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Morphological awareness and affix knowledge in EFL reading via vocabulary breadth

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Abstract

Morphological knowledge is a complex construct integral to vocabulary breadth and reading comprehension. To understand its complexity, researchers examine its dimensionality. First, this study contributes to this broad topic by investigating whether morphological awareness and affix knowledge, related concepts with a long history of investigation in second language (L2) research, constitute separate dimensions. Second, we examined how these concepts contribute to reading comprehension with vocabulary breadth as a mediator. We evaluated 508 Japanese university students using a series of linguistic tasks and analyzed their performance through confirmatory factor analysis and structural equation modeling. Our findings showed that morphological awareness and affix knowledge are distinct constructs. The study further revealed significant direct and indirect pathways from both variables to reading comprehension, mediated by vocabulary breadth, with a stronger overall effect of morphological awareness. Potential reasons for this result and pedagogical implications are discussed.

***Keywords*:** affix knowledge, confirmatory factor analysis (CFA), EFL, EFL reading, L2 reading, L2 reading comprehension, morphological awareness, Morphological Pathways Framework, reading comprehension, Reading System Framework, structural equation modeling (SEM), vocabulary breadth

Derivational morphemes such as prefixes and suffixes are fundamental to the formation of complex words and play a significant role in both vocabulary expansion and reading comprehension in English (e.g., Anglin et al., 1993; Berninger et al., 2010; Carlisle & Fleming, 2003; Deacon & Kirby, 2004; Deacon et al., 2014; Nagy et al., 2006). Derivational morphology generally takes longer to acquire compared with inflections and compounds (Ku & Anderson, 2003) and becomes increasingly crucial as learners advance to higher educational levels, where academic language grows in complexity and is often replete with morphologically complex words (Anglin et al., 1993). The academic community has observed a surge in research on the relationships between morphological knowledge and reading comprehension. The contribution of

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morphological knowledge to reading comprehension has been supported both in first language (L1) and second language (L2) contexts (e.g., L1: Kaldes et al., 2024; L2: Hamada et al., 2024; Jeon & Yamashita 2014, 2022; across L1 and L2: Bratlie et al., 2022).

Despite this progress, many questions remain. This study focuses on knowledge of derivational morphology and its relationship to reading comprehension by considering vocabulary breadth as a possible mediator. More specifically, it focuses on adult L2 learners whose L1 is typologically and orthographically distant from L2 and who are learning L2 in an input poor context, namely, L1 Japanese university students learning L2 English as a foreign language (EFL).

Literature Review

The Dimensionality of Morphological Knowledge

Morphological knowledge is a component of reading comprehension, and just like any other components of reading, it is a complex construct (Jeon & Yamashita, 2022). Its complexity could be especially pronounced because it encompasses all major linguistic aspects such as orthography, phonology, semantics, and syntax (e.g., Koda, 2016). Reflecting this complexity, various terminologies have been used without established distinctions, including morphological knowledge, morphological awareness, morphological analysis, or morphological processing (Goodwin et al., 2012). Following many researchers (e.g., Bratlie et al., 2022; Goodwin et al., 2021; Jeon & Yamashita, 2022; Nagy et al., 2014), we construe morphological knowledge as an umbrella term that includes both the tacit use and explicit knowledge of derivational morphemes in this paper.

To understand the complex nature of morphological knowledge, an increasing body of L1 research has examined its dimensionality—more specifically, whether it is unidimensional or multidimensional. A typical approach is to measure morphological knowledge with multiple tasks and extract underlying latent factors from the data using methods such as factor analysis or related families of statistical techniques. The results are mixed as some studies supported unidimensionality (e.g., James et al., 2021; Muse, 2005; Spencer et al., 2015) but others supported multidimensionality (e.g., Goodwin et al., 2017, 2021; Kaldes et al., 2024; Tighe & Schatschneider, 2015). However, a growing consensus in favor of the multidimensional view has emerged, as represented by the introduction of a recent theoretical framework called the Morphological Pathways Framework (Levesque et al., 2021). It synthesizes a wide range of prior research and conceptualizes morphological knowledge as part of the orthographic system, linguistic system, and lexical representation in the reader's mind. The next section discusses this model, highlighting the implications that guided this study.

Adult learners, L2 learners. Most L1 studies have examined primary and secondary school students; however, Tighe and Schatschneider (2015) expanded the scope to include the adult population. They supported multidimensionality and found that morphological knowledge measured with real words and with non-words were separate factors. They argued that this result may indicate that morphological knowledge is used differently when adults read real words compared with non-words. Because participants in the current study are also adults, we examined whether this finding of L1 adults applies to L2 adult learners. If real word items and

non-word items are different constructs, it has implications for the measurement of L2 morphological knowledge.

Unlike L1 studies, few L2 studies have examined the dimensionality of morphological knowledge. Interestingly, two related but different L2 research fields have different traditions in measuring L2 morphological knowledge, possibly tapping into its different dimensions. One field is L2 reading research, where researchers typically measure morphological awareness, defined as "the ability to reflect on and manipulate morphemes and word formation rules in a language" (Kuo & Anderson, 2006, p. 161), and adopt tasks to measure morphological awareness that has been commonly employed in L1 reading research (e.g., Pasquarella et al., 2011; Wang et al., 2009; Xue & Jiang, 2017; Zhang, 2017).

L2 vocabulary research. Another field is L2 vocabulary research, where researchers regard morphological knowledge as a component of vocabulary knowledge and measure knowledge of word parts (or affix knowledge). Nation's (2013) framework of vocabulary knowledge, which postulates three aspects (form, meaning, and use) in knowledge, is the theoretical basis of affix knowledge, which is conceptualized as the ability to recognize affix form (spelling or sound), meaning (semantic meaning), and use (grammatical class) (Sasao & Webb, 2017). Unlike morphological awareness tests, which often require analyzing and manipulating morphemes, many tasks used in L2 affix tests do not require such skills (e.g., morphemes are explicitly given as a test prompt) but instead evaluate explicit knowledge of affixes, demanding a clear understanding of elements such as the grammatical role of a suffix or the meaning of a prefix, with explicit meta-linguistic prompts such as nouns, verbs, and suffixes. This test format may be because affix knowledge tests are often developed for adult learners who learn L2 in classroom settings with explicit grammar instructions (Mizumoto et al., 2019; Mochizuki & Aizawa, 2000; Sasao & Webb, 2017).

Sasao and Webb's (2017) Word Parts Levels Test (*WPLT*) and its computer-adaptive version (*CAT-WPLT*) by Mizumoto et al. (2019) are significant advancements in testing affix knowledge in L2 research, with demonstrated validity and reliability on a large scale (Mizumoto et al., 2019; Sasao & Webb, 2017). Both versions measure three aspects of affix knowledge (form, meaning, and use) with a multiple-choice format and offer valuable diagnostic feedback to test-takers. The WPLT is viewed as the "only one standardized, comprehensive measure of derivational affix knowledge" (Iwaizumi & Webb, 2022, p. 305).

Crossing boundaries of two research traditions. We discuss the different traditions in the measurement of morphological knowledge in two related L2 research fields because we have seen the emergence of studies crossing the boundaries of these research traditions; that is, scholars are increasingly utilizing the *WPLT* (or *CAT-WPLT*) to investigate the relationship between morphological knowledge and reading abilities (Alshehri & Zhang, 2022; Yamashita & Kusanagi, 2024; Zhang & Lin, 2021). The strength of this test includes an influential theoretical framework (Nation, 2013), relative ease of administration, and efficient diagnostic feedback. Communication between different research fields is certainly desirable and should be encouraged. However, assessment tasks for morphological awareness and affix knowledge are different, casting doubt on whether they measure the same construct. If they are different constructs, research results would offer different pedagogical implications depending on which

construct we examine in relation to reading comprehension. If they are different constructs, more nuanced pedagogical implications could emerge if these two are examined together, as we discuss later.

To the best of our knowledge, only Wang and Zhang (2023) have investigated whether morphological awareness and affix knowledge are separate constructs, based on a sample of senior high school EFL students (117 10th and 109 11th graders) in China. For morphological awareness measurement, they utilized a morpheme recognition task ("come from" task) and a morpheme discrimination task (e.g., "Circle the odd word out of the group: *classroom, bedroom, mushroom*," both adapted from Ku and Anderson [2003]). Affix knowledge was assessed using the WPLT by Sasao and Webb (2017). The results of the confirmatory factor analysis indicated that morphological awareness and affix knowledge represented two distinct latent variables.

In summary, we have not yet reached a consensus on the dimensionality of morphological knowledge. Whether morphological awareness and affix knowledge are separate constructs is an important question that is unique to L2 research. Both concepts have long been examined in two related L2 research fields. We needed to facilitate communication between the fields to enhance our understanding of L2 morphological knowledge and its relationship to reading comprehension.

Contributions of Morphological Knowledge to Vocabulary and Reading Comprehension

Although there is no doubt on the importance of morphological knowledge for reading comprehension in both L1 and L2 (e.g., Bratlie et al., 2022; Hamada et al., 2024; Jeon & Yamashita, 2014, 2022; Kaldes et al., 2024; Lee et al., 2022), how it affects reading comprehension has yet to be explored. A strong theoretical contribution to addressing this question was proposed by Levesque et al.'s (2021) Morphological Pathways Framework, which is grounded in the Reading System Framework (Perfetti et al., 2005; Perfetti & Stafura, 2014). This new framework underlines the importance of morphology in literacy development. It posits that morphological awareness resides within the linguistic system, while the understanding of orthographic representations of morphemes falls under the orthographic system, as proposed by the Lexical Quality Hypothesis (Perfetti & Hart, 2002). It further integrates the morphological structure of words into lexical representations. The model emphasizes the multidimensionality of morphological knowledge and outlines three distinct pathways from morphological knowledge to reading comprehension: (a) a direct pathway, (b) an indirect pathway via morphological analysis and lexical representation, and (c) another indirect pathway via morphological decoding and a word identification process.

As discussed above, the Morphological Pathways Framework postulates lexical knowledge and skills as a possible mediator between morphological knowledge and reading comprehension. Although there are different aspects in vocabulary knowledge such as breadth (most typically the number of words a learner knows) and depth (how well words are known, encompassing aspects such as collocations, register, and syntactic behavior) (Nation, 2013; Qian, 2002), the current study focuses on breadth as a foundational layer in vocabulary development in line with previous studies (see below).

Several L2 studies have tested some, if not all, of the pathways hypothesized in this framework. Zhang and Lin (2021) measured affix knowledge using the Form and Meaning sections of the *WPLT* to examine direct and indirect pathways to reading comprehension among Chinese EFL learners. Possible mediators were vocabulary breadth and lexical inference. They observed both direct and indirect effects on reading comprehension. Additionally, Zhou (2022) examined the relationship among morphological awareness, vocabulary breadth, and reading comprehension with Chinese EFL learners. They found an indirect effect of morphological awareness on reading comprehension but no direct effect. Yamashita and Kusanagi (2024) explored the direct and indirect contributions of affix knowledge to reading comprehension among Japanese EFL learners. Their study used *CAT-WPLT* (Mizumoto et al., 2019), covering form, meaning, and use, with a concomitant vocabulary breadth assessment and reading comprehension task. They found direct effects from meaning, use, and vocabulary, and indirect effects from meaning and use of affix knowledge via vocabulary; however, form did not significantly impact reading comprehension.

Finally, Zhang et al. (2023) conducted a meta-analytic structural equation modeling study based on the Morphological Pathways Framework, exploring the direct and indirect contributions of morphological awareness to reading comprehension among school-aged English readers. This extensive analysis included 107 studies and 21,818 participants. It assessed the impact of morphological awareness across various groups, categorized by language status (monolingual vs. bilingual), age or grade levels (lower elementary, upper elementary, middle or high school), and the modality of morphological awareness tasks (spoken vs. written). The findings indicate that morphological awareness significantly enhances reading comprehension through indirect pathways involving word reading and vocabulary knowledge across all examined subgroups. The direct pathway was significant in all groups except the lower elementary age group. Bilingual readers showed smaller indirect effects through word reading compared with monolinguals, while older readers demonstrated stronger effects through vocabulary knowledge than younger ones. These results lend support to the Morphological Pathways Framework.

Although Zhang et al.'s (2023) large-scale research synthesis is respectable and informative, it does not offer answers to our interests in this paper. They focused only on morphological awareness, without any implication regarding the possible difference between morphological awareness and affix knowledge. In addition, they did not distinguish between English as a second language and EFL learners, categorizing them under "bilingual." We focus on EFL students. Considering mixed results from EFL studies as reviewed above (Yamashita & Kusanagi, 2024; Zhang & Lin, 2021; Zhou 2022), more studies are needed.

The Current Study

This study had two primary objectives. First, following the work of Wang and Zhang (2023), it aimed to examine the dimensionality of morphological knowledge in L2. We made two significant updates from their study: first, we employed the *CAT-WPLT* instead of the paper-pencil version, which allows efficient and individualized measurement and is particularly advantageous for large-scale online testing; second, we included both words and non-words in morphological awareness tasks. This inclusion was based on findings that these represent

separate latent variables (Tighe & Schatschneider, 2015) and have different magnitudes of influence on reading comprehension (Kaldes et al., 2024).

The second objective was to explore the direct and indirect morphological pathways to reading comprehension. Our analysis for this purpose is dependent on the result of the first analysis; if morphological awareness and affix knowledge are separate constructs, we treat them accordingly in the second analysis. We used vocabulary breadth as the potential mediator in the indirect pathways. Our research questions (RQs) are:

RQ1: Are morphological awareness and affix knowledge separate constructs?

RQ2: Does morphological awareness of words and non-words constitute separate constructs?

RQ3: How do morphological awareness and affix knowledge contribute to reading comprehension, directly or indirectly mediated through vocabulary breadth?

Methodology

Participants

Participants comprised 520 Japanese learners of EFL from a university in Japan. Twelve participants were excluded due to incomplete online tests, leaving data from 508 participants for analysis. All were first-year students majoring in various disciplines, including engineering, law, informatics, and science. Each participant had studied English for a minimum of six years prior to university enrollment. The average age of the participants was 18 or 19 years. Their average *Test of English for International Communication* (*TOEIC*) score was 589.73, with a standard deviation of 113.66, indicating that their English proficiency was at the B1 level according to the *Common European Framework of Reference for Languages*.

Measures

Affix Knowledge Assessment. Affix knowledge was assessed using the *CAT-WPLT* developed by Mizumoto et al. (2019). The *CAT-WPLT* (like the original *WPLT*) includes three sections. The "Form" section evaluates knowledge of affix forms by requiring participants to select a correct affix from four options—for example, 1. *-ing*, 2. *-nge*, 3. *-eld*, 4. *-kle*—with the distractors being non-morphemic parts of existing English words ($k = 20$).

The "Meaning" section assesses participants' understanding of affix meanings. Participants are presented with an affix and two example words and must select the correct meaning from four options. For example, with the affix "-ed" and example words "waked" and "played," the choices might include: (1) *past*, (2) *not*, (3) *many*, and (4) *person* ($k = 15$).

The "Use" section evaluates participants' knowledge of the parts of speech associated with specific affixes. It presents a target affix along with two example words (e.g., *-ency* in "tendency" and "dependency"), and participants must choose the correct part of speech from four

options: noun, adjective, verb, or adverb. An instructional segment explains each part of speech, and the test section provides the Japanese translation for each part of speech to assist comprehension of the grammatical terms (k = 10).

Although participants' scores are recorded on the first author's web server, item response data to compute reliabilities are not available from the testing system, which prevents computing reliability from the current data. However, large-scale test validation studies demonstrated high reliabilities with Cronbach's alpha over 0.91 (Sasao & Webb, 2017) with international participants and with Japanese university students (Mizumoto et al., 2019). Therefore, we assumed high reliability of this test.

Morphological Awareness Assessment. Participants' morphological awareness was evaluated using two specific tests: the Derivation part of *Test of Morphological Structure* (*TMS*) and the *Derivational Suffix Test* (*DST*) Word and Non-word. The *TMS* was selected based on its widespread use in both L1 and L2 morphology studies (e.g., Pasquarella et al., 2011; Wang et al., 2009, for L2 contexts). The *DST* was chosen due to its frequent use in L1 morphology research and its ease of online implementation through a multiple-choice format.

Test of Morphological Structure: Derivation. The Derivation part of the *TMS* (Carlisle, 2000) was used. Participants received a stem and a sentence with a blank space, where they had to add a suffix to the stem to complete the sentence (e.g., "Farm. My uncle is a _____."). Although the test is often given orally to L1 children who have not yet learned reading, we gave the written test to the EFL students to minimize the influence of their English listening skills. We administered the test online to facilitate data collection. Items were randomized for each participant to prevent memorization and order effects. Responses were input via a keyboard. The reliability (Cronbach's alpha) of this test was 0.85.

Derivational Suffix Test. The *DST* developed by Muse (2005) and Singson et al. (2000) was used. Test-takers were required to select the correct suffixed word from four options to complete a sentence. The test was administered in both real-word (DST_W) and non-word (DST_NW) formats. For example, in DST_NW, an item might read, "I could feel the _____: A. froodly B. froodful C. frooden D. froodness." While DST_W evaluates syntactic knowledge, it also poses the risk of participants relying on their familiarity with word meanings. To mitigate this possibility, DST_NW was also employed. Both tests were administered online, and items were presented visually to the participants. The reliability (Cronbach's alpha) for both DST_W and DST_NW was 0.72.

Vocabulary Breadth Test. Participants' vocabulary breadth was assessed using a vocabulary test developed from a list specifically tailored to university students in Japan (Enokida et al., 2018, 2021). Each participant received a unique set of 50 items, randomly drawn from a pool of 1,000 words, resulting in different word selections across individuals. This test consisted of 50 items, each randomly selected from a comprehensive list of 1,000 words. Half of the items were presented in English with 10 Japanese options, and the other half were in Japanese with 10 English options. Participants were required to select the word that corresponded to a given target word. Owing to the random selection of items from the vocabulary list, it is not possible to

calculate the reliability. However, Morita and Kusanagi (2021) demonstrated high discriminatory power through item response theory, confirming the validity of the test.

Reading Comprehension. The Reading Comprehension section of the *TOEIC* Listening and Reading test was employed in this study. A computer-adaptive online version was used, which is divided into two units, each containing three parts. The first unit included five sentence completion questions, four text completion questions, and 16 reading comprehension questions. The second unit consisted of seven, four, and nine items, respectively, in the same formats. All questions were presented in a multiple-choice format. Participants were given 35 minutes to complete this section. Scores in this section ranged from 0 to 495.

Similar to the *CAT-WPLT*, a computer-adaptive version of *TOEIC* does not provide item response data, making it impossible to compute the test's reliability. However, *TOEIC* scores are widely used as a measure of English proficiency, and their high reliability and validity have been reported by research teams at the Educational Testing Service (e.g., Powers, 2010; Wei & Low, 2017).

Procedure

All tests were administered during English classes. The morphological awareness tests were conducted in the first week, followed by the affix knowledge and vocabulary tests. The vocabulary test constituted 5% of the course evaluation, whereas the other tests were not for credit but served diagnostic purposes. The educational and research objectives were clearly explained to the participants, who were required to sign a consent form before beginning the tests. The *TOEIC* was administered in the fifth week of the curriculum.

Morphological awareness and vocabulary tests were conducted via an online learning management system. The *CAT-WPLT* was hosted on a server, enabling participants to access the site and complete the tests. Although the morphological awareness tests and *CAT-WPLT* were not timed, participants typically took approximately five to 10 minutes to complete them, respectively. The vocabulary test was timed at 13 minutes, which was considered sufficient for completion. The *TOEIC* was conducted online in lecture rooms, adhering to the instructors' protocol, and took approximately 60 minutes to complete.

Results

Table 1 presents the descriptive statistics for the eight tests. The scores for the *CAT-WPLT* are expressed as logits, which are calculated through an Item Response Theory procedure. These logits reflect the abilities of the test-takers and include positive and negative values, with lower scores indicating lower abilities. The skewness and kurtosis values for all tests indicate that the scores are normally distributed. For further analysis, to mitigate the scale discrepancy between the affix knowledge scores (logits) and the reading comprehension and vocabulary scores (raw accuracy), we applied grand-mean centering to the reading comprehension and vocabulary variables.

Table 1. *Descriptive Statistics for All Tests*

Construct	Variables	Min.	Max.	*M*	*SD*	Skewness	Kurtosis
AK	Form	2.56	1.97	-0.31	0.62	-0.03	1.10
	Meaning	2.74	1.15	-0.80	0.71	-0.45	0.50
	Use	-2.08	1.28	-0.21	0.75	-0.30	-0.04
MA	Derivation	1.00	28.00	15.45	5.62	-0.24	-0.49
	DTS_W	4.00	20.00	15.79	3.25	-0.83	0.39
	DST_NW	1.00	20.00	14.97	4.19	-0.72	0.26
Vocabulary		0.00	50.00	35.46	6.43	-0.51	0.57
Reading Comprehension		0.00	470.00	284.95	71.48	-0.13	-0.26

Note. AK = affix knowledge; MA = morphological awareness; Derivation = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

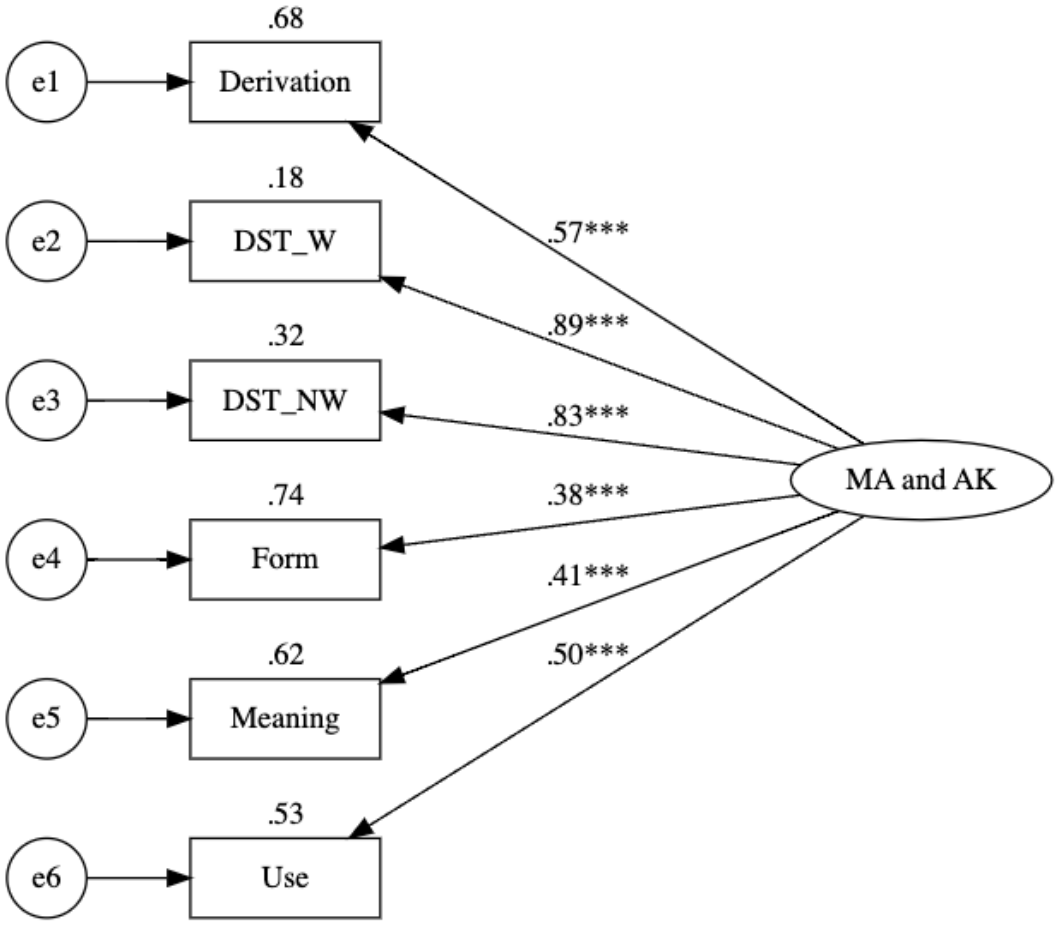
Table 2. *Correlation Between All Tests*

	1	2	3	4	5	6.	7	8
1.Read.	1.00	.40 ***	.31 ***	.30 ***	.29 ***	.35 ***	.52 ***	.42 ***
2.Voca.		1.00	.33 ***	.28 ***	.32 ***	.47 ***	.46 ***	.44 ***
3.Form			1.00	.34 ***	.32 ***	.21 ***	.31 ***	.28 ***
4.Mean.				1.00	.43 ***	.27 ***	.34 ***	.29 ***
5.Use					1.00	.26 ***	.42 ***	.38 ***
6.Deriv.						1.00	.50 ***	.46 ***
7.DST_W							1.00	.75 ***
8.DST_NW								1.00

Note. *** $p < .001$ Read. = Reading comprehension; Voca. = Vocabulary; Mean. = Meaning; Deriv. = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

Table 2 displays the correlation coefficients between the scores of all tests. All tests were significantly and positively correlated ($p < .001$), with most correlations ranging from low to medium. There were no concerns of multicollinearity, as indicated by Variation Inflation Factor (VIF) values below five: 1.90 (Reading Comprehension), 1.51 (Derivation), 2.61 (DST_W), and 2.39 (DST_NW). Correlations among the affix knowledge variables ranged from low to moderate (.21 to .43), while those among the morphological awareness variables ranged from moderate to high (.46 to .72). Reading Comprehension showed low correlations with affix knowledge variables and moderate to high correlations with morphological awareness variables. Vocabulary correlated with affix knowledge variables at low (.28) to medium levels (.33) and

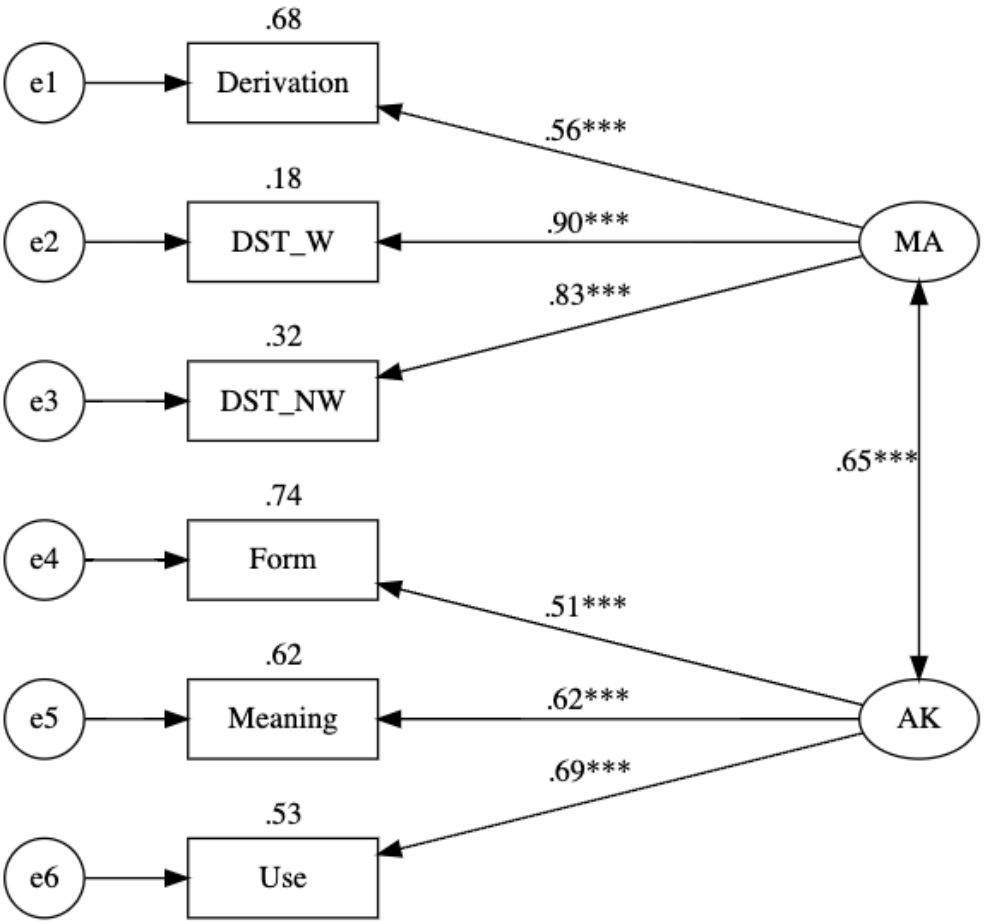
with morphological awareness variables at medium levels (.44 to .47). The correlation between Reading Comprehension and Vocabulary was medium at .40.



Note. $p < .001$ AK = Affix Knowledge; MA = Morphological Awareness; Derivation = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

Figure 1. Single-factor Confirmatory Analysis of Affix Knowledge and Morphological Awareness.

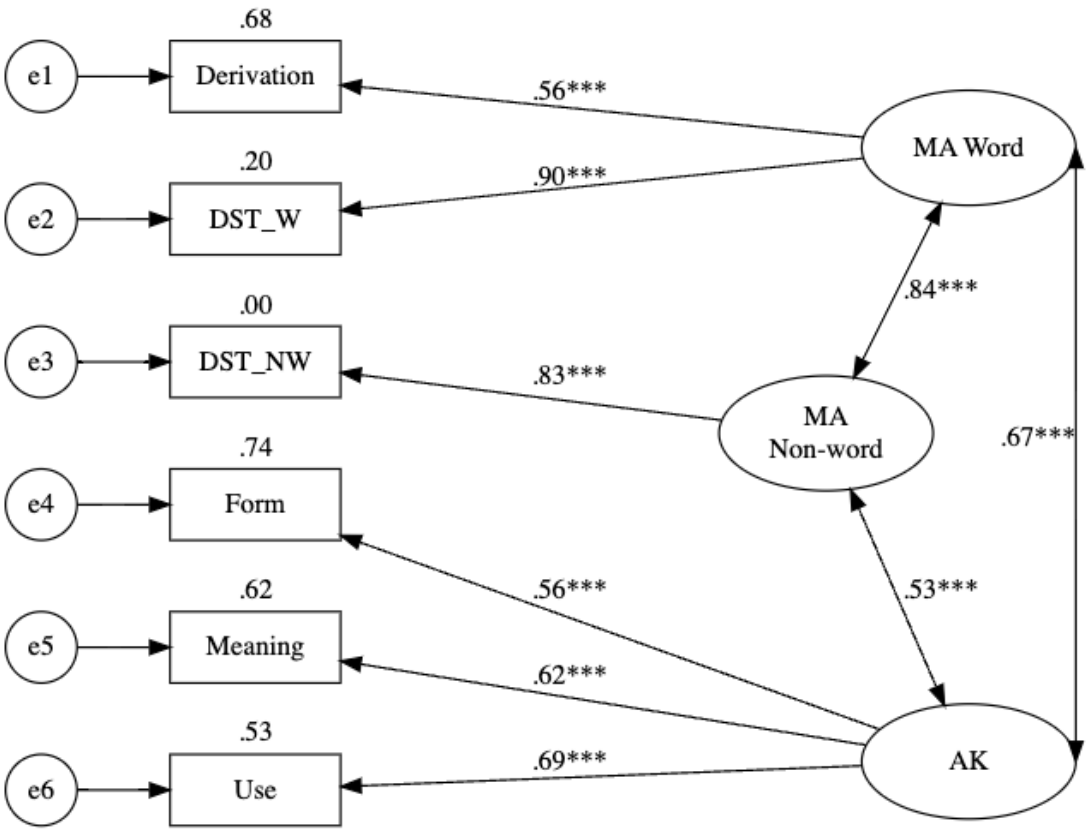
To answer RQs 1 and 2, a series of confirmatory factor analyses were conducted using R version 4.2.2 (R Core Team, 2022) and the *lavaan* package (Rosseel, 2012). Three models were tested. The first (unidimensional) and second (two-dimensional) models replicate Wang and Zhang (2023). The first model postulates that morphological awareness and affix knowledge represent the same construct (Figure 1). The second model proposes that morphological awareness and affix knowledge are two distinct constructs (Figure 2). The third model (three-dimensional) expands the second model by dividing the morphological awareness construct into two: one for real words and another for non-words, based on Tighe and Schatschneider (2015) (Figure 3).



Note. $p < .001$ AK = affix knowledge; MA = morphological awareness; Derivation = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

Figure 2. Two-factor Confirmatory Analysis of Affix Knowledge and Morphological Awareness

Table 3 displays the goodness-of-fit results for these models. Both the two- and three-dimensional models demonstrated a significantly better fit to the data compared to the unidimensional model. Given that the relative fit indices for the two- and three-dimensional models were nearly identical, the simpler of the two was selected as the best-fit model. This model indicates that, while morphological awareness and affix knowledge are separate constructs, morphological awareness is not further distinguished between real words and non-words.



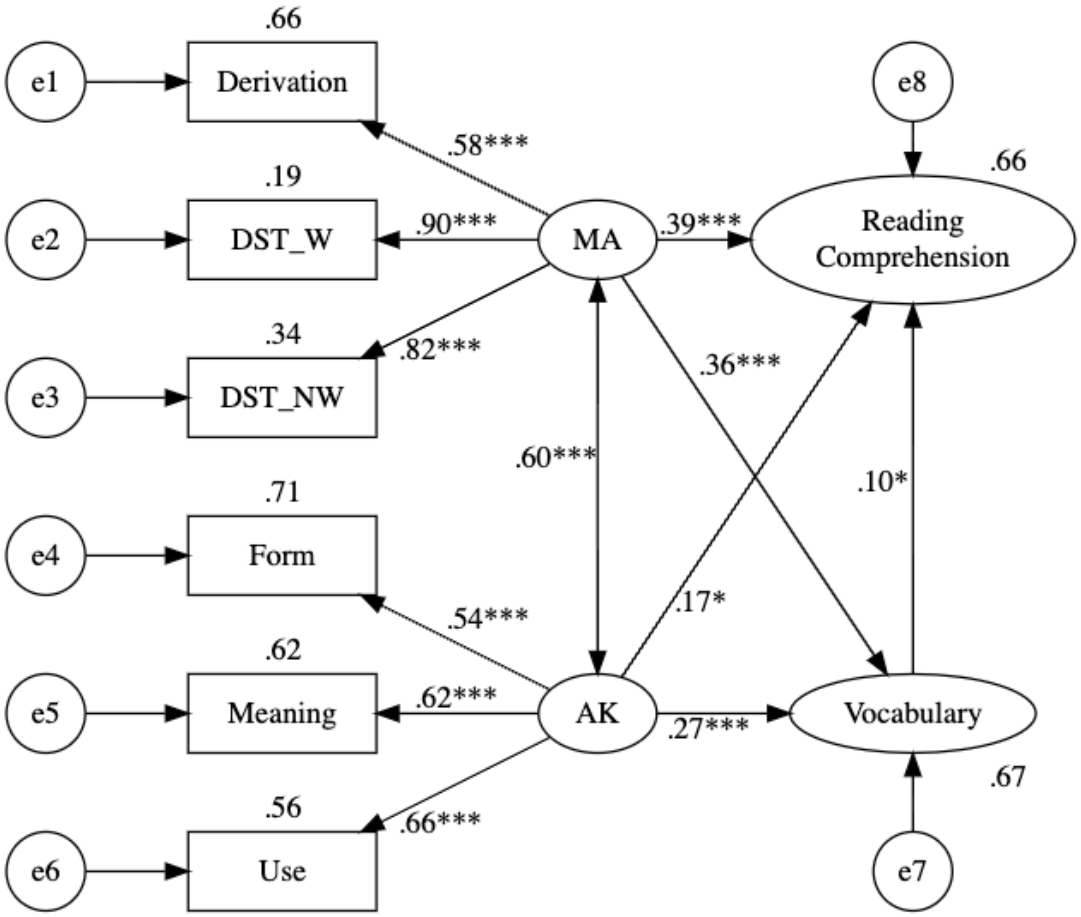
Note. $p < .001$ AK = affix knowledge; MA = morphological awareness; Derivation = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

Figure 3. Three-factor Confirmatory Analysis of Affix Knowledge and Morphological Awareness

Table 3. *Model Comparison*

Model	χ^2 (*df*)	*p*	CFI	TLI	RMESA (90% CI)	SRMR	AIC
Single-factor	85.568 (9)	0.000	.912	.853	.132 (.108-.158)	.073	11128.625
Two-factor	8.589 (8)	0.378	.999	.999	.012 (.000-.054)	.019	11050.646
Three-factor	8.112 (7)	0.323	.999	.997	.018 (.000-.059)	.018	11052.169

Based on this result, RQ3 was addressed by assuming two dimensions in morphological knowledge (MA and AK). A structural equation model (SEM) was employed to test a model in which vocabulary mediates the relationship between morphological constructs and reading comprehension (Figure 4). This model demonstrated a good fit, with $\chi^2(16) = 56.19$, $p < 0.001$, $CFI = 0.969$, $TLI = 0.946$, $RMSEA = 0.070$ [0.051-0.091], and $SRMR = 0.035$.



Note. ***p < .001, *p < .05 AK = affix knowledge; MA = morphological awareness; Derivation = Test of Morphological Structure: Derivation; DST_W = Derivational Suffix Task with word; DST_NW = Derivational Suffix Task with non-word.

Figure 4. The Structural Model of Morphological Awareness and Affix Knowledge Contributions to Reading Through Vocabulary

Table 4 summarizes the direct, indirect, and total effects of the predictor variables. The model explained 45% of the variance in reading comprehension (R^2 = .45), 29% in vocabulary breadth (R^2 = .29), and 13% in affix knowledge (R^2 = .13), indicating substantial explanatory power. The table also lists the bootstrapped 95% confidence intervals; none included zero, indicating that the direct effects of all predictor variables and indirect effects of morphological variables through vocabulary breadth were significant. Specifically, the standardized magnitudes of these indirect effects were 0.04 for morphological awareness and 0.03 for affix knowledge (Table 4). The total effects, combining indirect and direct effects, were 0.43 for morphological awareness and 0.20 for affix knowledge (Table 4).

The bootstrapped estimate of total effects of the two morphological dimensions on reading comprehension was significant. Morphological awareness displayed a larger effect, 42.048 (*SE* = 17.090, 95% CI [9.159, 77.365]), compared to affix knowledge, 9.427 (*SE* = 1.725, 95% CI

[6.202, 13.017]). This larger total effect from morphological awareness than affix knowledge was primarily due to their direct effects rather than indirect effects.

Table 4. *Results of Mediating Effects Test*

Variables	Point estimate	Standardized	Products of coefficients		Bootstrapping (5000) Bias-corrected 95% CI		Bootstrapping (5000) Percentile 95% CI	
			SE	*z*	Lower	Upper	Lower	Upper
Indirect								
MA → Vocabulary → Reading	0.81	0.04	0.41	1.98	0.07	1.858	0.01	1.74
AK → Vocabulary → Reading	5.88	0.03	3.11	1.89	0.62	15.452	0.01	13.87
Direct								
MA → Reading	8.62	0.39	1.53	5.62	5.453	12.082	5.47	12.10
AK → Reading	36.17	0.17	16.02	2.26	3.774	71.914	3.07	71.88
Total								
MA	9.43	0.43	1.54	6.11	6.186	12.993	6.20	13.02
AK	42.05	0.20	15.76	2.67	10.460	76.958	9.16	77.37

Note. AK = affix knowledge; MA = morphological awareness.

Discussion

As noted in the literature review, investigation into the dimensionality of morphological knowledge has been increasing in L1 research. However, there is a dearth of research in the L2 field. This study first examined the dimensionality of L2 morphological knowledge by focusing on the separability of the constructs between morphological awareness and affix knowledge. As discussed earlier, the choice of these subcategories of morphological knowledge was motivated by the emerging communication across two related L2 research fields with different traditions in the measurement of morphological knowledge. If morphological awareness and affix knowledge are different constructs, albeit interconnected, more fine-tuned pedagogical implications should be drawn from research outcomes.

RQ1: Are morphological awareness and affix knowledge separate constructs?

Our results indicated that morphological awareness and affix knowledge are separate constructs. This finding was in line with Wang and Zhang (2023), despite the different tasks used by their

and the current study to measure morphological awareness and different versions of tests for affix knowledge (paper-based *WPLT* and *CAT-WPLT*).

RQ2: Does morphological awareness of words and non-words constitute separate constructs?

We also examined whether item types (real words vs non-words) affect dimensionality with respect to Tighe and Schatschneider (2015) and Kaldes et al. (2024), but our findings did not support the item type effect. This result suggests that whether researchers use real word items or non-word items in their measurement of L2 morphological knowledge, the construct they measure is basically common, providing liberty of item selection in the measurement. However, reasons for this discrepancy are unclear. If L1 adult readers indeed use morphological knowledge differently between real words and non-words as Tighe and Schatschneider (2015) speculated, our result shows that L2 adult readers do not do so. However, the precise mechanism underlying the difference between real words and non-words needs to be explored in future studies (see the Limitations and Future Directions section).

RQ3: How do morphological awareness and affix knowledge contribute to reading comprehension, directly or indirectly mediated through vocabulary breadth?

Drawing on our final two-dimensional model, our next question was how morphological awareness and affix knowledge contribute to L2 reading comprehension. More specifically, we examined their direct and indirect (via vocabulary breadth) effects on reading comprehension. Direct effects from all predictors (morphological awareness, affix knowledge, and vocabulary breadth) were significant. Additionally, both morphological awareness and affix knowledge contributed indirectly through vocabulary breadth to reading comprehension. Overall, morphological awareness displayed a larger total effect than affix knowledge (0.43 vs 0.20). The significant direct and indirect effects of morphological knowledge replicate previous studies (Yamashita & Kusanagi, 2024; Zhang & Li, 2021) but differ from Zhou (2021) who found only direct effect.

A unique finding of this study is a larger contribution of morphological awareness compared to that of affix knowledge; this distinction of two dimensions of morphological knowledge has not been investigated in previous studies. Overall, the current finding, together with various other L2 studies, supported the Morphological Pathways Framework and demonstrated that this framework applies to L2 reading even if L1 and L2 are distant languages (Japanese and English) and in an input poor EFL context.

There are two potential reasons for the overall stronger effect of morphological awareness than affix knowledge. First, we used the partial production task. In the Derivation task, the participants were given a word and asked to add an appropriate suffix to the word and type in the whole word to fill in a blank in a sentence. Therefore, the participants were required to have knowledge of the correct spelling knowledge. According to the Lexical Quality Hypothesis (Perfetti & Hart, 2002; Perfetti, 2017), high-quality lexical representation, embodying the flexible and precise connections among a word's constituents (phonology, orthography, semantics, and morphosyntax), and processing abilities are essential for reading comprehension. The Form section of the *CAT-WPLT* measures orthographic knowledge of morphemes at the

recognition level, but the Derivation task is likely to tap into the orthographic representation and its processing ability to a greater degree as it requires the morphological manipulation and ability to correctly spell derivatives.

Another reason may also relate to the measurement characteristics. While morphological awareness tests required morphological analysis on the part of readers (readers must first identify morphemes by analyzing a target word into morphemes), the affix knowledge test did not necessitate this process (affixes are given as an isolated test item). Morphological awareness tests are more closely aligned with the process of reading comprehension as readers must analyze a morphologically complex word into its parts to read fluently and infer the meaning of the word if it is unknown.

However, the smaller degrees of impact of receptive affix knowledge do not mitigate its importance. Its effect was indeed significant, and it was found to play important roles that contribute to L2 reading comprehension directly and indirectly (see Yamashita & Kusanagi, 2024; Zhang & Lin, 2021). Wang and Zhang (2023) maintained that affix knowledge serves as the basis for morphological awareness because it would not be possible to use morphemes strategically in the process of literacy acquisition without knowing word parts (even receptively).

Nuanced Yet Actionable Pedagogical Implications

By examining the separate contributions of morphological awareness and affix knowledge to reading comprehension, this study offers more nuanced pedagogical implications. In EFL contexts, such as Japan, where the primary source of English input is textbooks in English language classrooms, the advancement of morphological knowledge cannot be anticipated without instructional methods (Schmitt & Meara, 1997). The need for explicit teaching is even more pronounced because EFL textbooks, at least in Japan, frequently lack sufficient derived words to broaden learners' morphological knowledge (Morita et al., 2019, 2021).

When delivering explicit instruction on morphological knowledge, a critical implication from our results is that teachers should be aware of whether their instruction is meant to enhance affix knowledge or morphological awareness. A common instructional practice that lists target affixes and requires students to memorize their meanings and syntactic roles would effectively teach basic associative knowledge between affix form and its meaning and function. Although such knowledge is foundational, instructions for enhancing morphological awareness grounded in affix knowledge are desired. Tasks that involve morphological analysis and processing, such as those introduced in this paper as test tasks and many others found in other studies (e.g., Goodwin & Ahn, 2010; Goodwin et al., 2017; Kirby & Bowers, 2017), may be useful for teachers to expand their instructional repertoire. Even if not creating specific morphological practices or worksheets, briefly drawing students' attention to morphologically complex words in reading material and having them reflect on word parts or analyze a word into its morphemes—to an extent that does not substantially disturb reading—would be a good step for raising morphological awareness.

To the best of our knowledge, this study is one of the few EFL research studies to examine the dimensionality of L2 morphological knowledge as well as simultaneously model the direct and

indirect contributions of morphological awareness and affix knowledge to reading comprehension. In this way, it expands our insights into the relationship between morphological knowledge and reading comprehension in L2.

Limitations and Future Directions

Several limitations of the present study should be acknowledged. First, although our confirmatory factor analysis distinguished morphological awareness and affix knowledge as separate constructs, the non-word morphological awareness factor was assessed using only a single task (DST_NW). This reliance on a single indicator limits the reliability of the latent construct and may have contributed to the minimal distinction observed between the two- and three-factor models. It may also partially relate to why no clear item type effect (real words versus non-words) was found in our dimensionality analysis. Future studies should incorporate multiple non-word tasks to more thoroughly investigate whether item type influences the structure of L2 morphological knowledge.

Second, vocabulary breadth was also assessed using a single test, albeit one validated in previous studies. For more robust modeling of vocabulary as a latent variable, future research should include multiple, diverse vocabulary measures, including assessments of vocabulary depth and word-reading skills. In particular, as Yamashita and Kusanagi (2024) noted, word-reading is an integral component of the Morphological Pathways Framework. Including such tasks could enhance our examination of the theoretical framework and validate its applicability in L2 contexts.

Finally, although we employed multiple morphological awareness tasks often used in L1 and L2 studies, there is a need for tasks that are more specifically validated for L2 settings. Goodwin et al. (2021) highlighted that the assessment of morphological knowledge varies significantly across studies, underscoring the need for a robust set of validated assessment measures. For instance, the assessment tool *Monster, P.I.*, developed by Goodwin et al. (2021), provides validated tools for assessing morphological awareness in L1 middle school contexts. It is vital that the findings of this study be further confirmed using a variety of tasks, ideally those specifically developed and validated for L2 learners.

Conclusion

This study explored the constructs of morphological awareness and affix knowledge and their relationships with vocabulary breadth and reading comprehension, employing confirmatory factor analysis and structural equation modeling. The confirmatory factor analysis showed that morphological awareness and affix knowledge are distinct constructs. Additionally, the structural equation modeling revealed significant direct and indirect pathways from both morphological awareness and affix knowledge to reading comprehension through vocabulary. By identifying the contribution of morphological knowledge to reading comprehension both directly and indirectly via vocabulary, this study supports the recent theoretical Morphological Pathways Model. Another contribution of this study is that we added empirical evidence from L2 learners whose L1 and L2 are distant and who are learning L2 in a foreign language context. These

findings not only validate the multidimensional nature of morphological knowledge but also indicate its pedagogical importance in foreign language contexts where morphological instruction is often underutilized.

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References

Alshehri, M., & Zhang, D. (2022). Word-to-text integration components in second language (L2) reading comprehension. *Frontiers in Education*, *7*, Article 926663. https://doi.org/10.3389/feduc.2022.926663

Anglin, J. M., Miller, G. A., & Wakefield, P. C. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, 58*(10), i–165. https://doi.org/10.2307/1166112

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of Psycholinguistic Research, 39*(2), 141–163. https://doi.org/10.1007/s10936-009-9130-6

Bratlie, S. S., Brinchmann, E. I., Melby-Lervåg, M., & Torkildsen, J. K. (2022). Morphology—A gateway to advanced language: Meta-analysis of morphological knowledge in language-minority children. *Review of Educational Research, 92*(4), 614–650. https://doi.org/10.3102/00346543211073186

Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing, 12*(3–4), 169–190. https://doi.org/10.1023/A:1008131926604

Carlisle, J. F., & Fleming, J. (2003). Lexical processing of morphologically complex words in the elementary years. *Scientific Studies of Reading, 7*(3), 239–253. https://doi.org/10.1207/S1532799XSSR0703_3

Deacon, S. H., Kieffer, M. J., & Laroche, A. (2014). The relation between morphological awareness and reading comprehension: Evidence from mediation and longitudinal models. *Scientific Studies of Reading, 18*(6), 432–451. https://doi.org/10.1080/10888438.2014.926907

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics, 25*(2), 223–238. https://doi.org/10.1017/S0142716404001110

Enokida, K., Morita, M., Sakaue, T., & Kida, S. (2018). Hirodai sutandado 6000 goirisuto no kaihatsu to katsuyou [Development and utilization of the Hirodai Standard 6000 vocabulary list (HiroTan)]. *Hiroshima Studies in Language and Language Education, 21*, 111–120. https://doi.org/10.15027/45304

Enokida, K., Morita, M., Sakaue, T., Kida, S., & Amano, S. (2021). Hirodai sutandado 6000 goirisuto no unyo to kairyou [Implementation and revision of the Hirodai Standard 6000

Vocabulary List (HiroTan)]. *Hiroshima Studies in Language and Language Education, 24*, 141–152. https://doi.org/10.15027/50452

Goodwin, A. P., & Ahn, S. (2010). A meta-analysis of morphological interventions: effects on literacy achievement of children with literacy difficulties. *Annals of Dyslexia, 60*(2), 183–208. https://doi.org/10.1007/s11881-010-0041-x

Goodwin, A. P., Huggins, A. C., Carlo, M., Malabonga, V., Kenyon, D., Louguit, M., & August, D. (2012). Development and validation of Extract the Base: An English Derivational Morphology Test for third through fifth grade monolingual students and Spanish-speaking English language learners. *Language Testing, 29*(2), 265–289. https://doi.org/10.1177/0265532211419827

Goodwin, A. P., Petscher, Y., Carlisle, J. F., & Mitchell, A. M. (2017). Exploring the dimensionality of morphological knowledge for adolescent readers. *Journal of Research in Reading, 40*(1), 91–117. https://doi.org/10.1111/1467-9817.12064

Goodwin, A., Petscher, Y., & Tock, J. (2021). Multidimensional morphological assessment for middle school students. *Journal of Research in Reading, 44*(1), 70–89. https://doi.org/10.1111/1467-9817.12335

Hamada, A., Shimizu, H., Hoshino, Y., Takaki, S., & Ushiro, Y. (2024). Robust evidence for the simple view of second language reading: Secondary meta-analysis of Jeon and Yamashita (2022). *Studies in Second Language Acquisition*, *46*(5), 1355–1372. https://doi.org/10.1017/S0272263124000226

Iwaizumi, E., & Webb, S. (2022). To what extent do learner- and word-related variables affect production of derivatives? *Language Learning, 73*(1), 301–336. https://doi.org/10.1111/lang.12524

James, E., Currie, N. K., Tong, S. X., & Cain, K. (2021). The relations between morphological awareness and reading comprehension in beginner readers to young adolescents. *Journal of Research in Reading, 44*(1), 110–130. https://doi.org/10.1111/1467-9817.12316

Jeon, E. H., & Yamashita, J. (2014). L2 reading comprehension and its correlates: A meta-analysis. *Language Learning, 64*(1), 160–212. https://doi.org/10.1111/lang.12034

Jeon, E. H., & Yamashita, J. (2022). L2 reading comprehension and its correlates: An updated meta-analysis. In Y. In'nami, & E. H. Jeon (Eds.), *Understanding L2 proficiency: Theoretical and meta-analytic investigations* (pp. 29–86). John Benjamins. https://doi.org/10.1075/bpa.13.03jeo

Kaldes, G., Tighe, E. L., Romski, M., Pigott, T. D., & Sun, C. D. (2024). Morphological assessment features and their relations to reading: A meta-analytic structural equation modeling study. *Educational Research Review, 43*, Article 100602. https://doi.org/10.1016/j.edurev.2024.100602

Kirby, J. R., & Bowers, P. N. (2017). Morphological instruction and literacy: Binding phonological, orthographic, and semantic features of words. In K. Cain, D. L. Compton, & R. K. Parrila (Eds.), *Theories of reading development* (pp. 437–462). John Benjamins.

Koda, K. (2016). Development of word recognition in a second language. In X. Chen, V. Dronjic, & R. Helms-Park (Eds.), *Reading in a second language: Cognitive and psycholinguistic issues* (pp. 70–98). Routledge.

Ku, Y. M., & Anderson, R. C. (2003) Development of morphological awareness in Chinese and English. *Reading and Writing, 16*, 399–422. https://doi.org/10.1023/A:1024227231216

Kuo, L. & Anderson, R. C. (2006). Morphological awareness and learning to read: A cross-language perspective. *Educational Psychologist*, *41*(3), 161–180. https://doi.org/10.1207/s15326985ep4103_3

Lee, J. W., Wolters, A., & Grace Kim, Y. S. (2022). The relations of morphological awareness with language and literacy skills vary depending on orthographic depth and nature of morphological awareness. *Review of Educational Research*, *93*(4), 528–558. https://doi.org/10.3102/00346543221123816

Levesque, K. C., Breadmore, H. L., & Deacon, S. H. (2021). How morphology impacts reading and spelling: Advancing the role of morphology in models of literacy development. *Journal of Research in Reading, 44*(1), 10–26. https://doi.org/10.1111/1467-9817.12313

Mizumoto, A., Sasao, Y., & Webb, S. A. (2019). Developing and evaluating a computerized adaptive testing version of the Word Part Levels Test. *Language Testing, 36*(1), 101–123. https://doi.org/10.1177/0265532217725776

Mochizuki, M., & Aizawa, K. (2000). An affix acquisition order for EFL learners: An exploratory study. *System*, *28*(2), 291–304. https://doi.org/10.1016/S0346-251X(00)00013-0

Morita, M., & Kusanagi, K., (2021). Hidoukigata Onrain Jyugyou ni okeru goigakushu no kouka kenshou [Verifying the effects of vocabulary learning in unsynchronized online classes]. *Hiroshima Studies in Language and Language Education, 24*, 153–165. https://doi.org/10.15027/50453

Morita, M., Uchida, S., & Takahashi, Y. (2019). The frequency of affixes and affixed words in Japanese junior high school textbooks: A corpus study. *Annual Review of English Language Education in Japan, 30*, 129–143. https://doi.org/10.20581/arele.30.0_129

Morita, M., Uchida, S., & Takahashi, Y. (2021). The frequency of affixes and affixed words in Japanese senior high school English textbooks: A corpus study. *Annual Review of English Language Education in Japan, 32*, 81–95. https://doi.org/10.20581/arele.32.0_81

Muse, A. E. (2005). *The nature of morphological knowledge* [Doctoral dissertation, Florida State University]. FSU Digital Repository. http://purl.flvc.org/fsu/fd/FSU_migr_etd-2161

Nagy, W., Berninger, V. W., & Abbott, R. D. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. *Journal of Educational Psychology, 98*(1), 134–147. https://doi.org/10.1037/0022-0663.98.1.134

Nagy, W. E., Carlisle, J. F., & Goodwin, A. P. (2014). Morphological knowledge and literacy acquisition. *Journal of Learning Disabilities, 47*(1), 3–12. https://doi.org/10.1177/0022219413509967

Nation, I.S.P. (2013). *Learning Vocabulary in Another Language* (2nd ed.). Cambridge University Press.

Pasquarella, A., Chen, X., Lam, K., Luo, Y. C., & Ramirez, G. (2011). Cross-language transfer of morphological awareness in Chinese–English bilinguals. *Journal of Research in Reading, 34*(1), 23–42. https://doi.org/10.1111/j.1467-9817.2010.01484.x

Perfetti, C. (2017). Lexical quality revisited. In E. Segers & P. van den Broek (Eds.), *Developmental perspectives in written language and literacy: In honor of Ludo Verhoeven* (pp. 51–67). John Benjamins. https://doi.org/10.1075/z.206.04per

Perfetti, C. A., & Hart, L. (2002). The lexical quality hypothesis. In L. Verhoeven, C. Elbro, & P. Reitsma (Eds.), *Precursors of functional literacy* (Vol. 11, pp. 189–213). https://doi.org/10.1075/swll.11.14per

Perfetti, C. A., Landi, N., & Oakhill, J. (2005). The acquisition of reading comprehension skill. In M. J. Snowling, & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 227–247). https://doi.org/10.1002/9780470757642.ch13

Perfetti, C., & Stafura, J. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading, 18*(1), 22–37. https://doi.org/10.1080/10888438.2013.827687

Powers, D. E. (2010). *Validity: What does it mean for the TOEIC tests?* (TOEIC Compendium Study TC-10-01). [Research report]. Educational Testing Service.

Qian, D. D. (2002). Investigating the relationship between vocabulary knowledge and academic reading performance: An assessment perspective. *Language Learning*, *52*(3), 513–536. https://doi.org/10.1111/1467-9922.00193

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.r-project.org/

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Sasao, Y., & Webb, S. (2017). The word part levels test. *Language Teaching Research, 21*(1), 12–30. https://doi.org/10.1177/1362168815586083

Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word associations and verbal suffixes. *Studies in Second Language Acquisition, 19*(1), 17–36. https://doi.org/10.1017/S0272263197001022

Singson, M., Mahony, D., & Mann, V. (2000). The relation between reading ability and morphological skills: Evidence from derivational suffixes. *Reading and Writing, 12*(3–4), 219–252. https://doi.org/10.1023/A:1008196330239

Spencer, M., Muse, A., Wagner, R. K., Foorman, B., Petscher, Y., Schatschneider, C., Tighe, E. L., & Bishop, M. D. (2015). Examining the underlying dimensions of morphological awareness and vocabulary knowledge. *Reading and Writing, 28*(7), 959–988. https://doi.org/10.1007/s11145-015-9557-0

Tighe, E. L., & Schatschneider, C. (2015). Exploring the dimensionality of morphological awareness and its relations to vocabulary knowledge in adult basic education students. *Reading Research Quarterly, 50*(3), 293–311. https://doi.org/10.1002/rrq.102

Wang, M., Ko, I. Y., & Choi, J. (2009). The importance of morphological awareness in Korean–English biliteracy acquisition. *Contemporary Educational Psychology, 34*(2), 132–142. https://doi.org/10.1016/j.cedpsych.2008.12.002

Wang, T., & Zhang, H. (2023). Examining the dimensionality of morphological knowledge and morphological awareness and their effects on second language vocabulary knowledge. *Frontiers in Psychology, 14*, Article 1207854. https://doi.org/10.3389/fpsyg.2023.1207854

Wei, Y., and Low, A. (2017), Monitoring score change patterns to support TOEIC® listening and reading test quality. [Research report]. https://doi.org/10.1002/ets2.12186

Xue, J & Jiang, X. (2017). The developmental relationship between bilingual morphological awareness and reading for Chinese EFL adult learners: a longitudinal study. *Reading and Writing, 30*, 417–438. https://doi.org/10.1007/s11145-016-9683-3

Yamashita, J., & Kusanagi, K. (2024). Direct and indirect contributions of three aspects of morphological knowledge to second language reading comprehension. *Education Sciences, 14*(3), Article 270. https://doi.org/10.3390/educsci14030270

Zhang, D. (2017). Derivational morphology in reading comprehension of Chinese-speaking learners of English: A longitudinal structural equation modeling study. *Applied Linguistics, 38*(6), 871–895. https://doi.org/10.1093/applin/amv072

Zhang, D., Ke, S. (Echo), & Mo, Y. (2023). Morphology in reading comprehension among school-aged readers of English: A synthesis and meta-analytic structural equation modeling study. *Journal of Educational Psychology, 115*(5), 683–699. https://doi.org/10.1037/edu0000797

Zhang, H., & Lin, J. (2021). Morphological knowledge in second language reading comprehension: Examining mediation through vocabulary knowledge and lexical inference. *Educational Psychology, 41*(5), 563–581. https://doi.org/10.1080/01443410.2020.1865519

Zhou, J. (2022). The contribution of morphological awareness and vocabulary knowledge to Chinese as a second language reading comprehension: A path analysis. *Journal of Psycholinguistic Research, 51*(1), 55–74. https://doi.org/10.1007/s10936-021-09810-2

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