Exploring Primary School Students' Morphological Awareness in Thailand

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Abstract

Understanding how words are formed is a crucial component of learning new words. A child's ability to manipulate the morphological elements of words is related to their subsequent vocabulary development. Morphological awareness can also enhance learning new syntactic and semantic properties of morphologically complex words to meet the demands of language production. However, there is a dearth of research on how receptive-productive morphological awareness is acquired, especially in an EFL context. This study used a quantitative design to explore the nature of morphological awareness in 104 Thai primary school students and to investigate the relationships between receptive-productive morphological awareness and vocabulary knowledge. All participants were given six measures of morphological awareness and two vocabulary knowledge tasks. The results revealed the close relationship between the students' morphological awareness and vocabulary knowledge, both receptively and productively. The results also indicated that Thai primary school students' morphological awareness grows gradually along the receptive and productive continuum and that morphological knowledge is learned at varying rates and improves with learners' increased education levels. Indeed, all aspects of morphological awareness contributed to receptive and productive vocabulary knowledge. Overall, the current study highlighted the importance of the word family construct for teaching and learning morphologically complex words. It was also shown that morphological awareness is a crucial mechanism for vocabulary acquisition and growth and a facilitative scaffold for forming morphologically complex words.

Keywords: morphological awareness, word families, primary school students, receptive knowledge, productive knowledge

1. Introduction

Studies in the field of second language (L2) learning and development have highlighted the role of vocabulary knowledge in mastering a second language. Morphological awareness (hereafter, MA), typically referred to as word part knowledge, is defined as the ability to recognize individual lexical items and to produce and use these items in context. MA is an essential tool for acquiring vocabulary size and depth (Bubchaiya & Sukying, 2022; McBride-Chang, Wagner, Muse, Chow, & Shu, 2005; Schmitt & Meara, 1997; Sukying, 2017, 2018a, 2020, 2022; Zimmerman, 2009). Vocabulary depth involves the quality of knowing a word. In contrast, vocabulary size refers to the number of vocabulary items at least partially known, and increased mastery of vocabulary size is regarded as adding to vocabulary depth. Previous studies have argued that MA eases the acquisition of new forms and meanings of unfamiliar words by parsing morphologically complex words into smaller parts in written and spoken texts. MA also assists learners in recognizing the form-meaning links, identifying a syntactic category of the words, and producing new words in language use (Hayashi & Murphy, 2011; Schmitt & Meara, 1997; Sukying, 2017, 2022). However, most studies have explored MA in native English children and L2 tertiary learners (Danilović, Savić, & Dimitrijević, 2013; Hayashi & Murphy, 2011; Mochizuki & Aizawa, 2000; Schmitt & Zimmerman, 2002; Sukying, 2018b, 2020; Ward & Chuenjundaeng, 2009). However, little research has been conducted to explore primary school students' MA, particularly in an English as a foreign (EFL) context. Therefore, understanding MA acquisition is of great value for practitioners and researchers on the vocabulary acquisition process and the role of MA on vocabulary expansion in young EFL learners.

2. Literature Review

2.1 Morphological Awareness

Morphological awareness (MA), often known as morphological knowledge (Fromkin, Rodman, Hyams, Cox,

Thornton, & Amberber, 2014; Masrai, 2016), affix knowledge (Sukying, 2017, 2018a, 2020) or knowledge of word parts (Bubchaiya & Sukying, 2022; Nation, 2013), refers to the ability to discern and understand the internal structure of morphemes, the smallest units of meaning in a language (Carlisle, 2000; Lieber, 2010; McBride-Chang et al., 2005; Sukying 2017, 2018b, 2020, 2022). MA accelerates the knowledge of new, often morphologically complex, words (Kuo & Anderson, 2006). A morpheme is "the smallest meaningful unit which carries meaning or serves a grammatical function" (Finegan, 2012, p. 538). Words may have only one morpheme, such as *teach*, or be multi-morphemic (contain multiple morphemes), such as *teachers*. The morpheme *-er* is a meaningful unit that changes the root word *teach*, a verb, to an agentive noun, *teacher*. The word *teachers* has three morphemes because adding *-s* transforms the singular agentive into the plural.

There are two kinds of morphemes in the English language: free morphemes, which can stand alone, and bound morphemes, which cannot. A bound morpheme is a word unit that is not meaningful and can "function only as part of a word: *un-, tele-, -ness, -er*" (Finegan, 2012, p. 46). However, a free morpheme can autonomously convey meaning (e.g., *zebra, very, soft*). Many English words are comprised of multiple morphemes. The morphemic structure consists of stems, roots, and affixes. A stem is the root of a word to which affixes (such as prefixes or suffixes) can be added (e.g., *friend* in the word *friendship*). Affixes are elements, such as prefixes or suffixes, which can be added to a word to indicate a number, person, or tense in inflected words. Affixes often change a word's grammatical category or meaning in derived forms. Exemplars include the prefix *un-* in *ungrateful* or the suffix *-ness* in *loneliness*. Thus, MA is essential for language learners. Knowing the internal structure of a word establishes morphological knowledge; that is, recognizing and manipulating morphemes and morphological rules that allow one to consider the amalgamation of morphemes in a language (Carlisle, 2000; Kuo & Anderson, 2006).

In language, MA comprises inflectional and derivational affix knowledge (McBride-Chang et al., 2005). Inflectional affixes reveal syntactic and semantic relations between words within a sentence. Base words or stems constantly accompany inflectional affixes to designate semantic or syntactic relations between different words in a sentence without changing their meaning or syntactic category (Claravall, 2016; Kuo & Anderson, 2006; Singleton, 2000). Inflectional affixes predictably assign the lexical item's syntactic characteristics and contain numbers and grammatical components for nouns, persons, tenses, and numbers in verbs and comparative or superlative degrees of adjectives or adverbs. Inflectional affixes neither reproduce words nor attune the syntactic property of words to which they are attached (Claravall, 2016; Singleton, 2000; Sukying, 2022). For example, verbs in English may be indicated by inflectional morphemes for tense (e.g., *listen-ed, I listen, he listen-s*). Nouns may be inflectionally blotched for agreement with other words in the sentence by numbers (e.g., *one apple, two apples*). This inflected system suggests a close rule-based process in which the inflected form is freely added to vocabulary items to create novel word forms.

Derivational affixes in English can be attached either as a prefix (added at the beginning of base words) or as a suffix (added at the end of base words). Prefixes can affect the meaning of a word but cannot affect its syntactic property, such as the words *believable* and *un-believable*, which are both adjectives. Most suffixes can influence the syntactic category of a word, such as the words *speak* (verb) and *speak-er* (noun), with some exemptions (e.g., both *horror* and *horror-ism* are nouns). Derivational affixes are generally less productive and more restricting in how they can be mingled with certain lexical stems than inflectional morphemes. For example, the suffix *-able* can only be added to verbs (eat), not nouns, to form an adjective (eatable) in English (Kuo & Anderson, 2006). Compounding also combines two or more lexical stems or bases to form new words, such as *school-bus.* In brief, derivational affixes describe syntactic and semantic relations within a word and engender a vocabulary item in different forms and grammatical categories.

2.2 The Importance of Morphological Awareness in Vocabulary Acquisition and Growth

MA has long been regarded as a hands-on approach to the rapidity and depth of vocabulary acquisition (Anglin, 1993; Carlisle & Katz, 2006; Kieliszek, 2015; Kim, 2013; Laufer & Goldstein, 2004; Nation, 2013; Pacheco & Goodwin, 2013; Sasao & Webb, 2017; Sukying, 2017, 2020, 2022; Wei, 2015; Wei & Nation, 2013). MA is an awareness of, and access to, the meaning and structure of morphemes. Morphemes are language's smallest components of meaning (McBride-Chang et al., 2005). Carlisle (1995, p. 194) defines MA as "children's conscious awareness of the morphemic structure of words and their ability to recognize and manipulate that structure". Theoretically, this comprehensive description allows us to consider children's MA of derivations and inflections in language. This knowledge contributes to a better understanding of the meaning of unconscious words by parsing affixed words into smaller meaningful morphological segments in written and spoken form. MA also supports learners in inferring from a syntactic category of new words based on a derivational suffix or coining a novel suffixed word to meet the need

for language use (Kieliszek, 2015; Kim, 2013; Laufer, 2013, 2017; Nagy, Carlisle & Goodwin, 2014; Pacheco & Goodwin, 2013; Sukying, 2017; 2022). For example, adding *-ion* to a verb will mark a noun (*relate- relation*), while adding *-al* to a noun creates an adjective (*relation-relational*).

The contributions of MA to vocabulary knowledge can be described in various aspects of vocabulary knowledge, including form, meaning, and use. According to word form, MA mediates spelling and cracking words by recognizing and breaking them down into smaller lexical segments. MA helps learners manipulate and isolate known words more simply and swiftly (Sukying, 2017). MA also assists in word recognition via chunking (Nagy et al., 2014). For example, *investigating* can be read through morphemes (*investigate* + *-ing*). However, both native speakers and non-native advanced L2 learners have difficulty constructing morphologically complex words (Schmitt & Zimmerman, 2002).

MA can raise consciousness that words can be broken down into smaller affixed components (Carlisle & Katz, 2006; Nagy et al., 2014; Pacheco & Goodwin, 2013, Sukying, 2018a, 2020, 2022). This consciousness can be used to understand information about the connotations of whole words and other word family members. A word family consists of a base word and all its derived and inflected forms that learners can understand without learning each form separately (Bauer & Nation, 1993). So, *create*, *creates*, *created*, and *creating* may all be members of the same word family for a learner with a command of the inflectional suffixes of English. Additionally, the connotation of *unbelievable* can be inferred simply from the consciousness of the word *believe* when learners distinguish the relatedness between lexically affixed segments.

MA and vocabulary knowledge are diverse in the particular context of literacy learning. For instance, Carlisle (2000) revealed that MA in third- and fifth-grade children could be used to estimate reading comprehension. Another study of second graders also showed that MA uniquely predicted reading comprehension, although not in fourth-graders at risk for writing difficulties (Nagy, Berninger, Abbott, Vaughan & Vermeulen, 2003). Fowler and Liberman (1995) showed that second to fourth-grade students' word reading and MA tasks were interrelated, even controlling for age and vocabulary level. Carlisle and Nomanbhoy (1993) also demonstrated that morphological production measurement significantly forecast word reading in first-grade students when phonological knowledge was statistically controlled. In first graders, the measure of morphological production was significantly associated with second-grade word recognition and reading comprehension, including phonological awareness (Carlisle, 1995). More recent studies also showed the links between morphological knowledge and reading ability (Apel & Henbest, 2016; Mitchell & Brady, 2014; Nagy et al., 2014).

Previous research in the field of vocabulary knowledge has also claimed that MA is a predicative indicator of English vocabulary learning (Bae & Joshi, 2016; Carlisle, 2000; Kieffer & Lesaux, 2012; McBride-Chang et al., 2005; Sukying, 2017; Zhang & Koda, 2013). For instance, Carlisle (2000) proved that MA was a statistically significant predictor of third- and fifth-grade students' English vocabulary for monolingual English-speaking children. However, the MA contribution was higher for the fifth-grade students than for the third-grade students. For kindergarteners and second graders, the contribution of MA to increased knowledge of English vocabulary was positively associated with other predictors of reading, such as rapid number naming and word identification (McBride-Chang et al., 2005). Kieffer and Lesaux (2012) also showed that MA is a statistically significant predictor of L2 learners' English vocabulary (e.g., Spanish, Vietnamese, and Filipino learners). The contribution of MA to increased vocabulary knowledge has also been elucidated among Chinese learners of English (Zhang & Koda, 2013).

MA is also an effective predictor of vocabulary growth in languages other than English. A longitudinal study showed that Korean, Chinese, and Cantonese kindergarteners' compound MA at Time 1 anticipated their vocabulary progression at Time 2 when controlling for nonverbal reasoning, age, and phonological awareness (McBride-Chang, Tardif, Cho, Shu, Fletcher, Stokes, Wong, and Leung, 2008). The results suggested that a capability to practice MA in one language may influence vocabulary development in another language, which supports cross-language transference. For example, Pasquarella, Chen, Lam, Yang, and Ramirez (2011) showed that the bidirectional cross-language transfer of Chinese ESL learners' MA was significantly linked to their vocabulary knowledge. That is, the L2 learners' compound MA shifted to their Chinese vocabulary knowledge, and in turn, their Chinese vocabulary ability also shifted to their English compound MA. Additionally, Ramirez, Walton, and Roberts (2014) reported that Spanish learners' native (Spanish) derivational MA was positively transferred to their L2 (English) vocabulary.

In summary, MA may build vocabulary knowledge, and gains in vocabulary knowledge may strengthen MA. That is, there may be mutual relationships. As such, practical and feasible measurements are required to explore the developmental model of receptive-productive morphological knowledge. This cross-sectional study quantitatively examined Thai EFL primary school learners' morphological awareness along the receptive and productive continuum

of learning. It also explored MA acquisition in EFL primary school learners using Bauer and Nation's (1993) word family concept on word learning and expansion in a Thai EFL context. Specifically, the current study addressed the following research questions:

RQ1: What is Thai primary school students' morphological awareness as measured by receptive and productive knowledge tasks?

RQ2: What is the relationship between Thai primary school children's MA and vocabulary knowledge, both receptively and productively?

3. Methodology

3.1 Participants

One hundred and four primary school students participated in this study. All participants were Thai native speakers recruited using the convenience sampling technique. The participants were fourth to sixth graders from a primary school in northeast Thailand, and their ages ranged from 10 to 12 years old. None of the participants had studied in an English-speaking country. At the time of data collection, they had seven to nine years of experience learning English, which had been taught as a compulsory school subject for at least seven years. Participants were exposed to English from Kindergarten, including singing and dancing in English. From Year 1, explicit English teaching was introduced. Four 60-minute English lessons were scheduled weekly, including three 60-minute English sessions with EFL teachers and one 60-minute session with native English-speaking teachers.

3.2 Instruments

Participants completed six different receptive and productive morphological awareness tests, including the Receptive morphological awareness form test (RMFT), Receptive morphological awareness meaning test (RMMT), Receptive morphological awareness use test (RMUT), Productive morphological awareness form test (PMFT), Productive morphological awareness meaning test (PMMT), Productive morphological awareness use test (PMUT), and two different tasks of vocabulary knowledge: the Vocabulary size-Thai test (VSTT) and Vocabulary production test (VPT). The content validity of all tests was rated by five scholars (all items > 0.5). An examination of reliability was also checked on the test items on the MA tests, indicating a high degree of internal consistency with Cronbach Alpha coefficients of all tests of more than 0.8 (Mackey & Gass, 2005). These tests are described in detail below.

3.2.1 Receptive Morphological Awareness Tasks

The RMFT was constructed and developed based on Hayashi and Murphy (2011) to measure receptive knowledge of morphological awareness form. The RMFT aimed to assess both class-changing and class-maintaining derivational affixes and inflectional suffixes. The test consisted of verbs, nouns, adjectives, and adverbs. The lexical items were comprised of different numbers of affixes, depending on the internal morphological structure of the word. For example, *unhappy* has one prefix (*un- +happy*), while *unhappily* has two affixes (*un- + happy + -ly*). The morphemes were based on Bauer and Nation's (1993) word family criteria.

The RMMT was administered as an L2-to-L1 translation format to measure receptive knowledge of the meaning aspect (Nation, 1983, 1990, 2013; Nation & Beglar, 2007; Sasao & Webb, 2017). It was formatted as a multiple-choice test, and the test takers were presented with four Thai definitions and were asked to select the answer with the exact definition as a target affix, as shown below:

1. mis- (<u>mis</u>take; <u>mis</u>understand)

(1) ไม่ (2) ถูก

(3) สงบ (4) กีดกัน

2. fore- (<u>fore</u>see; <u>fore</u>go)

(1) หลัง (2) นาน

(3) ก่อน (4) เกิน

The RMUT was developed based on Sasao and Webb (2017) to measure receptive knowledge of the use aspect. It was formatted as a multiple-choice test, and the test takers were asked to choose the most appropriate grammatical function of the affix illustrated in the two example words. There was no context for each item, and a target affix was followed by two example words with the affix underlined for easy recognition. All items had a fixed set of options; Noun, Verb, Adjective, and Adverb.

3.2.2 Productive Morphological Awareness Tasks

The PMFT was designed and developed based on Ishii and Schmitt (2009) and Zhong (2014). It was formatted as a fill-in-the-table task and was used to measure productive knowledge of morphological form aspects. For example,

Target words	Noun	Verb	Adjective	Adverb

easy	ease	easy	easily

Test takers were asked to supply a correct derivation of a word with its part of speech, including noun, verb, adjective, and adverb. It also required test takers to consider whether a particular word class for the target word exists.

The PMMT was developed based on Laufer and Goldstein (2004) and Webb (2005, 2009). This test was a productive measure of word meaning and was intended to measure the ability to recall a word based on the form-meaning aspect. The PMMT was formatted as L1-to-L2 translation with one line for each prompt word as follows:

1.อย่างระมัดระวัง **C**arefully

2.พูด **S**peak

The instructions encouraged the test takers to recall the meaning of each prompt word. The test takers were provided with the Thai words and were required to source the definition of a word in English by following a provided initial letter.

The PMUT was developed based on Nation (2013) and Sukying (2017). This test was primarily used to measure productive knowledge of the grammatical functions. For each prompt word on the test, test takers were required to supply all appropriate affixes and provide a correct word for each blank.

1. They *danced* at the party yesterday. *dance*
2. She's *unhappy* because she lost her dog. *happy*
3. I'm *waiting* for a school bus here. *wait*

Thus, there was only one accurate omitted word, and the allowable affixes were classified depending on the target words. The participants' answers were verified against the total probable correct answers within a word family, based on the British National Corpus (BNC) word list (Nation, 2013).

3.2.3 Vocabulary Knowledge Tasks

The VSTT was developed based on Schmitt, Schmitt and Clapham (2001). This vocabulary test measured word meaning and was intended to measure the ability to recall a word based on the meaning. The test takers were asked to choose the right word to match each Thai meaning definition and then write the number of that word next to its meaning. An example is shown below:

1	pencil		
2	clock	____6_____	ส่วนของบ้าน
3	shoe	____5_____	สัตว์สี่ขา
4	business	____1_____	สิ่งที่ใช้ในการเขียน
5	horse		
6	wall		

The VPT was developed based on Laufer and Nation (1999). This test was primarily used to measure productive knowledge. A cloze test form was used, which included 18 sentences with a blank space. The test provided a sentence context or a definition with a clue of the initial letters of the target words and required test-takers to produce predetermined target words. For example, an item from the PVLT was: *He h___many good friends*, or *She tried to lis_____ to him carefully.*

3.3 Selecting the Target Affixes

Morphological awareness tests, which included inflected and derived forms, were designed for the current study based on Bauer and Nation's (1993) levels of a word family:

Level 2: Inflectional suffixes

Level 3: The most frequent and regular derivational affixes

Level 4: Frequent orthographically regular affixes

Level 5: Regular but infrequent affixes

Table 1 presents the 33 affixes, including six inflected and 27 derived forms, used in the current study. Levels 2 to 5 were used as these affixes reflect the learning order of English affixes (Sukying, 2020). Notably, Level 1 (each form is

a different word) was excluded because learners are likely to conceptualize different forms (e.g., *pen* and *pens*) to be morphologically related or members of the word family (Bauer & Nation, 1993).

Table 1. Summary of the affixes used in the current study

Level	Justifications	Affixes
2	Inflectional suffixes (6)	-s, -es, -ed, -ing, -er, -est
3	The most frequent and regular derivational affixes (8)	-able, -er, -less, -ness, -ly, -th, un-, non-
4	Frequent, orthographically regular affixes (7)	-al, -ess, -ful, -ist, -ous, -ment, in-
5	Regular but infrequent affixes (12)	-ally, -dom, -en, -en, -hood, -ian,-ship, mis-, mid-, inter-, sub-, un-

3.4 Selecting the Target Words

The selection of the target words for determining students' morphological knowledge depended on the classroom exposure and the frequency of occurrence, according to frequency-based word lists (BNC/COCA). Words were selected from school textbooks as these words were required for productive use, which encouraged learning opportunities and improved the deep learning of the target words from receptive to productive use. Specifically, the target words in this study were selected from 120 English commercial textbooks authorized in the 2020 Academic Year by the Bureau of Academic Affairs and Educational Standards, Ministry of Education (http://academic.obec.go.th/textbook) and used in primary schools in Thailand. Finally, the Range Program was used to compile the words. The first 1,000-word level target words were selected in the frequency of occurrence, and words occurring less than 100 times were excluded from the list.

3.5 Procedures

All eight tests were administered to 120 primary school students (fourth, fifth, and sixth-grade students). However, only 104 students completed all tests (87% completion rate). The measures of vocabulary knowledge, i.e., Vocabulary size-Thai test (VSTT) and Vocabulary Production Test (VPT), were administered in the first week and were completed on the same day for each participant. During the second week, participants were given the receptive and productive tasks of morphological awareness, including the Receptive morphological awareness form test (RMFT), Receptive morphological awareness meaning test (RMMT), Receptive morphological awareness use test (RMUT), Productive morphological awareness form test (PMFT), Productive morphological awareness meaning test (PMMT), and the Productive morphological awareness use test (PMUT). Again, each participant completed all tasks on the same day. The productive vocabulary knowledge task was presented first to minimize the possibility that participants might draw a connection between the receptive vocabulary knowledge test and their spelling on the productive test. Productive morphological knowledge tests were also administered before the receptive morphological knowledge tests to avoid any interference from the metalinguistics knowledge the participants might acquire from the written forms of the affixes that appeared on the productive tasks. A 20-minute break was given between the tests to alleviate the exhaustion of participants. The instructions, explanations, and examples of the tests were given to participants in their native Thai language.

3.6 Data Analysis

The raw test scores of all MA tasks were converted into a percentage. Both descriptive and inferential statistics were employed to analyze and interpret the data. A repeated-measures ANOVA was also performed to detect whether there were any significant differences between different grades. Additionally, a correlation analysis was conducted to examine the relationship between various MA tasks. Finally, multiple regression was used to determine the extent to which different MA tasks could explain receptive and productive vocabulary knowledge.

4. Results

4.1 Morphological Awareness in Thai Primary School Students

Descriptive statistics were run to determine whether the scores met the assumption of normal distribution. Descriptive statistics of minimum and maximum scores, mean, standard deviation, skewness, and kurtosis are presented in Table 2. The percentage of the total score was calculated by dividing the total score of each test by its mean.

Table 2. Descriptive statistics of overall performance on morphological awareness

Tests	Aspects	*N*	Mean	SD	Skewness	Kurtosis
RMFT	R	104	53.90	17.17	0.266	-0.304
RMMT	R	104	49.06	19.26	0.402	-0.563
RMUT	R	104	44.31	17.67	1.039	0.516
PMFT	P	104	30.54	9.24	0.829	0.246
PMMT	P	104	39.97	15.68	0.467	-0.318
PMUT	P	104	29.89	13.43	0.691	0.299

Notes: R = Receptive knowledge, P = Productive knowledge

Table 2 summarizes the descriptive statistics for the overall performance of Thai EFL participants on the six morphological awareness tests, i.e., RMFT, PMFT, RMMT, PMMT, RMUT and PMUT. The results indicated that participants achieved the highest mean performance of receptive knowledge (53.90%, *SD* = 17.17) on the RMFT task, followed by 49.06% on the RMMT task (*SD* = 19.26) and 44.31% on the RMUT task (*SD* = 17.67). Participants gained the highest score mean of productive knowledge on the PMMT (39.97%, *SD* = 15.68), followed by the PMFT (30.54 %, *SD* = 9.24) and the PMUT (29.89%, *SD* = 13.43). Skewness and kurtosis scores were within the statistical assumptions of normality of two standard deviations for the morphological knowledge tests combined. However, there was a higher frequency of students achieving a higher or lower score range than the normally distributed bell curve among these six tests.

The means and standard deviations for the morphological awareness scores are presented in Table 3. The total scores were converted into percentages to allow for comparisons across different educational levels. As illustrated in Table 3, the participants in grades 4, 5, and 6 achieved the highest scores on the RMFT, (*M* = 49.38%, *SD* = 16.55; *M* = 57.57%, *SD* = 15.79; *M* = 57.67%, *SD* = 18.14, respectively) and achieved the lowest scores on the PMUT (*M* = 27.33%, *SD* = 11.36; *M* = 26.14%, *SD* = 10.22; *M* = 37.27%, *SD* = 16.19, respectively). This indicates that young Thai EFL learners scored higher on receptive MA knowledge tests than on productive knowledge tests.

Table 3. Descriptive statistics of scores on morphological awareness

	Grade 4 (n = 47)		Grade 5 (n = 27)		Grade 6 (n = 30)	
MA tasks	Mean	SD	Mean	SD	Mean	SD
RMFT	49.38	16.55	57.57	15.79	57.67	18.14
RMMT	44.03	16.45	52.74	16.54	53.63	23.83
RMUT	40.29	12.03	46.01	16.40	49.09	24.19
PMFT	29.89	9.22	29.99	7.76	32.05	10.52
PMMT	36.16	15.30	37.03	13.35	48.58	15.32
PMUT	27.33	11.36	26.14	10.22	37.27	16.19

Note: N = 104

A reliability analysis was also conducted on the items in the MA tasks. High degrees of internal consistency across the items on these tasks were observed, as measured by the Cronbach Alpha coefficient, ranging from 0.890 to 0.940. The data from the MA tasks were then analyzed using a repeated-measures ANOVA on morphological awareness scores from the MA tests (RMFT, PMFT, RMMT, PMMT, RMUT and PMUT) and one between-subjects variable (Grades 4, 5, and 6). The participants' performance on MA tasks was found to be significant between the MA tasks. The results showed a main effect for Morphological Awareness ($F(3.838, 387.615) = 107.767$, $p < .001$), and a main effect for Education Level ($F(2, 101) = 4.243$, $p < .01$). Moreover, there was a significant Education Level x Morphological Awareness interaction ($F(7.676, 387.615) = 3.208$, $p < .01$). Figure 1 summarizes primary school participants' overall performance on MA tests.

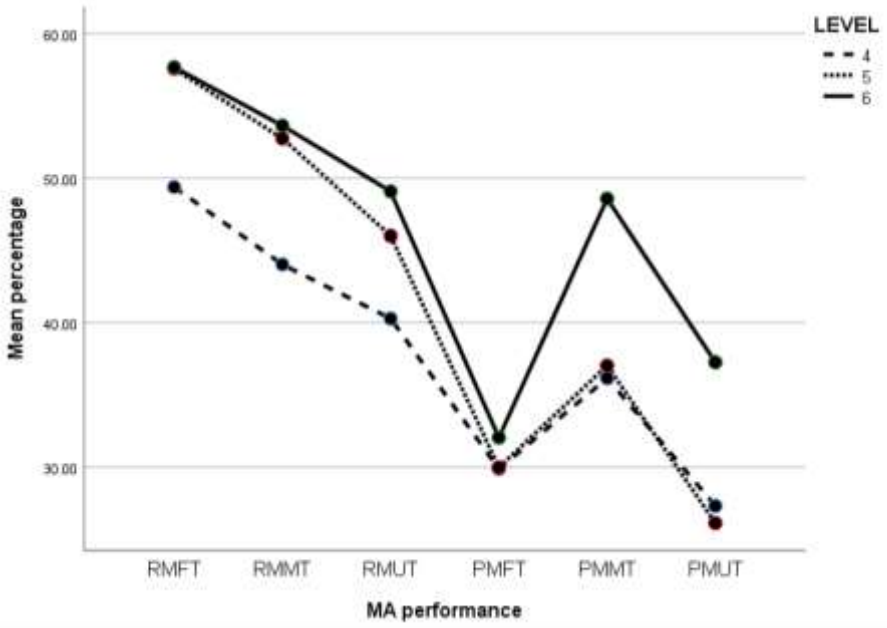

Figure 1. Mean percentage of correct responses on the morphological awareness tasks

Participants from three education levels showed significantly better receptive knowledge than productive morphological awareness. The participants achieved their highest receptive morphological knowledge scores on the RMFT test, followed by the RMMT and the RMUT test. Additionally, the participants achieved their highest productive morphological knowledge scores on the PMMT test, followed by the PMFT and PMUT tests. The findings suggest that the acquisition of morphological awareness follows a specific order. That is, the participants initially obtained receptive knowledge, including morphological awareness of form, meaning and use, and then productive knowledge of morphology, including meaning, form and use of morphological awareness. This is consistent with previous research (Schmitt & Meara, 1997; Sukying, 2017, 2018a, 2020). Another interesting point is that grade 6 students performed better than grade 5 students, who outperformed grade 4 students. This finding suggests that morphological awareness increases with education level.

4.2 Morphological Awareness in Relation to Vocabulary Knowledge in Thai Primary School Students

The means and standard deviations for the vocabulary knowledge scores are presented in Table 4. On the VSTT, participants in Grades 4, 5, and 6 scored 65.67% (*SD* = 22.53), 65.92% (*SD* = 19.96), and 71.44% (*SD* = 11.19), respectively, and on the VPT, they scored 45.74% (*SD* = 16.97), 55.18% (*SD* = 17.18), and 53.83% (*SD* = 15.18), respectively. This indicates that Thai EFL students scored higher on receptive MA knowledge tests than productive MA knowledge tests.

Table 4. Descriptive statistics of overall performance on vocabulary knowledge

	Grade 4 (n = 47)		Grade 5 (n = 27)		Grade 6 (n = 30)	
Tasks	Mean	SD	Mean	SD	Mean	SD
VSTT	65.67	22.53	65.92	19.96	71.44	11.19
VPT	45.74	16.97	55.18	17.18	53.83	15.18

Note: N = 104

Pearson correlations were also calculated to explore the relationship between the participants' MA and receptive and productive knowledge vocabulary. The strength of the relationships was based on Cohen's (1988) guidelines. The results of the correlational analysis on all aspects of morphological and vocabulary knowledge are shown in Table 5. The receptive and productive MA and vocabulary knowledge positively correlate with each other. The correlations between MA and vocabulary knowledge among grade 4 participants ranged from 0.49 to 0.97, indicating moderate to large relationships (Cohen, 1988), from 0.24 to 0.99 for grade 5 participants, suggesting moderate to large associations, and from 0.17 to 0.92 for grade 6 students, indicating small to large links. All correlation coefficients between morphological knowledge and vocabulary knowledge were positive and statistically significant, in line with the results from the previous studies (Danilović et al., 2013; Hayashi & Murphy, 2011; Mochizuki & Aizawa, 2000; Sukying, 2018a, 2022).

Table 5. Correlations between vocabulary knowledge and morphological awareness

Level	Tests	RMFT	RMMT	RMUT	PMFT	PMMT	PMUT
Grade 4	VSTT	.77	.86	.87	.49	.97	.70
	VPT	.74	.70	.75	.82	.72	.84
Grade 5	VSTT	.28	.56	.24	.61	.68	.37
	VPT	.56	.99	.36	.87	.80	.72
Grade 6	VSTT	.42	.17	.92	.52	.59	.66
	VPT	.78	.67	.72	.49	.47	.25

Notes: $p < 0.01$ level (two-tailed)

The extent to which receptive and productive MA could account for receptive and productive vocabulary knowledge was also investigated using multiple regressions. As shown in Tables 6-8, the six measures of morphological knowledge accounted for 3.70% of the variance in receptive vocabulary knowledge and 3.20% of the variance in productive vocabulary knowledge for participants in grade 4 (see Table 6). Additionally, the six MA measures explained 19.8% of the variance in productive vocabulary knowledge and 13.3% in receptive vocabulary knowledge for grade 5 students (see Table 7). Table 8 illustrates the predictive explanation of the variance of MA in vocabulary knowledge. The morphological knowledge predictors explained 33.7% of the variance in grade 6 students' receptive vocabulary knowledge and 11.2% of the variance in productive vocabulary knowledge. According to these findings, vocabulary knowledge at all levels of education is likely insufficient for dealing with morphologically complicated terms in L2 acquisition. Moreover, the correlational results indicate that the larger the vocabulary knowledge, the stronger the relationship between morphological awareness and vocabulary knowledge.

Table 6. Regression analyses explaining vocabulary knowledge

Grade 4	*β*	*t-value*	R^2
Predicting receptive VK			.032***
RMFT	-.10	-.26	
RMMT	-.12	-.30	
RMUT	.09	.20	
PMFT	-.58	-.87	
PMMT	-.14	-.39	
PMUT	.01	.02	
Predicting productive VK			.037***
RMFT	.00	.01	
RMMT	-.27	-.65	
RMUT	.38	.86	
PMFT	.49	.74	
PMMT	-.16	-.43	
PMUT	-.23	-.41	

Notes: $F(6, 46) = 47.194$, $p < .001$ for receptive VK; $F(6, 46) = 35.374$, $p < .001$ for productive VK.

***$p < .001$ (two-tailed); VK = vocabulary knowledge

Table 7. Regression analyses explaining vocabulary knowledge

Grade 5	*β*	*t-value*	R^2
Predicting receptive VK			.133***
RMFT	.46	1.11	
RMMT	-.42	-.99	
RMUT	.35	.97	
PMFT	-.38	-.46	
PMMT	-.24	-.54	
PMUT	.34	.57	
Predicting productive VK			.198***
RMFT	.53	1.31	
RMMT	-.59	-1.42	
RMUT	.54	1.54	
PMFT	-.60	-.75	
PMMT	-.38	-.87	
PMUT	.32	.55	

Notes: $F(6, 26) = 66.474$, $p < .001$ for receptive VK; $F(6, 26) = 49.003$, $p < .001$ for productive VK.

***$p < .001$ (two-tailed); VK = vocabulary knowledge

Table 8. Regression analyses explaining vocabulary knowledge

Grade 6	*β*	*t-value*	R^2
Predicting receptive VK			.337***
RMFT	.01	.05	
RMMT	-.19	-1.11	
RMUT	.00	-.00	
PMFT	.00	.01	
PMMT	.15	.58	
PMUT	.21	.97	
Predicting productive VK			.112***
RMFT	-.06	-.29	
RMMT	-.28	-2.04	
RMUT	.19	1.14	
PMFT	-.28	-.99	
PMMT	-.16	-.72	
PMUT	.18	.97	

Notes: $F(6, 29) = 29.691$, $p < .001$ for receptive VK; $F(6, 29) = 26.426$, $p < .001$ for productive VK.

***$p < .001$ (two-tailed); VK = vocabulary knowledge

Overall, the current findings show that knowledge of morphology among Thai primary school students increases with their education levels. Specifically, grade 4 students tended to achieve the lowest performance on MA measures, whereas grade 6 participants performed the best on the same MA tasks. Furthermore, the current study also indicates that primary school students develop their MA according to the receptive and productive continuum of learning. The result indicates that, like vocabulary, study participants acquire some aspects of MA before others and gradually develop such knowledge with increased learning experiences.

5. Discussion

The receptive and productive morphological awareness measures (RMFT, PMFT, RMMT, PMMT, RMUT and PMUT) were developed based on the conceptual framework of word families (Bauer & Nation, 1993) and the vocabulary knowledge tests (VSTT and VPT) were adapted from existing tests. The results from these tests show that test performance is significantly related and that all tests are reliable tools for assessing morphological and vocabulary knowledge.

Concerning morphological awareness in Thai EFL young learners, the current findings show that, like vocabulary knowledge, Thai EFL students have a receptive and productive continuum of morphological awareness. A hierarchical order of morphology learning was also revealed among these learners. For instance, on receptive MA tasks, Thai EFL primary school learners from all three education levels achieved higher scores on receptive MA than productive MA. These findings are consistent with the claims of previous studies that the development of the L2 mental lexicon is complex and incremental (Hayashi & Murphy, 2011; Sukying, 2018a, 2022). The results also suggest that the acquisition of morphological awareness follows a specific order; that is, participants progressed from receptive knowledge, in which they gained some morphological awareness of form and meaning links, to productive morphological knowledge, in which they acquired meaning, form, and use of morphological awareness.

From a lexical perspective, the recognition of individual vocabulary items may represent an initial stage in MA processing in which the knowledge is not fully acquired for retrieval and, therefore, the word cannot be produced in context. The productive use of MA, as measured by PMFT, PMMT and PMUT, may impose heavier cognitive processing on primary school students than the ability to recognize some aspects of MA, as measured by RMFT, RMMT and RMUT. This acquisition pattern of different MA aspects indicates that receptive knowledge of MA enhances productive use of morphological lexicons, which continue to grow gradually throughout primary school education in a Thai context. Together, the results from the current study support previous studies showing that, like vocabulary knowledge, MA consists of multidimensional aspects that grow incrementally following increased learning experience and exposure (Bubchaiya & Sukying, 2022; Claravall 2016; Laufer 2017; Nation 2013; Stauffer 1942; Sukying, 2017, 2018a, 2018b, 2020, 2022; Sasao & Webb, 2017).

The results also revealed positive relationships between MA and vocabulary knowledge, both receptively and productively. The correlations between different MA aspects and receptive and productive vocabulary knowledge in Thai primary school children also grow as their education levels and vocabulary knowledge performance increase. These findings support the conceptualized framework of vocabulary knowledge as an incremental construct (Henriksen, 1999; Nation, 2013; Schmitt, 2010). In addition, the overall knowledge of MA could account for a wide range of the variance in receptive and productive vocabulary knowledge (up to 33%). While this is lower than what

has previously been observed (Sukying, 2017), the current study nonetheless demonstrates that morphological lexicons, namely affixes, are essential elements of complex words that allow students to relate an established form of a word to other unknown forms within the word family.

Overall, the correlational analysis revealed a positive relationship between MA and vocabulary knowledge, both receptively and productively. The current result aligns with previous studies (Bubchaiya & Sukying, 2022; Danilović et al., 2013; Mochizuki & Aizawa, 2000; Sukying, 2017, 2018a, 2018b, 2020, 2022), but it contrasts with that of Hayashi and Murphy (2011) who found that only productive knowledge of MA positively correlated with receptive vocabulary knowledge. These contrasting results may be due to the different tests of MA that were used in each study. Indeed, the primary purpose of the receptive knowledge task used in Hayashi and Murphy's (2011) study was to parse a complex word into smaller parts. In contrast, the test used in this study measures the participant's ability to recognize the form, meaning and use of morphologically complex words. The current findings suggest that the relationship between different aspects of MA and receptive and productive vocabulary knowledge in Thai EFL participants grows as their vocabulary knowledge and education level increase.

The regression analysis of the current findings also demonstrated that, for grade 4 students, MA accounted for 3.70% of the variance in receptive vocabulary knowledge and 3.20% of the variance in productive vocabulary knowledge. For grade 5 students, the six MA measures explained 19.8% of the variance in productive vocabulary but only 13.3% of the variance in receptive vocabulary knowledge. Finally, for grade 6 participants, the predictors of morphological knowledge explained 11.2% of the variance in productive vocabulary knowledge and 33.7% in receptive vocabulary knowledge. These findings indicate that receptive and productive knowledge of morphology is an essential foundation of vocabulary knowledge. That is, MA is a facilitative mechanism for the pace and depth of vocabulary knowledge. Lower-grade students' MA may be at a developmental stage where they have not fully mastered receptive MA for productive use in different contexts (Hayashi & Murphy, 2011; Sukying, 2017, 2018a, 2022).

In conclusion, the current study demonstrates that, in Thai primary school students, all aspects of MA have an influence on the development of receptive and productive vocabulary knowledge, and morphological awareness develops with higher education levels. These findings demonstrate the simultaneous acquisition and development of MA and receptive and productive vocabulary knowledge among Thai primary school students.

6. Conclusion

The present study revealed the close relationship between Thai EFL primary school learners' morphological awareness and vocabulary knowledge, both receptively and productively. The results also showed that recognition of receptive MA aspects is a preliminary stage of vocabulary learning, which enhances productive use of morphological awareness. Specifically, the study indicated that Thai primary school students' morphological awareness grows gradually along the receptive and productive continuum and that morphological knowledge is learned at varying rates and develops with the learners' education levels. The results of the current study also indicate that the concept of word family is essential for teaching and learning morphologically complex words. Morphological awareness is a critical mechanism for vocabulary acquisition and growth, and it is a facilitative scaffold for forming morphologically complex words. However, longitudinal research is required to examine the distinct aspects of morphological knowledge requirements in L2 learners at different education levels. More importantly, a deductive research approach is also required due to the progressive vocabulary acquisition that occurs across developmental stages. Indeed, the same group of learners must be studied over time to track their developmental path of vocabulary knowledge. Further investigations would also benefit from a greater focus on understanding the relationship between external variables and the development of internal vocabulary knowledge. Such research would have significant pedagogical, theoretical, and empirical implications. Indeed, measuring receptive and productive vocabulary knowledge is critical for identifying potential barriers to vocabulary acquisition and developing remedial vocabulary learning strategies. More research into these aspects of vocabulary knowledge in L2 learners is still needed, including research on the interrelationships between different aspects of vocabulary knowledge.

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