Multiple Aspects of Word Knowledge in Thai EFL Students: The Hierarchical Acquisition and Relationships

Worakrit Nontasee [a]
n.worakrit@gmail.com
English Language Teaching (ELT) Programme,
Faculty of Humanities and Social Sciences,
Mahasarakham University, Maha Sarakham, Thailand

Apisak Sukying
apisak.s@msu.ac.th
Department of Western Languages and Linguistics,
Faculty of Humanities and Social Sciences,
Mahasarakham University, Maha Sarakham, Thailand

ABSTRACT

This research explored the nature of the word knowledge construct by analyzing the hierarchical difficulty in acquiring different word knowledge aspects and their relationships. The research examined Nation's (2013) framework, which is the most widely accepted conceptualization of what is involved in knowing a word. Therefore, this article presents the hypothesized concept of knowing a word as a multi-aspect construct. A battery test of word knowledge aspects was administered to 500 senior high school participants who were English as a Foreign Language (EFL) students in Thailand. The results showed that the receptive knowledge test of an aspect showed higher scores than its productive knowledge test. There was also a positive correlation between knowledge of the different aspects. Besides, an analysis of Implicational Scaling (IS) illustrated a valid implicational pattern of word knowledge aspects and found that productive knowledge could be known without complete mastery of all aspects of receptive knowledge. Finally, a Structural Equation Modeling (SEM) analysis demonstrated the benefit of the various word knowledge aspects to acquiring word knowledge. Overall, the current research corroborates previous evidence for the vocabulary acquisition pattern and the conceptualization of word knowledge and provides empirical evidence in a Thai EFL context. It also implies that word knowledge is acquired along a developmental learning continuum.

Keywords: Word acquisition; Word knowledge; Word aspects; Receptive word knowledge; Productive word knowledge

INTRODUCTION

Word knowledge is a multi-aspect construct acquired through an incremental learning process (González-Fernández & Schmitt, 2020; Henriksen, 1999; Milton & Fitzpatrick, 2014; Nation, 2013; Schmitt, 2014; Sukying & Nontasee, 2022). It is precisely known that the various aspects of word knowledge are related to one another, but they may not be known simultaneously. Indeed, it implies that these aspects are continually known at varying rates, which the receptive-productive foundation regulates (e.g., Chen & Truscott, 2010; Laufer & Goldstein, 2004; Nontasee & Sukying, 2020, 2021; Schmitt & Meara, 1997; Zhong, 2018). The precise stages of the word

---

[a] *Main & corresponding author*

acquisition process are still unknown clearly, particularly in terms of the various developmental rates for word aspects (e.g., Chui, 2006; Li & Kirby, 2015; Milton & Hopkins, 2006; Pellicer-Sanchez & Schmitt, 2010; Schmitt, 2008; Schmitt & Zimmerman, 2002; Webb, 2005). Various aspects of word knowledge in development have been fragmentarily investigated and have inconsistent results (Nation, 2013; Schmitt, 1995), but studies that examine word knowledge as a whole construct remain rare. However, the multi-aspect conceptualization of word knowledge and how different word aspects are acquired and fit together was basically demonstrated (González-Fernández, 2022; González-Fernández & Schmitt, 2020). Noticeably, it still requires to be proven in a Thai English as a Foreign Language (henceforth, EFL) context. This research thus aims to gain deeper insight into the rich, multifaceted nature of word knowledge by investigating the word knowledge construct as a multi-aspect framework. The current research first measures different word aspects: (1) written form, (2) word part, (3) form-meaning link, (4) association, (5) grammatical function, and (6) collocation at both reception and production. The research also examines the acquisition hierarchy of these aspects and models the relationships between the various word aspects. This research will advance our comprehension of the role of different word aspects and the nature of the word knowledge construct. Also, it will posit the conceptualization of word aspects as the primary hierarchical acquisition configuration and their relationships in EFL students in Thailand.

CONSTRUCT OF WORD KNOWLEDGE

Word knowledge is conceptualized as a multi-aspect construct. Nation (2013) proposed a comprehensive word knowledge framework with 18 sub-knowledge aspects within the receptive-productive distinction, as shown in Figure 1. This framework represents a construct of knowing a word as a taxonomy, starting with the reception of knowledge and ending with its production in the context correctly. Nation also notes that native (henceforth, L1) speakers and second language (henceforth, L2) students necessitate knowing multiple aspects to master their word knowledge.
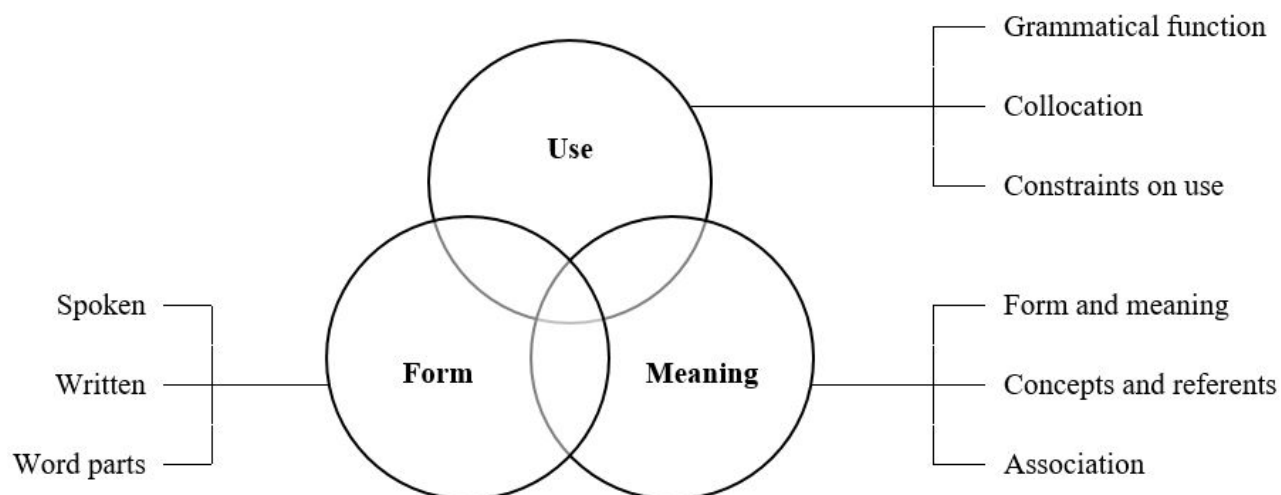

FIGURE 1. Aspects of word knowledge (Nation, 2013)

Nation has proposed three main aspects. First, *form knowledge* incorporates the ability to identify the phonological and morphological features in both written and spoken modes. Second, *meaning knowledge* involves insight into the form and meaning link, conceptual referent, and word association. Finally, *use knowledge* defines the places where each word can be used, such as collocation, grammatical function, and constraints on use.

In addition to this, each aspect is divided into receptive and productive knowledge. While receptive knowledge is known as word comprehension and recognition, productive knowledge is word recall and use. The reception of word knowledge is first acquired and added to production (e.g., Hayashi & Murphy, 2011; Sukying, 2020; Zhong, 2018). Both aspects, however, can be defined differently based on the specific purpose (Read, 2000). Receptive word knowledge in this research specifies the capability to recognize and know a word, at least to some extent. Productive word knowledge mentions to the capacity to recall and retrieve a word and use it in context.

Although Nation's list presents the most inclusive explanation of word knowledge to date and the detailed entirety of what students must know, it is unspecified how different word aspects are acquired and fit together. More recently, some previous studies exposed significant evidence for a multi-aspect conceptualization of word knowledge and the hierarchy of acquisition of these aspects (González-Fernández, 2022; González-Fernández & Schmitt, 2020). However, it is required to experimentally replicate and verify how various aspects relate to one another and how they should be prioritized in acquisition in a particularly Thai EFL context.

RESEARCH ON MULTI-ASPECT OF WORD KNOWLEDGE

Studies in vocabulary acquisition have provided a vibrant description of work knowledge as a multi-aspect construct. They provide empirical evidence that word knowledge is commonly known as an incremental learning process (e.g., Schmitt & Meara, 1997; Sukying & Nontasee, 2022; Webb, 2020), and all word aspects fall along a continuum rather than being known or unknown (Henriksen, 1999). Specifically, all aspects are found to be interrelated but acquired at different rates (Jeensuk & Sukying, 2021; Laufer & Goldstein, 2004; Nontasee & Sukying, 2021; Peters, 2016; Sridhanyarat, 2018; Tannenbaum, Torgesen, & Wagner, 2006). It is unclear, based on fragmentary explorations and inconsistent results, about the hierarchy of the aspects to be acquired and whether it can be generalizable to other L2 or EFL learner populations. Together, knowing various word aspects benefits vocabulary acquisition and development (Lin, 2015; Sukying, 2022; Zhong, 2018); for example, learners can easily understand and use a word if they are capable of various knowledge aspects. Word aspects develop more or less in an equivalent manner (González-Fernández & Schmitt, 2020). Furthermore, exposure to the English language influences word knowledge development and probably requires explicit instruction (Bubchaiya & Sukying, 2022; Magnussen & Sukying, 2021; Sukying, 2020; Teng, 2016; Webb, 2005, 2020; Yowaboot & Sukying, 2022).

Researchers have argued that word knowledge is an incrementally multi-aspect learning process. Schmitt and Meara (1997) first studied how word association and grammatical suffix knowledge change over time, both receptively and productively, in high school and Japanese university students and specified that word association and suffix knowledge were related to each other at both reception and production. Later, Laufer and Goldstein (2004) studied the sequential progress from the reception to the production of form and meaning of word knowledge and suggested that the production of word knowledge was likely more difficult than the reception of word knowledge. Yet, the relationship between form and meaning knowledge remains uncertain.

Relatedly, Chui (2006) investigated four knowledge aspects, namely, word-class reception, meaning recall, collocation reception, and derivative form production, in EFL students; it was found that word-class reception and meaning production were well known and, therefore, might be known earlier than the productive derivative form or receptive collocation. The results suggested that some aspects of productive knowledge could be known before some aspects of receptive knowledge, meaning that students were not required to master all aspects of receptive knowledge to obtain productive knowledge.

A plethora of studies has focused on the relationship between receptive and productive mastery of word knowledge (Sukying, 2017, 2018a, 2018b; Nontasee & Sukying, 2021; Zhong, 2018). For instance, Zhong (2018) examined the interface between receptive and productive knowledge in a multi-aspect framework in EFL Spanish junior high school students by assessing the relationship between multiple receptive aspects (form, meaning, word class, association, and collocation) and productive word use in sentence writing and demonstrated the positive influence of each receptive aspect on productive word use in context. Likewise, Lin (2015) explored the relationships between multi-aspect with a particular focus on word form (morphology and orthography) and unveiled that multiple related aspects, both receptively and productively, influence word acquisition. As demonstrated, learners can receptively and productively acquire a word if they possess various aspects. They cannot use a single lexical processing approach, either top-down or bottom-up, when learning a new word because more extensive word knowledge across multiple learning modes benefits overall vocabulary development than a single learning mode alone. Furthermore, Sukying (2020) investigated word knowledge through morphological awareness instruction in Thai EFL university students and suggested that deliberating instructional methods helped students harness their word knowledge more successfully. Together, these prior studies point out that word knowledge is developed over exposure to multiple related aspects, raises questions about the impact of English word knowledge on vocabulary acquisition, and has pedagogical inferences for language classrooms.

Literature on vocabulary research has also shown the nature of word learnability, indicating that words are acquired at varying stages and involve the receptive-productive knowledge process (e.g., González-Fernández & Schmitt, 2020; Sukying & Nontasee, 2022). Nontasee and Sukying (2020, 2021), for example, explored the word knowledge acquisition within different word aspects, which were the reception and production of word part, form-meaning link, and collocation, in Thai students and unveiled a positive relationship between word aspects. Specifically, it was shown that students first acquire word part, followed by form-meaning link and, finally, collocation. Receptive knowledge of an aspect is also acquired before its productive knowledge. More recently, Sukying and Nontasee (2022) investigated the hierarchical acquisition of word aspects in different-grade students and found a valid implication acquisition pattern. Yet, the different grades showed different patterns. These previous studies reveal the progression of word knowledge as an incremental learning pattern. Still, the results are inconsistent and uncertain acquisition patterns of multiple related aspects and require sophisticated analyses to detect and statistically prove valid findings. It indeed requires more research to further investigate the multi-aspect nature of word knowledge to theorize a precise acquisition pattern.

Similarly, González-Fernández and Schmitt (2020) studied the nature of the word knowledge construct within the various aspects [form–meaning link, derivative, multiple-meaning, and collocation (reception and production)] in Spanish EFL students and clarified that the reception and production of word knowledge are independent aspects. A process of receptive-productive knowledge is essential to build on the conceptualization of vocabulary development.

Yet, González-Fernández and Schmitt first address the valid acquisition pattern of the various word aspects, indicating that form-meaning link recognition is the easiest, followed by collocate form recognition, multiple-meaning recognition, derivative form recognition, collocate form recall, form-meaning link recall, derivative form recall, and at least, multiple-meaning recall. It remains some other aspects that seem to be known initially, i.e., written form and grammatical function, and some other L2 or EFL contexts that require to be explored. However, they employed valid methodology to prove the data and illustrated a primarily hierarchical relationship of word aspects. As González-Fernández and Schmitt studied the nature of word knowledge as a holistic construct and revealed clearly valuable details, this research, therefore, grasps their study as a base and aims to extend and build on their hypothesized model and findings to add value in the domain of word knowledge acquisition by exploring a different L1 group and assessing different types of word knowledge with different tests. More recently, González-Fernández (2022) further investigated the nature of L2 word knowledge by examining the hypothesis of how various word aspects fit together across different groups of L1 background learners and found that the unidimensional model was consistent across the two groups of different L1 backgrounds. These findings offer the unidimensionality of L2 word knowledge, which highlights the need for further refinement of the conceptualization of the construct. Therefore, this research replicates and extends the conceptualization of word knowledge as a multi-aspect, particularly in a Thai EFL context.

While vocabulary researchers have argued for the growth process of word knowledge, there is limited evidence to illustrate the hierarchy of the acquisition of word aspects or identify the nature of their relationships. It requires more evidence to replicate in different other contexts, particularly a Thai EFL context. Indeed, a precise reason for the absence of a general theory and pattern of word knowledge is that there is rarely an exploration of the entire vocabulary construct, and is unspecified any hierarchical conceptualization of the multiple interrelated aspects in Thailand. Plus, a large restriction in the existing literature is rarely sophisticated analysis used to examine its concepts (e.g., Nontasee & Sukying, 2021). A general theory of the acquisition and development of word knowledge is yet to be developed. More particularly, this research is premeditated based on prior findings of multi-aspect word knowledge studies (i.e., González-Fernández, 2022; González-Fernández & Schmitt, 2020; Sukying & Nontasee, 2022) to prove the hypothesized concept of word knowledge in a Thai EFL context.

This research thus intends to explore the construct of word knowledge as a multi-aspect framework based on Nation's (2013) description [written form, word part, form-meaning link, association, collocation, and grammatical function (both reception and production)]. The research aims to measure different word aspects, examine these aspects' hierarchical difficulty in acquiring, and then model the relationships between various word aspects. The following research questions were formed to guide the research:

1. Is there a hierarchical difficulty in acquiring different word knowledge aspects among Thai EFL high school students?
2. What is the prediction model of the various word aspects to acquire a word among Thai EFL high school students?

METHOD

PARTICIPANTS

This research included 500 senior high school students. The participants were high school students comprising the tenth-grade (*n* = 165), eleventh-grade (*n* = 198), and twelfth-grade (*n* = 137) students, ranging in age from 16 to 18 years old (*M* = 16.94, *SD* = 0.78). They were all Thai native speakers using L1 to converse in daily life and studied English lessons as EFL for about ten years of systematic schooling at local high schools under a well-established government university administration in northeastern Thailand. None had studied in an English-speaking nation. Their English language abilities ranged from advanced beginner to upper-intermediate. Senior high school students have been exposed to high-frequency words, based on the Basic Education Curriculum B.E. 2544 (A.D. 2001) and B.E. 2551 (A.D. 2008) in Thailand, and their English proficiency is considered at the B1 or B2 level based on the Common European Framework of Reference for Languages (CEFR) in Thailand (The Ministry of Education in Thailand, 2008).

WORD SELECTION

The New General Service List (NGSL), according to Browne, Culligan, and Phillips (2013), and the New Academic Word List (NAWL) by Coxhead (2012) were used to choose the target word. The NGSL comprises English's most important high-frequency words, giving over 90% coverage of the meanings that students probably need to communicate. The NAWL is crucial for students preparing for academic study to use English vocabulary more successfully. At the end of high school and the start of university studies, L2 students know roughly 2,000-4,000 word families (Laufer, 2010), and they need to know 86% of high-frequency words and 10% of academic words to further study at a higher level (Hayashi & Murphy, 2011; Sukying, 2020). Based on the Thai Ministry of Education, senior high school students would have learned 2000 most frequent and academic words in English classrooms by the time they graduate from high school. Nation (2013) also prescribes the frequency principle that the words of assessment need to be relevant to the student's current vocabulary knowledge. Therefore, the target words should be familiar to the students.

The frequency of the target words was first cross-checked to an international standard using the CEFR at B1 and B2 levels. The Meaning Comprehension Test, developed based on Wesche and Paribakht (1996), which contained the target words as a five-point Likert scale, was further conducted with 126 senior high school students excluding the main study and then used to verify the appropriateness of the target words in the research context. An additional point in the current research was that the words should be neutral in terms of difficulty, neither the easiest nor the most difficult for assessment (Bruton, 2009). Unknown and well-known words were detached based on participants' scores. The item reached a mean extent of 40% and 60%. Moreover, the item difficulty and discrimination were rated as moderate, ranging from 0.3 to 0.7 (Hopkins & Antes, 1990). The neutral words were used for assessment. This directed to a final list of 30 target words for the twelve tests (19 from the NGSL and 11 from the NAWL) (see Figure 2). Consequently, a final list of target words for the twelve tests was regarded as appropriate to assess senior high school students' word knowledge in the research setting, and all of the items were flexed to the types of word knowledge aspects. To be noted, all target words were verb-form bases because they can be derived into other forms of a word.

30 target words					
NGSL (19 items) CEFR B2	increase relate satisfy threaten	determine prevent admire argue	desire approve disturb advertise	employ aim profit combine	permit divide frighten
NAWL (11 items) CEFR B1	occur concentrate publish	require aware	appropriate adjust	participate consult	purchase transfer

FIGURE 2. A list of the target words

MEASURES

Twelve tests were used to measure the participants' receptive and productive word knowledge. An examination of reliability indicates the acceptance of the word tests (all Cronbach's α values ≥ 0.8) based on Dörnyei's (2007) implication. Five experts rated the validity of the content; all items scored > 0.5, which was acceptable based on Lynn's (1986) suggestion. The discrimination and difficulty were assessed as moderate in all items, ranging from 0.3 to 0.7 based on Hopkins and Antes's (1990) proposition. Each test comprised 30 items. The length of each test of receptive knowledge was 15 minutes, and 20 minutes were allotted for each test of productive knowledge. The tests of productive knowledge, which necessitated more demanding knowledge strategies, were allocated more time than the tests of receptive knowledge (Hayashi & Murphy, 2011). All instructions for each test were presented to the participants in the English language and also explained by the researcher in their L1.

Six tests were employed to assess students' receptive knowledge of word aspects. The Form Recognition Test (FRT), applied based on Webb's (2005) form recognition task, was used to assess spelling knowledge (written form) in reception. The format version of the FRT was validated by producing a reliability of 0.85 on Cronbach's Alpha for internal consistency. Participants needed to select the word spelled correctly from three distractors. Each item had one correct form of the word and three pseudo-words. The distractors were formed both phonetically and orthographically to the target words. An accurate choice was made by discriminating between correct and incorrect forms. Each correct answer was awarded one point, while a blank or incorrect answer was awarded none. An extract from this test is given below (Instructions: Please select the word that is spelled correctly).

A. Approval
B. Aproval
C. Appoval
D. Approvor

The Word Recognition Test (WRT), modified based on Ishii and Schmitt's (2009) morphology task and presented as a fill-in-the-table task, was employed to assess word part knowledge (word class) in reception. Its validation produced high reliability of 0.93. The test encourages participants to recognize the different categories of the word. Each target word was

given to be matched with its part of speech (i.e., noun, verb, adjective, and adverb). The test consisted of 11 nouns, eight verbs, eight adjectives, and three adverbs. A varied number of items in each category of the target words were used to avoid any guesses. Its limitation was that the completion of adverbs was highly linked to knowledge of adjectives because students who knew the correct form of the adjective might also know its adverb form. One correct answer was provided one point, and an incorrect or no answer gave no point. An extract is given below(Instructions: Please fill in the given word in the correct part of speech, noun, verb, adjective, and adverb).

The target words:

| increasingly | employer | undivided | approve |
| satisfy | appropriately | | |

Noun	Verb	Adjective	Adverb

The L2 Translation Test (L2TT) was improved based on the translation task (Laufer & Goldstein, 2004; Webb, 2005). It was designed as an L2-to-L1 translation to assess the form-meaning link in reception. Its reliability was 0.80. The English words highlighted in the sentences were given to be translated into Thai. The sentence delivered the context of the word to prevent a mix-up of the target meaning. A correct word definition was worth one point, while no response or incorrect response, such as a false form-meaning match definition, was worth none. An extract of the L2TT is provided below (Instructions: Please translate the bolded word from English to Thai).

His parents now **approve** of his marriage. = _____

The Association Recognition Test (ART) was adapted based on Zhong's (2018) Word Associates Test (WAT) and was used to assess association in reception. Its reliability was 0.87. Participants were asked to select the synonym of the target word. Each item contained four words, including one associate synonym and three distracters. Participants were asked to recognize the synonym of the word. All of the words in each set of distractors were offered in the same part of speech to prevent any suggestions on the association of the word category. Each correct synonym response received one point, while an incorrect or no response received no points. An excerpt from the ART is given below (Instructions: Please select a word that has a similar meaning to the target word).

Word: Approve

A. Resist	B. Accept	C. Insult	D. Raise

The Grammatical Recognition Test (GRT) was advanced based on Webb's (2005) receptive grammatical functions task and was formatted in a multiple-choice format. Its reliability was 0.93. The test was used to assess grammatical function in reception. Participants needed to choose one correct sentence (among three alternatives containing the target word). This test

influences the recognition of the word's grammatical accuracy in the context. This test independently measured systematic knowledge, i.e., subject-verb agreement, passive use, and word-part accuracy. Each choice contained a sentence that was likely to be relatively complex and needed grammatical knowledge strategies. Each correct response received one point, while an incorrect or no response received none. An excerpt is given below (Instructions: Please select the grammatically correct sentence).

A. She doesn't approval of cosmetic surgery.
B. He isn't approve of alcohol.
C. This project will be approved by Thursday.

The Collocation Recognition Test (CRT) was modified based on the receptive collocation test (Nontasee & Sukying, 2021) and produced a reliability of 0.85. The CRT was offered as a receptive measure of collocation, with a particular emphasis on adjective-noun collocations. Adjective-noun collocations are often used and prevalent in basic instruction for students. Participants needed to choose one adjective word (from a list of four) that was suitably collocated with the given noun word. All target words were derived into noun forms. The collocational words were checked on the websites, including the Longman Dictionary of Contemporary English and the Online Oxford Collocation Dictionary. No point was given for an incorrect or a blank response, and one point was given for each correct answer. An illustration of the CRT is below (Instructions: Please select the adjective that collocates with the target noun properly).

_____ approval

fine	official	active	dark

Regarding language use in context, six tests were also used to assess students' productive knowledge of word aspects. The Form Production Test (FPT), adjusted based on Webb's (2005) productive orthography task, was used to assess spelling knowledge (written form) in production. This FPT was regarded as an isolatedly productive measure of spelling knowledge. Its reliability was 0.91. Participants have necessitated re-correct the misspelling form of the word. All target words were the derivative forms to avoid knowledge recognition from other tests. A correct answer gave one point, while an incorrect or blank response gave no point. An excerpt of this test is demonstrated below (Instructions: Please re-correct the form of the misspelled given word).

aprovemend = _____

The Recall Word Test (RWT) was modified based on Ishii and Schmitt's (2009) morphology task and structured as a fill-in-the-table task. Its reliability was 0.90. The test was employed to measure word part (word-class) in production and encouraged the recall of the word's different categories. Participants necessitated supplying a correct derived form of the word with its part of speech (i.e., noun, verb, and adjective). The adverbs were removed to avoid the link between recognition knowledge of adjectives and recall knowledge of adverbs (Ishii, 2005). One point was given for each correct answer, such as supplying a correct type of a derived word. No point was given for an incorrect or no response. An instance from the RWT is illustrated below (Instructions: Please write the correct derivative form of the given word in each part of speech;

Note that leave the answer blank if any of the given words have no form in any part of speech, such as noun or adjective).

Word	Noun	Verb	Adjective
Approve			
Relate			

The L1 Translation Test (L1TT), designed based on the translation task (Laufer & Goldstein, 2004; Webb, 2005), was used to measure the form-meaning link in production and produced a reliability of 0.92. This test was presented as L1-to-L2 translation, requiring the ability to recall English words. The highlighted Thai target word with the contextual sentence was necessitated to translate and supply the correct form in English, which related to its definition by following a given initial letter. A correct word definition awarded one point, while no or incorrect answer provided no point. Below is an extract of the L1TT (Instructions: Please translate the bolded word from Thai to English by following the two initial letters).

ตำแหน่งของฉันได้รับ**การอนุมัติ**เมื่อปีที่แล้ว = ap_____

The Association Production Test (APT), designed based on Laufer and Goldstein's (2004) active recall task, was employed to assess the knowledge of word association in production. Its reliability was 0.91. Asking to supply the associated words to the target words can raise their recall of the semantic association of the word. This test was designed as an independent measure of productive word association and needed participants to supply a synonym that was associated with the target word. The synonyms of the target words were checked through the Longman Basic English-Thai Dictionary, Cambridge English-Thai Dictionary, and Oxford English-Thai Dictionary. A correct word synonym received one point, while no answer or incorrect answer received none. Below is an example from this test (Instructions: Please write a word with a similar meaning to the target word).

approve = _____

The Grammatical Production Test (GPT), constructed based on Webb's (2005) productive grammatical function test, was used to assess grammatical function in production. It was presented as a sentence writing task but gauged only grammatical accuracy. Its reliability was 0.90. The target word was provided in derivative form, and participants needed to compose a grammatically correct sentence using the given form of the target word. The correction focused on systematic knowledge, i.e., subject-verb agreement, passive use, and word-part accuracy. Each correct grammatical function of the given word in the created sentence was worth one point, while no point was granted for no response or an incorrect grammatical function of the given word in the created sentence. An extract of the GPT is presented below (Instructions: Please use the given word to make a sentence with grammatical accuracy).

approved = _____

The Collocation Production Test (CPT) was adapted based on Nontasee and Sukying's (2021) productive collocation test. This test, formatted as a gap-filling task, assessed collocation

in production, mainly adjective-noun collocations, and its reliability was 0.85. Participants needed to produce predetermined target words by supplying a sentence context. All target words were noun forms, and participants needed to recall their collocational adjectives. There could only be one correct answer. The start letters of the target collocations were supplied to minimize non-target words that could fit in the assigned sentence. This was made to alleviate guessing and to ensure that participants provided only the target word. Each correct answer received one point. There were no points provided for incorrect or blank answers. Below is an excerpt from this test (Instructions: Please follow the two initial letters to complete the missing adjective to match the following noun in the sentence).

The president has already given his fi_____ approval to the plan.

PROCEDURES

The production tests were administered before the reception tests to eliminate any cross-test effects (Laufer & Goldstein, 2004; Schmitt, 2010; Webb, 2005). The word use tests (i.e., collocations and grammatical functions) were administered first, then the word meaning tests (i.e., form-meaning links and associations), and lastly, the word form tests (i.e., word parts and written forms). The test administration was given across three days to evade test weariness. The participants were not informed that tests using the same target words would take place over the next days, which diminished the cross-test effects. Therefore, participants knew that there would be three days of testing, but they were unaware that the exact words would be examined across days.

ANALYSIS

All voluntary participants were asked to take 12 tests. Any participant who did all tests incompletely, made patterned answers to multiple-choice tests, turned in blank tests, or had over 50% unfinished tests, was disqualified from the analysis. The mean, skewness, kurtosis, and standard deviation in single variables were first used to assess univariate normality, and multivariate normality of all variables was also detected. A paired-samples *t*-test was then used to determine any significant differences between receptive and productive test performances. A repeated-measures ANOVA was further used to detect significant differences in all test performances regarding the same words used across all of them. A correlation analysis was done to analyze the relationships between various word aspects. Next, an analysis of effect size was used to scrutinize the strength of the effect of knowledge differences and correlations when it was found in the population.

An analysis of Implication Scaling (IS) was used to approximate the acquisition difficulty for different word aspects. The IS can establish systematically hierarchical relationships between variables (Guttman, 1944; Rickford, 2002), and it was used to predict how the various word aspects are achieved. Lastly, Structural Equation Modeling (SEM) was used to examine the hypothesized model of the relationships between various word aspects. SEM explains the theoretical models that found relationships among various variables and concurrently examines the entire set of relationships among these variables. It analyzes the strength of any path in the model's relationship and creates a set of model fit indexes that indicate how well the data fit the model. While the IS showed information about the difficult hierarchy of the word aspects, the SEM indicated how these aspects were related to each other as an entire construct of word knowledge. The use of latent variables permits the relationships between variables to be evaluated without measurement error

(Tannenbaum, Torgesen, & Wagner, 2006). Therefore, it can arrange for a precise illustration of the relationships between the aspects of word knowledge. This hypothesized model signifies word knowledge as a general, underlying latent construct comprising written form, word part, form-meaning link, association, collocation, and grammatical function at both reception and production, as shown in Figure 3. SEM was used to analyze this conceptualization.

RESULTS

As shown in Table 1, the descriptive statistics indicate that the participants knew roughly 62.58% of the items, and they scored higher on the receptive test of an aspect than its productive test.

TABLE 1. Descriptive statistics for all word tests

Aspects		Tests	*M*	*SD*	Skewness	Kurtosis	Total (%)
Written form	R	FRT	23.16	6.81	-1.336	1.718	77.21
	P	FPT	21.21	7.92	-0.971	0.405	70.71
Word part	R	WRT	21.48	6.02	-1.255	1.779	71.61
	P	RWT	17.86	7.79	-0.660	-0.485	59.53
Form-meaning link	R	L2TT	21.35	4.85	-0.446	-0.501	71.15
	P	L1TT	14.75	6.26	-0.270	-0.630	49.17
Association	R	ART	21.31	6.72	-1.126	1.067	71.02
	P	APT	14.76	6.19	-0.621	-0.220	49.19
Grammatical function	R	GRT	17.97	8.42	-0.556	-0.786	59.91
	P	GPT	16.76	7.08	-0.495	-0.303	55.87
Collocation	R	CRT	21.20	6.65	-1.058	0.618	70.67
	P	CPT	13.46	6.45	-0.523	-0.529	44.87

Notes: R = Receptive knowledge, P = Productive knowledge

An examination of the normal distribution of all tests, the skewness and kurtosis values for all vocabulary tests were at the conservative range of ± 1 (all ≤ 2) and were proved to be normal on the performance across different vocabulary knowledge tests (Hill, 1998). Multivariate normality was also verified (Mahalanobis values ≤ 10.44), which was less than the standard threshold set at ≤ 13.82. Thus, the normality parametric assumption was not violated (Larson-Hall, 2016).

A repeated-measures ANOVA analyzed all word tests and illustrated a significant difference between tests, with a large effect size ($F_{(11, 499)} = 191.13$, $p < 0.001$, $\eta^2 = 0.28$). Follow-up comparisons showed that the receptive and productive tests of an aspect were significantly different, and all effect sizes were from small to large (FRT versus FPT: $t = 5.23$, $p < 0.001$, $d = 0.26$; WRT versus RWT: $t = 9.97$, $p < 0.001$, $d = 0.52$; L2TT versus L1TT: $t = 30.26$, $p < 0.001$, $d = 1.18$; ART versus APT: $t = 20.78$, $p < 0.001$, $d = 1.01$; GRT versus GPT: $t = 2.92$, $p < 0.005$, $d = 0.20$; CRT versus CPT: $t = 24.57$, $p < 0.001$, $d = 1.18$). A large effect size suggests that results have practical importance, whereas a small effect size implies that the study results have limited practical applicability. These results indicate that word knowledge aspects are at various rates, particularly different levels of receptive and productive knowledge of an aspect.

As shown in Table 2, scores on word aspects, both receptively and productively, were correlated (small to large) with medium to large effect sizes (all *r* values ≥ 0.27; R^2 values ≥ 0.07). This indicates that word aspects are interrelated and that the aspects are significantly and positively correlated in the broader population.

TABLE 2. Correlations between scores on word tests

Tests	FRT	FPT	WRT	RWT	L2TT	L1TT	ART	APT	GRT	GPT	CRT	CPT
FRT	1											
FPT	.37*	1										
WRT	.27*	.37*	1									
RWT	.46*	.44*	.33*	1								
L2TT	.53*	.50*	.38*	.54*	1							
L1TT	.46*	.46*	.36*	.45*	.64*	1						
ART	.39*	.46*	.32*	.37*	.51*	.44*	1					
APT	.37*	.40*	.28*	.40*	.55*	.47*	.41*	1				
GRT	.37*	.38*	.28*	.41*	.48*	.40*	.34*	.32*	1			
GPT	.32*	.29*	.30*	.36*	.58*	.42*	.32*	.30*	.29*	1		
CRT	.41*	.45*	.27*	.47*	.59*	.53*	.39*	.41*	.40*	.37*	1	
CPT	.46*	.46*	.33*	.45*	.61*	.53*	.44*	.41*	.44*	.42*	.42*	1

*Notes: *$p < 0.001$ (2-tailed)

      The IS analysis was used to approximate the difficulty of the word tests and systematize a hierarchical relationship of the acquisition of word knowledge aspects. The implicational scale of the observed word aspects in the participants was horizontally posited in a matrix and hierarchized from most known to least known (left to right): Written form reception > Word part reception > Form-meaning link reception > Association reception > Written form production > Collocation reception > Grammatical function reception > Word part production > Grammatical function production > Association production > Form-meaning link production > Collocation production.

      The IS results based on Guttman's (1944) indication [Coefficient of reproducibility (C_{rep}) ≥ 0.90; Coefficient of scalability (C_{scal}) ≥ 0.60] demonstrated a very good fit scale for the participants (C_{rep} = 0.93; C_{scal} = 0.60). The findings from the pattern reveal that knowledge of a higher aspect on the scale reflects knowledge of all lower aspects, which means that association reception implies form-meaning link reception, word part reception, and written form). In other words, if the participants can retrieve one aspect, it is presumed, based on the C_{rep}, that they will always know the other four aspects at the receptive level. Based on González-Fernández and Schmitt's (2020) findings which found all aspect receptions were acquired before any productions, this research differently revealed that word part production was known before the two reception aspects of collocation and grammatical function. This implies that grammatical function reception may infer collocation reception and word part production. The C_{scal} signifies the strength of the aspects on an implicational scale and indicates whether the aspects are unidimensional and, by this means, scalable. The data is regarded as scalable if the C_{scal} is > 0.60, reflecting a more valid implicational scale. The C_{scal} represents that the scalability pattern is relatively active and that the measured aspects are one-dimensional (González-Fernández & Schmitt, 2020).

      The hypothesized model of word knowledge illustrated in Figure 3 was examined in the conceptualized model of the relationships between various aspects. The SEM analysis via the maximum likelihood robust estimator analyzed how well the hypothesized model fits the sample data. All word tests were verified to be a normal distribution of scores and passed univariate assumptions (Sk and Ku values ≤ 2), multivariate normality (MAH values ≤ 10.44), and measurement reliability (Cronbach's α values ≥ 0.8) to construct the SEM model (Phakiti, 2007). A good fit model is set at the following thresholds: Model Chi-Square (X^2), Degree of Freedom Ratio (*df*), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit (GFI), Adjusted Goodness-of-Fit (AGFI), Standardized Root Mean Square Residual (SRMR), Normed-Fit Index (NFI), and Comparative-Fit Index (CFI) (Brown, 2015; Hu & Bentler, 1999).
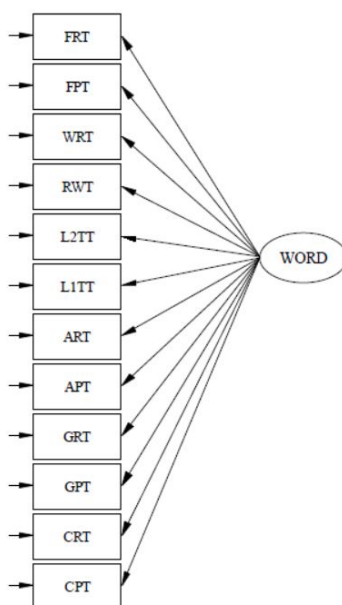
FIGURE 3. Hypothesized model of relationships between word knowledge aspects

The hypothesized model of word knowledge was conceptualized based on González-Fernández and Schmitt's (2020) previous model of word knowledge as independent word knowledge aspects. Together, based on the IS results, the model considered the receptive and productive word aspects as individual direct indicators of the general word knowledge construct, which indicated that the receptive and productive aspects differed significantly. Also, based on the high correlation results, the receptive and productive knowledge of the same aspect were interrelated. This model is illustrated in Figure 4.
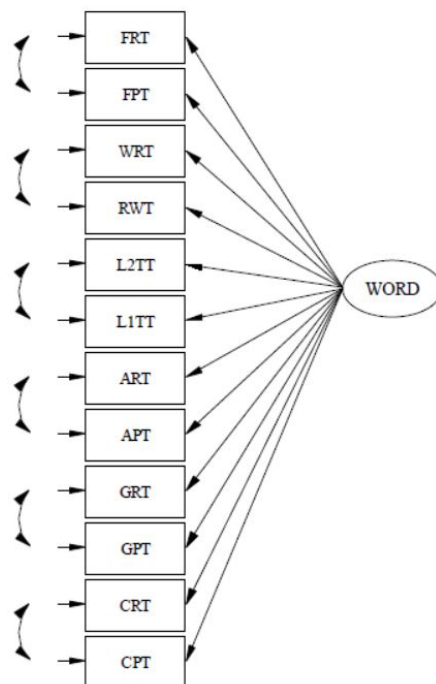
FIGURE 4. Relationship model of word knowledge that reception and production as independent aspects

TABLE 3. Model fit indexes

	X^2	df	*p*-value	RMSEA	GFT	AGFT	SRMR	NFI	CFI
Acceptable fit			> 0.05	< 0.05	> 0.95	> 0.95	< 0.05	> 0.95	> 0.95
Word knowledge model	53.84	46	0.20	0.02	0.98	0.97	0.02	0.99	1.00

As shown in Table 3, the results of the model of word knowledge demonstrated a good fit model. The insignificant X^2 ($p > 0.05$) and all other statistical values reached and exceeded a commonly acceptable fit threshold. All the model fit indexes passed the generally accepted fit thresholds, revealing the aptness of the model and, consequently, the validity of the construct. Furthermore, various word aspects significantly predicted ≥ 47% of word acquisition, as shown in Table 4.

TABLE 4. Predictions of word aspects on word knowledge

Word aspects	*β* values
Predicting word knowledge	
Receptive written form knowledge (FRT)	0.63
Productive written form knowledge (FPT)	0.66
Receptive word part knowledge (WRT)	0.47
Productive word part knowledge (RWT)	0.65
Receptive form-meaning link knowledge (L2TT)	0.85
Productive form-meaning link knowledge (L1TT)	0.74
Receptive association knowledge (ART)	0.60
Productive association knowledge (APT)	0.61
Receptive grammatical function knowledge (GRT)	0.58
Productive grammatical function knowledge (GPT)	0.55
Receptive collocation knowledge (CRT)	0.69
Productive collocation knowledge (CPT)	0.71

The regression coefficients (*β*) indicated that all these aspects revealed different level predictions (i.e., related paths between word knowledge and these twelve aspects), which indicates varying degrees of a path to vocabulary growth (Kline, 2016). This illustrates that these aspects were different sub-constructs of word knowledge and can be understood as a single construct. Thus, based on the data, this model seems to be a good representative of word knowledge. The model suggests that all word aspects positively contribute to the acquisition of word knowledge and further description of the word knowledge construct, demonstrating that they are all crucial aspects of knowing a word.

To summarize, firstly, the statistical analysis showed that word aspects differed receptively and productively. Secondly, the results revealed positive relationships between all word aspects. Thirdly, the hierarchical pattern was found to be a valid implicational scale. Finally, the receptive and productive knowledge of the word aspects positively contributed to overall word knowledge.

DISCUSSION

This research investigated the nature of the word knowledge construct as a multi-aspect by examining the hierarchical acquisition of various word aspects and their relationships. The overall results largely confirm previous assumptions about word knowledge acquisition. The results showed that word aspects were interrelated but not acquired simultaneously, suggesting that word knowledge is a developmental learning process.

It was shown that scores on the receptive test of an aspect were higher than scores on the productive test for the same aspect, which is consistent with earlier studies (e.g., González-Fernández & Schmitt, 2020; Jeensuk & Sukying, 2021; Nontasee & Sukying, 2020, 2021; Zhong, 2018). This indicates that productive knowledge requires more knowledge strategies than receptive knowledge and that receptive knowledge is first acquired and functions as a foundation for productive knowledge (Hayashi & Murphy, 2011; Sukying, 2017, 2020). Based on the correlational results, all word aspects at both the receptive and productive levels were related to one another. That is, various aspects of word knowledge are interrelated, and knowledge of one dimension can indicate knowledge of other aspects (e.g., Lin, 2015; Nontasee & Sukying, 2021; Schmitt & Meara, 1997; Zhong, 2018).

Furthermore, the IS results in this research provided new insight into evidence about the hierarchical acquisition of word knowledge among Thai EFL students by showing the difficult hierarchy of the various word aspects in acquisition as a valid implication scale. Written form reception was known first, followed by word part reception, form-meaning link reception, association reception, written form production, collocation reception, grammatical function reception, word part production, grammatical function production, association production, form-meaning link production, and lastly, collocation production. Based on previous studies, receptive knowledge of written form, word part, form-meaning link, and association seem to be known at the early stage (Laufer & Goldstein, 2004; Nontasee & Sukying, 2020; Suying, 2017; Sukying & Nontasee, 2022). Yet, it is unclear whether form or meaning knowledge is acquired first because different factors, such as educational settings and individual learning styles, imply different acquisitions of word aspects (Laufer & Goldstein, 2004; Nontasee & Sukying, 2021). Sukying and Nontasee (2022) found inconsistencies in hierarchical acquisition patterns of written form (form knowledge) and form-meaning link (meaning knowledge) among students with different language backgrounds. Form-meaning link was proven to be well-known (González-Fernández & Schmitt, 2020). However, the unmeasured knowledge aspects, such as spelling and word class, might be

initially acquired before form-meaning links. Others revealed that the form-meaning link came after word-part (Nontasee & Sukying, 2021), spelling and word class (Webb, 2005), and even association (Chen & Truscott, 2010). Collocation and grammatical function receptions (or word use knowledge) are the most difficult to be learned and are acquired last (Nontasee & Sukying, 2020, 2021; Sukying & Nontasee, 2022; Webb, 2005; Zhong, 2018). The acquisition of word knowledge relies on exposure to the language (Sukying & Nontasee, 2022), as well as the learning environment (Nation, 2013) and students' first language (Lin, 2015).

At the productive level, written form (spelling) production scored higher than collocation and grammatical function reception. The test of written form production might be easier for the participants because it only required them to re-correct the misspelled words. Based on the findings of González-Fernández and Schmitt (2020), who found that all aspect receptions were learned before any productions, this research, based on the IS results, showed that word part production was recalled before the two reception aspects of collocation and grammatical function. This entails that the reception of collocation or grammatical function may deduce the production of word part knowledge. This implies that some productive knowledge aspects can be known without mastering all receptive knowledge aspects, which is consistent with previous literature (Chui, 2006; Laufer & Goldstein, 2004; Nation, 2013). For example, Chui (2006) found that the reception of collocation and production of derivatives were at a similar level of difficulty, whereas others found that all aspects of reception were known before progressing to the aspects of production (González-Fernández & Schmitt, 2020; Nontasee & Sukying, 2021). Notably, the findings could lead to inconsistent conclusions if the participants are asked to freely spell the word without any indicators or are tested on the production of the full word form knowledge. Indeed, word form knowledge linked with limited syntactic knowledge of word family members is difficult for learners and is achieved somewhat late in the process (Sukying, 2022).

The current findings suggest that grammatical function production was likely known before association and form-meaning link production. This is partly because knowledge of grammatical function was related to word part knowledge. The GPT required participants to free-write only one correct grammar sentence by using the target word. By contrast, association and form-meaning link production required participants to recall the semantic word. Form-meaning link production was more difficult than association production because the FPT required participants to recall the word's meaning and its form concurrently. In contrast, APT required them to recall only one synonym. It has also been shown that association is difficult for students and is likely known after other aspects. Indeed, acquiring word association hinges on the natural setting and presents an obstacle for Thai EFL students.

Finally, collocation production was the most difficult aspect to be achieved in this research. This knowledge necessitates knowing other aspects and adequate exposure to the language. The grammatical function and collocation aspects were regarded as the hardest and the latest to be mastered, which is congruent with prior studies (Nontasee & Sukying, 2020, 2021; Peters, 2016). In contrast, collocation knowledge was found to be simpler than derivative and multiple-meaning knowledge based on González-Fernández and Schmitt's (2020) study, which was partially attributable to the different ranges of difficulty of the measures used (only a single collocation, but for four derivative forms) and the apparent advantage of the cognate nature of Spanish participants. Furthermore, grammatical function knowledge might be more straightforward due to its overlap with other knowledge, such as word part and collocation (Webb, 2005). The grammatical function measure used in this research had several flaws, which might indicate that it was particularly complicated or challenging.

There is currently no consensus in the literature concerning the interface between the various word aspects. Some studies found that form knowledge of a word, i.e., morphology, orthography, spelling, and word class, was generally acquired before others (Chen & Truscott, 2010; Schmitt & Meara, 1997; Sukying, 2017; Webb, 2005), but others revealed that meaning knowledge, i.e., form-meaning link and association was the most accessible aspect to be known (Pellicer-Sanchez & Schmitt, 2010; Tannenbaum, Torgesen, & Wagner, 2006; Zhong, 2018). Alternatively, González-Fernández and Schmitt (2020) showed that collocation (word use knowledge) was sometimes better known before others (multiple-meaning and derivative form), and Webb (2005) also argued that word use, such as grammatical function, was easier to be learned than others. González-Fernández (2022) proved that the unidimensional model of word aspects held true across different L1 background students. Still, Sukying and Nontasee (2022) reported that the implicational patterns of word aspects in different grade students differed. Remarkably, these studies affirm the exact stage of the reception and production of word knowledge, indicating that receptive knowledge is early known and followed by productive knowledge.

It is clear that the interface between word knowledge aspects in acquisition requires further research, but overall, word aspects appear to be acquired at different rates. Furthermore, it should be noted that the knowledge aspects not tested in this research and the distinct methods and contexts may prove different vocabulary acquisition results.

This research develops Nation's (2013) framework by revealing how the aspects relate to one another and by examining the relationships among the word aspects using latent variables. All of these variables indicated various level estimations (i.e., related paths between word knowledge and these twelve aspects). This demonstrates that these aspects were distinct sub-constructs of word knowledge that could be interpreted as a single construct (Kline, 2016). The results demonstrated that the various word aspects were found to influence the acquisition of word knowledge. Specifically, the construct of word knowledge emphasizes the process of multiple related aspects. The reception and production of the word aspects were the primary mechanisms for acquiring word knowledge. However, all aspects of both reception and production behaved differently from each other. No word aspect was known both in reception and production before another aspect, and not all receptive aspects were mastered before productive aspects. This suggests that the growth of word knowledge is implied by multiple-related-aspect contribution, indicating that knowing multiple aspects of word knowledge helps students to develop their word knowledge more successfully.

Although this research generates some more new insight into the nature of word knowledge construct in the acquisition, there is still a necessity to straightly investigate the hierarchical acquisition of word knowledge aspects as a multi-framework to obtain more empirical evidence on the hierarchical structure of word knowledge (González-Fernández, 2022). This research reveals that the implicational scale (the word acquisition pattern) and the conceptualized model of word knowledge may be crucial resources in this field. This research is an early attempt to examine the nature of the word knowledge construct. Further research using alternative measurements and learner populations will either support or disprove its generalizability. We argue with the previous claim by González-Fernández and Schmitt (2020) and anticipate that, while the sequential acquisition of the aspects may alter slightly with different measures or participants, the receptive and productive distinction will probably persevere.

Furthermore, this research offers a conceptualized model of word knowledge for L2 classroom practice. The findings point to a practical vocabulary teaching and learning principle and may help to develop policy in English instruction, particularly in Thailand. The concept of

vocabulary teaching and learning necessitates linking with the nature of vocabulary acquisition and development, as the study indicated hierarchical acquisition of vocabulary knowledge aspects. This may be valuable, known as the learnability of a word in EFL learners, for naturally teaching and learning word knowledge. The findings also imply that any aspects of word knowledge should not be overlooked in vocabulary learning and teaching because EFL learners would benefit from the added value of these aspects to their acquisition and development if they are exposed to multiple aspects of a word rather than a single aspect alone.

CONCLUSION

This research provides significant evidence for the multi-construct nature of word knowledge acquisition in Thai EFL students. Notably, the research examined students of only one L1; therefore, it is unclear whether the results can be generalized to other EFL students. Second, participants with a wide range of educational levels, such as primary, high school, and university students, should be incorporated into further research to better comprehend the roles of word aspects in particular contexts. This research is also restricted to a cross-sectional research design; a longitudinal research design may provide a better description of the nature of vocabulary knowledge acquisition and development. Further research should also measure all aspects of word knowledge in Nation's (2013) framework. Other instruments based on qualitative methodologies, such as observation, questionnaires, and interviews, should be applied to certify the reliability and validity of the data and gather supplementary information on vocabulary acquisition (e.g., the interview may help to gain insightful information to explain more clearly how various aspects are prioritized and learned before others by learners). Finally, the tests used here were devised for the precise research aims of this research; hence, further research should verify that the test content and the test itself are adjusted to the specific research setting.

In conclusion, the research investigated the nature of word knowledge construct in an EFL context, examining the hierarchical acquisition of word knowledge aspects and their relationship model. The results showed that word knowledge aspects were interrelated and were acquired at different rates. Specifically, it was shown that receptive knowledge of an aspect is easier to be known before its productive knowledge. Additionally, the hierarchical patterns of the IS results indicated that all aspects of reception did not need to be mastered before knowing the aspects of production. Furthermore, the SEM results indicated that the receptive-productive process was fundamental to the conceptualization of word knowledge. The present findings establish the interrelatedness of word knowledge aspects and reinforce previous claims that the various word aspects are acquired according to an incremental continuum. This research implies a new insight into word knowledge acquisition of Thai EFL students by suggesting the hierarchical acquisition of word knowledge and the model of the relationships between the various word aspects.

REFERENCES

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.

Browne, C., Culligan, B., & Phillips, J. (2013). The new general service list. Retrieved 17 March, 2021, from www. Newgeneralservicelist. Org.

Bruton, A. (2009). The vocabulary knowledge scale: A critical analysis. *Language Assessment Quarterly, 6*(4), 288-297. https://doi.org/10.1080/15434300902801909

Bubchaiya, N. & Sukying, A. (2022). The effect of word part strategy instruction on the vocabulary knowledge of Thai primary school learners. *Journal of Education and Learning*, *11*(5), 70-81. https://doi.org/10.5539/jel.v11n5p70

Chen, C., & Truscott, J. (2010). The effects of repetition and L1 lexicalization on incidental vocabulary acquisition. *Applied Linguistics, 31*, 693-713. https://doi.org/10.1093/applin/amq031

Chui, A. S. Y. (2006). A study of the English vocabulary knowledge of university students in Hong Kong. *Asian Journal of English Language Teaching, 16*, 1-23.

Coxhead, A. (2012). A new academic word list. *TESOL Quarterly, 34*(2), 213-238. https://doi.org/10.2307/3587951

Dörnyei, Z. (2007). *Research methods in applied linguistics.* Oxford: Oxford University Press.

González-Fernández, B. (2022). Conceptualizing L2 vocabulary knowledge: An empirical examination of the dimensionality of word knowledge. *Studies in Second Language Acquisition, 44*(4), 1124-1154. https://doi.org/10.1017/S0272263121000930

González-Fernández, B., & Schmitt, N. (2020). Word knowledge: Exploring the relationships and order of acquisition of vocabulary knowledge components. *Applied Linguistics, 41*(4), 481-505. https://doi.org/10.1093/applin/amy057

Guttman, L. (1944). A basis for scaling qualitative data. *American Sociological Review, 9*, 139-150. http://dx.doi.org/10.2307/2086306

Hayashi, Y., & Murphy, V. (2011). An investigation of morphological awareness in Japanese students of English. *Language Learning Journal, 39*(1), 105-120. https://doi.org/10.1080/09571731003663614

Henriksen, B. (1999). Three dimensions of vocabulary development. *Studies in Second Language Acquisition, 21*(2), 303-317. https://doi.org/10.1017/S0272263199002089

Hill, K. (1998). The effect of test-taker characteristics on reactions to and performance on an oral English proficiency test. In A. J. Kunnan (Ed.), *Validation in language assessment* (pp. 209–230). Lawrence Erlbaum.

Hopkins, C. D., & Antes, R. L. (1990). *Classroom measurement and evaluation* (3rd ed.). F. E. Peacock Publishers. https://doi.org/10.3102/0013189X011008020

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Ishii, T. (2005). Diagnostic test of vocabulary knowledge for Japanese learners of English [Doctoral dissertation, University of Nottingham].

Ishii, T., & Schmitt, N. (2009). Developing an integrated diagnostic test of vocabulary size and depth. *RELC Journal, 40*(1), 5-22. https://doi.org/10.1177/0033688208101452

Jeensuk, S., & Sukying, A. (2021). An investigation of high school EFL learners' knowledge of English collocations. *Journal of Applied Linguistics and Language Research, 8*(1), 90-106.

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). The Guilford Press.

Larson-Hall, J. (2016). *A guide to doing statistics in second language research using SPSS* (2nd ed.). London: Routledge. https://doi.org/10.4324/9781315775661

Laufer, B. (2010). Form focused instructions in second language vocabulary learning. In R. Chacón Beltrán, C. Abello-Contesse, & M. M. Torreblanca-López (Eds.), *Insights into non-native vocabulary teaching and learning* (pp. 15-27). Bristol: Multilingual Matters.

Laufer, B., & Goldstein, Z. (2004). Testing vocabulary knowledge: Size, strength, and computer adaptiveness. *Language Learning, 54*(3), 399-436. https://doi.org/10.1111/j.0023-8333.2004.00260.x

Li, M., & Kirby, J. R. (2015). The effects of vocabulary breadth and depth on English reading. *Applied Linguistics, 36*, 611-634. https://doi.org/10.1093/applin/amu007

Lin, C. C. (2015). L2 word learnability: A focus on written form of words. [Doctoral dissertation, University of Sydney].

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research, 35*(6), 382-386.

Magnussen, E. & Sukying, A. (2021). The impact of songs and TPR on Thai preschoolers' vocabulary acquisition. *THAITESOL Journal*, *34*(1), 71-95.

Milton, J., & Fitzpatrick, T. (2014). *Dimensions of vocabulary knowledge*. Basingstoke: Palgrave Macmillan. https://doi.org/10.1017/S0272263114000382

Milton, J., & Hopkins, N. (2006). Comparing phonological and orthographic vocabulary size: Do vocabulary tests underestimate the knowledge of some students? *The Canadian Modern Language Review, 63*(1), 127-147. https://doi.org/10.1353/cml.2006.0048

Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd ed.). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139524759

Nontasee, W., & Sukying, A. (2020). The acquisition of vocabulary knowledge in Thai EFL high school students. *Journal of Man and Society Faculty of Humanities and Social Sciences, 6*(1), 63-87.

Nontasee, W., & Sukying, A. (2021). The learnability of word knowledge aspects in Thai EFL high school students. *Journal of Language and Linguistic Studies, 17*(1), 34-55. https://doi.org/10.52462/jlls.3

Pellicer-Sanchez, A., & Schmitt, N. (2010). Incidental vocabulary acquisition from an authentic novel: Do things fall apart? *Reading in a Foreign Language, 22*, 31-55. https://doi.org/10125/66652

Peters, E. (2016). The learning burden of collocations: The role of interlexical and intralexical factors. *Language Teaching Research, 20*, 113-138. https://doi.org/10.1177/1362168814568131

Phakiti, A. (2007). *Strategic competence and EFL reading test performance: A structural equation modeling approach.* Peter Lang.

Read, J. (2000). *Assessing vocabulary.* Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511732942

Rickford, J. R. (2002). Implicational scales. In J. K. Chambers, P. Trudgill, & N. Schilling-Estes (Eds.), *The handbook of language variation and change* (pp. 142-167). Blackwell Publishers.

Schmitt, N. (1995). A fresh approach to vocabulary: Using a word knowledge framework. *RELC Journal, 26*(1), 86-94. https://doi.org/10.1177/003368829502600105

Schmitt, N. (2008). Review article: Instructed second language vocabulary learning. *Language Teaching Research, 12*(3), 329-363. https://doi.org/10.1177/1362168808089921

Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual.* New York: Palgrave Macmillan. http://dx.doi.org/10.1057/9780230293977

Schmitt, N. (2014). Size and depth of vocabulary knowledge?: What the research shows. *Language Learning, 64*(4), 913-951. http://dx.doi.org/10.1111/lang.12077

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

Schmitt, N., & Zimmerman, C. B. (2002). Derivative word forms: What do students know? *TESOL Quarterly, 36*(2), 145-171. https://doi.org/10.2307/3588328

Sridhanyarat, K. (2018). Thai learners' acquisition of L2 collocations: An interlanguage perspective. *GEMA Online® Journal of Language Studies, 18*(1), 1-21. http://doi.org/10.17576/gema-2018-1801-01

Sukying, A. (2017). The relationship between receptive and productive affix knowledge and vocabulary size in an EFL Context. [Doctoral dissertation, University of Sydney].

Sukying, A. (2018a). Investigating receptive and productive affix knowledge in EFL learners. In D. Hirsh (Ed.), *Explorations in second language vocabulary research* (pp. 183-218). Peter Lang.

Sukying, A. (2018b). The acquisition of English affix knowledge in L2 learners. *NIDA Journal of Language and Communication, 23*(34), 89-102.

Sukying, A. (2020). Word knowledge through morphological awareness in EFL students. *TESOL International Journal, 15*(1), 74-85.

Sukying, A. (2022). A taxonomy of English affix acquisition in EFL learners. In D. Hirsh (Ed.), *Research perspectives in language and education* (pp. 49-82). Peter Lang. https://doi.org/10.3726/b19346

Sukying, A., & Nontasee, W. (2022). The acquisition order of vocabulary knowledge aspects in Thai EFL students. *World Journal of English Language, 12*(5), 306-319. https://doi.org/10.5430/wjel.v12n5p306

Tannenbaum, K. R., Torgesen, J. K., & Wagner, R. K. (2006). Relationships between word knowledge and reading comprehension in third-grade children. *Scientific Studies of Reading, 10*, 381-98. https://doi.org/10.1207/s1532799xssr1004_3

Teng, F. (2016). The effects of word exposure frequency on incidental learning of the depth of vocabulary knowledge. *GEMA Online® Journal of Language Studies, 16*(3), 53-70.

The Ministry of Education. (2008). *English curriculum in 2551*. Khurusapha Press. [in Thai].

Webb, S. (2005). Receptive and productive vocabulary learning: The effects of reading and writing on word knowledge. *Studies in Second Language Acquisition, 27*(1), 33-52. https://doi.org/10.1017/S0272263105050023

Webb, S. (2020). *The routledge handbook of vocabulary studies.* Routledge.

Wesche, M., & Paribakht, T. S. (1996). Assessing second language vocabulary knowledge: Depth versus breadth. *The Canadian Modern Language Review, 53*(1), 13-40. https://doi.org/10.3138/cmlr.53.1.13

Yowaboot, C., & Sukying, A. (2022). Using digital flashcards to enhance Thai EFL primary school students' vocabulary knowledge. *English Language Teaching, 15*(7), 61-74. https://doi.org/10.5539/elt.v15n7p61

Zhong, H. F. (2018). The relationship between receptive and productive vocabulary knowledge: A perspective from vocabulary use in sentence writing. *The Language Learning Journal, 46*(4), 357-370. https://doi.org/10.1080/09571736.2015.1127403

ABOUT THE AUTHORS

Worakrit Nontasee is a PhD student in English Language Teaching (ELT) Programme, Mahasarakham University, Maha Sarakham, Thailand. His research interests are L2 vocabulary acquisition and second language acquisition.

Apisak Sukying is an assistant professor in English language teaching at Mahasarakham University, Thailand. He completed his Ph.D. in TESOL from the University of Sydney, Australia. His research interests include L2 vocabulary acquisition, academic writing, SLA, ESP, and ELT.