared (Aloe & Becker, 2012). Furthermore, path analysis allows for the consideration of multiple dependent variables and the inclusion of indirect paths. In constructing a path model, it is vital to incorporate directionality specifications for each path, which should be based on well-founded rationales (Kline, 2015).

To determine the sample size required for path analysis, a rule of thumb was applied, which involves having a minimum of 10 observations per variable (Nunnally, 1967). This requirement was satisfied in this study with 90 participants and eight variables, resulting in an average of 11.25 observations per variable.

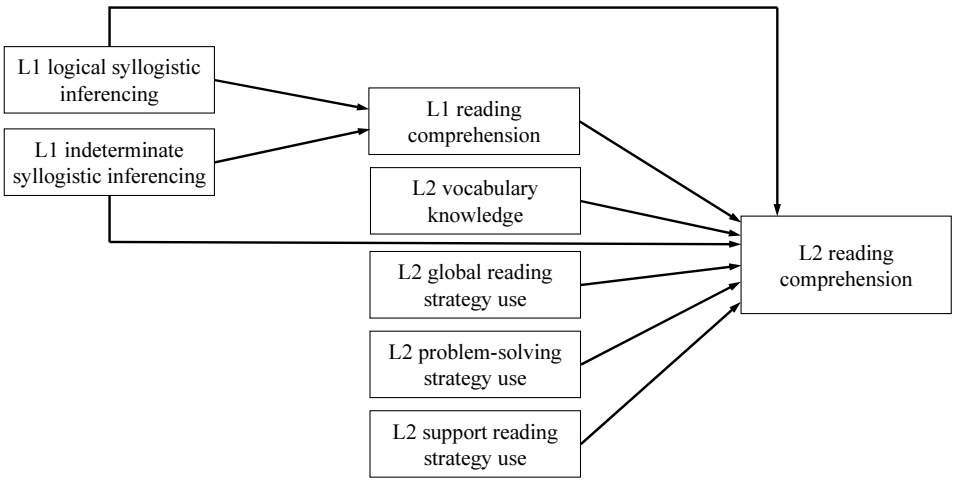
Before performing path analysis, several preliminary analyses were carried out, including assessments of univariate normality, multivariate normality, and correlation analysis. The distribution of each variable was assessed for normality using skewness and kurtosis, with values falling within the range of |2| considered indicative of normal distribution, following George and Mallery (2010). Multivariate normality, a prerequisite for conducting path analysis, was examined using Mardia's (1970) multivariate skewness and kurtosis coefficients. In the correlation analysis, when both indices under analysis exhibited normal distribution, Pearson's correlations (*r*) were reported. However, if one of the two indices did not conform to normal distribution, Spearman's rank order correlations (*rho*) were reported. Following the results of the correlation analysis, variables that exhibited significant correlations with L2 reading comprehension scores, the predicted variable, were selected for inclusion in the path analysis. This selection aimed to incorporate only meaningful variables into the path analysis.

A hypothesized path model is presented in Figure 2. This model postulated that enhanced performance in L2 reading comprehension would be directly predicted by the following factors: increased L1 syllogistic inferencing skills (Kim, 2022), higher L1 reading comprehension proficiency (Cummins, 1979), greater L2 vocabulary knowledge (Jeon & Yamashita, 2014), and more extensive use of L2 metacognitive reading strategies (Guo, 2018).

Additionally, an indirect path, involving L1 syllogistic inferencing and L1 reading comprehension, was estimated, such that L1 syllogistic inferencing was expected to impact L2 reading comprehension indirectly through its influence on L1 reading comprehension. This expectation was grounded in the belief that enhanced L1 syllogistic inferencing skills

would be predictive of improved L1 reading comprehension (Segers & Verhoeven, 2016), subsequently leading to enhanced L2 reading comprehension. To examine indirect effects, the analysis employed bootstrapping, which involves random resampling with replacement of the same sample size, and this process was iterated 5000 times to create 95% confidence intervals (CIs) (Hayes, 2013). If the 95% CI does not encompass zero, it indicates a significant effect.

FIGURE 2
Hypothesized Model



To assess the overall model fit, three goodness-of-fit measures were used: the χ^2 (Chi-square), comparative fit index (CFI), and standardized root mean square residual (SRMR). The non-significance of the χ^2 statistic indicates good fit. Signs of a model's adequacy include CFI values exceeding .90 and SRMR values lower than .08 (Hu & Bentler, 1999). Path analysis was conducted using *R*.

IV. RESULTS

Table 2 presents descriptive statistics for the eight measured variables and the correlation coefficients associated with L2 reading comprehension scores. Correlations among the eight variables are presented in Appendix A. Notably, skewness and kurtosis values for two variables, specifically L1 logical syllogistic inferencing and L2 problem-solving strategy use, deviated from a normal distribution. Consequently, correlation coefficients involving L1 logical syllogistic inferencing and L2 problem-solving strategy use were

calculated using Spearman's correlation. In contrast, the remaining six variables exhibited normal distribution patterns, with skewness values of –1.18 and 1.11 and kurtosis values of .17 and 1.74, all falling within the normal range. For these variables, Pearson's correlations were computed for analysis.

TABLE 2
Descriptive Statistics and Correlations with L2 Reading Comprehension ($N = 90$)

Variable (maximum possible score)	*M*	*SD*	Range	Skewness	Kurtosis	$r^{\dagger}$
L1 logical syllogistic inferencing (10)	8.93	1.44	2–10	–1.95	5.00	$-.10^{rho}$
L1 indeterminate syllogistic inferencing (10)	7.58	2.45	0–10	–1.17	.94	$.23^{*}$
L1 reading comprehension (28)	16.59	3.5	7–22	–.80	.17	$.29^{**}$
L2 vocabulary knowledge (48)	36.99	6.76	12–48	–1.18	1.74	$.43^{**}$
L2 global reading strategy use (5)	3.21	.66	1–5	.09	1.21	–.03
L2 problem-solving strategy use (5)	3.75	.70	1–5	–.89	2.23	$.02^{rho}$
L2 support reading strategy use (5)	3.14	.71	1–5	.18	.70	$-.25^{*}$
L2 reading comprehension (42)	16.21	5.61	8–35	1.11	1.49	n/a

Notes. † denotes the correlation coefficient associated with L2 reading comprehension scores.; ^{rho} indicates that correlation coefficient was derived from Spearman's correlation.; * indicates $p < .05$.; ** indicates $p < .01$.

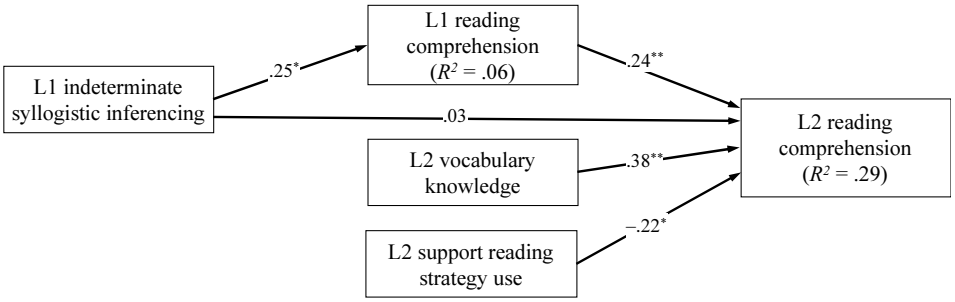
The results of the correlation analysis unveiled significant correlations between L2 reading comprehension and four variables: L1 indeterminate syllogistic inferencing ($r = .23$, $p < .05$), L1 reading comprehension ($r = .29$, $p < .05$), L2 vocabulary knowledge ($r = .43$, $p < .01$), and L2 support reading strategy use ($r = –.25$, $p < .05$). These four variables were included in the path analysis. In contrast, L2 reading comprehension did not display significant correlations with three variables: L1 logical syllogistic inferencing ($rho = –.10$, $p > .05$), L2 global reading strategy use ($r = –.03$, $p > .05$), or L2 problem-solving strategy use ($rho = .02$, $p > .05$). Consequently, these non-significant three variables were not incorporated into the path analysis.

Before conducting path analysis, a multivariate distribution test was performed, revealing non-normality. To address this, the maximum likelihood method (MLM) estimator was employed, which utilizes standard maximum likelihood to estimate model parameters while providing robust standard errors and a Satorra–Bentler scaled test statistic (Satorra & Bentler, 1994). Additionally, the assumptions for path analysis, including linearity among variables, interval-level data, and the absence of correlation between residuals of an outcome variable and the variables predicting the outcome variable, were met.

The results of the path analysis are provided in Figure 3 and Table 3. The final model

demonstrated excellent fit: $\chi^2(2) = 1.06$, $p = .59$, CFI = 1.00, SRMR = .03. With respect to direct effects, the results indicated that L2 reading comprehension was directly predicted by L1 reading comprehension (β = .24, $p < .01$), L2 vocabulary knowledge (β = .38, $p < .01$), and L2 support reading strategy use (β = –.22, $p < .05$). These findings suggest that higher L2 reading comprehension proficiency was associated with better L1 reading comprehension ability, greater L2 vocabulary knowledge, and reduced use of L2 support reading strategies. Conversely, despite a significant correlation, L1 indeterminate syllogistic inferencing scores did not have a direct impact on L2 reading comprehension scores (β = .03, $p = .70$). However, in terms of indirect effects, L1 indeterminate syllogistic inferencing skills indirectly influenced L2 reading comprehension through L1 reading comprehension (β = .06, $p < .05$, 95% CI [.03, .32]). This implies that while L1 indeterminate syllogistic inferencing skills did not exert a direct influence on L2 reading comprehension, they did have an indirect effect through their association with L1 reading comprehension. In the path model, approximately 29% of the variance in L2 reading comprehension scores was accounted for.

FIGURE 3
Results of the Path Model



Notes. Estimates are standardized coefficients; * indicates $p < .05$.; ** indicates $p < .01$.

TABLE 3
Results of the Path Analysis

Path	*B*	*SE*	β	*p*	95% CI
Direct effect					
L1 indeterminate syllogistic inferencing → L1 reading comprehension	.35	.14	.25	< .05	[.08, .65]
L1 indeterminate syllogistic inferencing → L2 reading comprehension	.07	.19	.03	.70	[–.32, .50]
L1 reading comprehension → L2 reading comprehension	.38	.12	.24	< .01	[.12, .63]
L2 vocabulary knowledge → L2 reading comprehension	.31	.08	.38	< .01	[.17, .49]

L2 support reading strategy use → L2 reading comprehension	–1.75	.79	–.22	< .05	[–3.62, –.25]
Indirect effect					
L1 indeterminate syllogistic inferencing → L1 reading comprehension → L2 reading comprehension	.13	.06	.06	< .05	[.03, .32]

Notes. SE = standard error; CI = confidence interval; → indicates "has influence on."

V. DISCUSSION

The aim of this study was to examine the degree to which L2 reading comprehension scores could be predicted by L2 vocabulary knowledge, L1 syllogistic inferencing skills, L1 reading comprehension, and the use of L2 reading metacognitive strategies. The findings suggested that L2 vocabulary knowledge, L1 reading comprehension, and the use of L2 support reading strategies were direct predictors of L2 reading comprehension. Furthermore, L1 indeterminate syllogistic inferencing indirectly influenced L2 reading comprehension.

L2 vocabulary knowledge emerged as a significant predictor of L2 reading comprehension. This finding aligns with prior research, underscoring the vital role of L2 vocabulary knowledge in L2 reading comprehension (Jeon & Yamashita, 2014; Koda, 2005; van Gelderen et al., 2007). It is also worth noting that L2 vocabulary knowledge had the most pronounced impact on L2 reading comprehension (β = .38) in the path model compared to other variables, which included L1 reading comprehension (β = .24) and L2 support reading strategies (β = –.22). This reinforces the idea that language-specific vocabulary knowledge, operating at the lower level of reading comprehension, holds greater predictive value for L2 reading comprehension than cross-linguistic influence or the use of reading strategies.

Next, in this study, inferencing was operationalized through two categories of syllogistic reasoning: straightforward, logical syllogisms (calling for a simple yes or no response) and more challenging, indeterminate syllogisms (demanding a nuanced maybe answer through elaborative inferencing). The study yielded intricate findings. Notably, L1 logical syllogistic inferencing skills exhibited no significant correlation with L2 reading comprehension scores. This observation may be attributed to the fact that logical syllogistic skills might have been intuitively and easily answered, without necessitating complex inferential processes. Consequently, this lack of complexity resulted in limited variability among the participants, particularly university-level learners, leading to no significant role of L1 logical syllogistic inferencing skills in L2 reading comprehension. Evidently, the mean score for L1 logical syllogistic inferencing was 8.93 out of a possible 10, indicating

the presence of ceiling effects.

In contrast, L1 indeterminate syllogistic inferencing skills were found to have an indirect influence on L2 reading comprehension through their impact on L1 reading comprehension. The finding that L1 indeterminate syllogistic inferencing skills significantly positively predicted L1 reading comprehension supports previous L1 research (Segers & Verhoeven, 2016; Stanovich & West, 2000). Furthermore, the result that L1 indeterminate inferencing scores were significantly correlated with L2 reading comprehension (r = .23) aligns with prior research (Kim, 2022) that found a positive relationship between better L1 indeterminate syllogistic inferencing skills and enhanced L2 inferential reading comprehension for adolescent Korean EFL learners.

However, the effect of L1 indeterminate syllogistic inferencing on L2 reading comprehension disappeared when considered alongside L1 reading comprehension. In this aspect, what seems to be a novel insight, and to the best of my knowledge, has not been previously documented, is the indirect effect of L1 indeterminate syllogistic inferencing on L2 reading comprehension through its influence on L1 reading comprehension. This finding suggests that greater L1 indeterminate syllogistic inferencing skills may contribute to improved L2 reading comprehension, but this effect may be more pronounced when learners also possess higher L1 reading comprehension ability. Importantly, this indirect effect of L1 indeterminate syllogistic inferencing skills on L2 reading comprehension reveals more intricate connections between L1 and L2 reading. In particular, the enhanced ability to establish relationships within the given premises for syllogistic inferencing in L1 could have a positive influence on improved L1 reading comprehension, which, in turn, contributes to enhanced L2 reading comprehension.

In terms of the role of L1 reading comprehension, the finding that L1 reading comprehension directly predicted L2 reading comprehension supports the linguistic interdependence hypothesis (Cummins, 1979). This suggests that the common underlying proficiency may have contributed to the enhanced performance of L2 readers who had developed their L1 reading comprehension ability to some extent.

Nevertheless, it is worth noting that the correlation between L1 and L2 reading comprehension in this study (r = .29) was lower than in previous studies, such as .85 reported by van Gelderen et al. (2007) and .56 – .79 in Kim and Pae (2023). A possible explanation for this discrepancy could be attributed to the use of standardized L1 and L2 reading comprehension tests in this study, which differed substantially in terms of passage genres and question types. In contrast, van Gelderen et al. (2007) and Kim and Pae (2023) employed researcher-developed tests that included comparable passage types and question formats. However, additional research is required to further substantiate this hypothesis.

In terms of L2 metacognitive reading strategy use, this study encompassed three dimensions, as outlined by Mokhtari and Reichard (2002): global reading strategies,

problem-solving strategies, and support reading strategies. The unexpected observation that L2 global reading and problem-solving strategy use, as self-reported by L2 students, exhibited no correlation with L2 reading comprehension scores contrasts with prior research findings (Guo, 2018; Kim, 2017; Phakiti, 2003) that established their close associations.

This incongruity can potentially be attributed to the questionnaire employed in this study, the MARSI, originally designed by Mokhatari and Reichard (2002) for application "while reading academic or school- related materials" (p. 249). A potential disparity may exist between the strategies students habitually employ when reading academic materials within a school context, as reported in the strategy questionnaire, and the strategies they actually apply when reading passages in a testing context. This disparity may have impacted the performance of L2 reading. Consequently, it is conceivable that in this study, L2 students may not have put into practice global and problem-solving strategies to the same extent as indicated in the questionnaire, which, in turn, may account for the absence of observable relationships between L2 global reading and problem-solving strategies and L2 reading comprehension scores.

Furthermore, certain global reading strategies, such as contemplating "what I know" or having "a purpose in mind," and specific problem-solving strategies, like reading "slowly but carefully" or rereading when encountering difficulties for better comprehension may not necessarily prove advantageous within a testing context where L2 students are required to read rapidly and accurately, often without the luxury of considering purposes or with limited opportunities for re-reading. In other scenarios, L2 students may possess declarative knowledge concerning effective L2 metacognitive reading strategies but might encounter challenges when it comes to their practical application in actual reading processes (Choi & Chang, 2013).

On the flip side, the use of L2 support reading strategies exhibited a notable negative correlation ($r = –.25$) and acted as a negative predictor for L2 reading comprehension. This discovery is equally astonishing. L2 support reading strategies are essentially tied to the utilization of external resources, such as seeking assistance from others and consulting reference materials, as well as relying on self-support methods, such as reading aloud the text when faced with challenges and posing questions to oneself. The strategies reported as general tendencies among L2 students during L2 academic reading contexts may not necessarily lead to improved L2 reading performance, especially within the limitations of a testing context. In reality, more proficient L2 readers who achieve higher scores in L2 reading tests may function as independent readers, less reliant on external aid or self-guidance.

These findings emphasize the need for further research to comprehensively explore the role of L2 metacognitive reading strategies, considering both perceived and actual strategy

usage, and examining various reading comprehension contexts, from testing situations to academic reading environments.

VI. CONCLUSION

The goal of this study was to examine the extent to which L2 reading comprehension scores can be predicted by L2 vocabulary knowledge, inferencing skills, L1 reading comprehension, and L2 reading metacognitive strategy use. Overall, the results demonstrate that L2 vocabulary knowledge and L1 reading comprehension proficiency have a positive influence on L2 reading comprehension, aligning with prior research. However, this study extends the findings of many prior studies in several ways. It unveils the indirect impact of L1 syllogistic inferencing skills on L2 reading comprehension through their influence on L1 reading comprehension. Additionally, it sheds light on the potential adverse effects of L2 support reading strategies, which are part of L2 metacognitive reading strategies, on L2 reading comprehension, particularly in a testing context.

The findings of this study hold several pedagogical implications. First, in L2 reading classrooms, priority should be given to nurturing knowledge and skills related to the lower levels of L2 reading processes, exemplified by L2 vocabulary knowledge, as explored in this study. While other factors, such as L1 reading comprehension and the use of L2 metacognitive reading strategies, remain crucial, L2 teachers should underscore the significance of L2 vocabulary knowledge. Second, the positive link between L1 syllogistic inferencing and L2 reading comprehension through the mediation of L1 reading comprehension suggests that L2 learners facing challenges in syllogistic inferencing in their native language may benefit from practicing such inferencing in their L1. This practice, in turn, could contribute to an improvement in their L1 reading comprehension and, consequently, L2 reading comprehension. Essentially, L2 learners can enhance their syllogistic inferencing skills in their native language and construct mental representations of syllogistic premises of shorter lengths, which could subsequently aid them in forming coherent representations of longer L2 passages. Third, the finding that L1 reading comprehension positively impacts L2 reading comprehension implies that L2 teachers should take into account the interplay of cross-linguistic advantages and constraints in the learning process of L2 reading comprehension for L2 learners. Finally, when instructing L2 metacognitive reading strategies, L2 teachers should be mindful of the fact that not all strategies are universally beneficial in all reading contexts. Therefore, L2 teachers need to make thoughtful selections of which metacognitive strategies to teach, equipping their students with the ability to effectively deploy strategies and actively engage in various

reading processes.

This study also has several limitations. First, the participant sample in this study was relatively small. To enhance the generalizability of the findings, a larger sample size is necessary. Second, inferencing skills were assessed using a syllogistic inferencing test. Future studies may benefit from employing alternative inferencing tests to ensure a more comprehensive evaluation. Third, the measurement of L2 metacognitive strategies in this study relied on a self-reported questionnaire. To achieve a more thorough exploration of the role of L2 metacognitive reading strategies, future research could involve direct observations of tangible behaviors exhibited by L2 readers, along with insights into their cognitive processes. Furthermore, this investigation could encompass a range of reading scenarios, spanning from testing contexts to academic reading environments. Lastly, it is important to consider other variables that may influence L2 reading comprehension, including factors like L2 grammar knowledge, motivation, and the ability to construct a mental representation of text.

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APPENDIX A

Correlations among the Measured Variables ($N = 90$)

Variable	1	2	3	4	5	6	7
1. L1 logical syllogistic inferencing	1						
2. L1 indeterminate syllogistic inferencing	.06^{rho}	1					
3. L1 reading comprehension	.21^{rho*}	.24*	1				
4. L2 vocabulary knowledge	–.14^{rho}	.24*	.13	1			
5. L2 global reading strategy use	–.12^{rho}	–.07	.06	–.03	1		
6. L2 problem-solving strategy use	.08^{rho}	–.08^{rho}	.29^{rho**}	.06^{rho}	.48^{rho**}	1	
7. L2 support reading strategy use	–.16^{rho}	–.23*	.04	–.07	.73**	.55^{rho**}	1
8. L2 reading comprehension	–.10^{rho}	.23*	.29**	.43**	–.03	.02^{rho}	–.25*

Notes. ^{rho} indicates that correlation coefficient was derived from Spearman's correlation.; * indicates $p < .05$.; ** indicates $p < .01$.

Examples in: English

Applicable Languages: English

Applicable Levels: Tertiary

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