



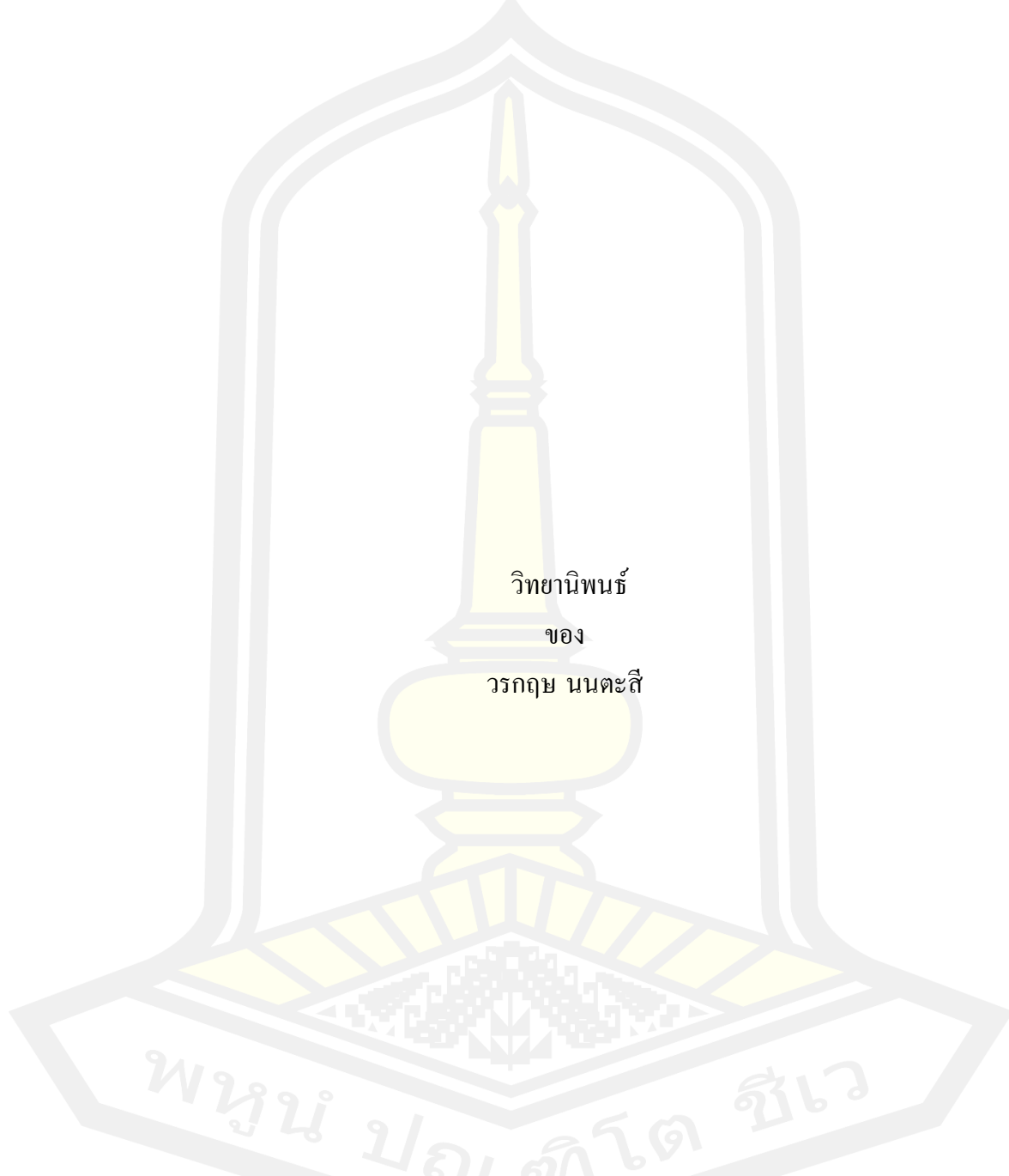
Vocabulary Knowledge Aspects: The Acquisition Order and their Relationships in
Thai EFL High School Learners

Worakrit Nontasee

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in English Language Teaching
March 2023

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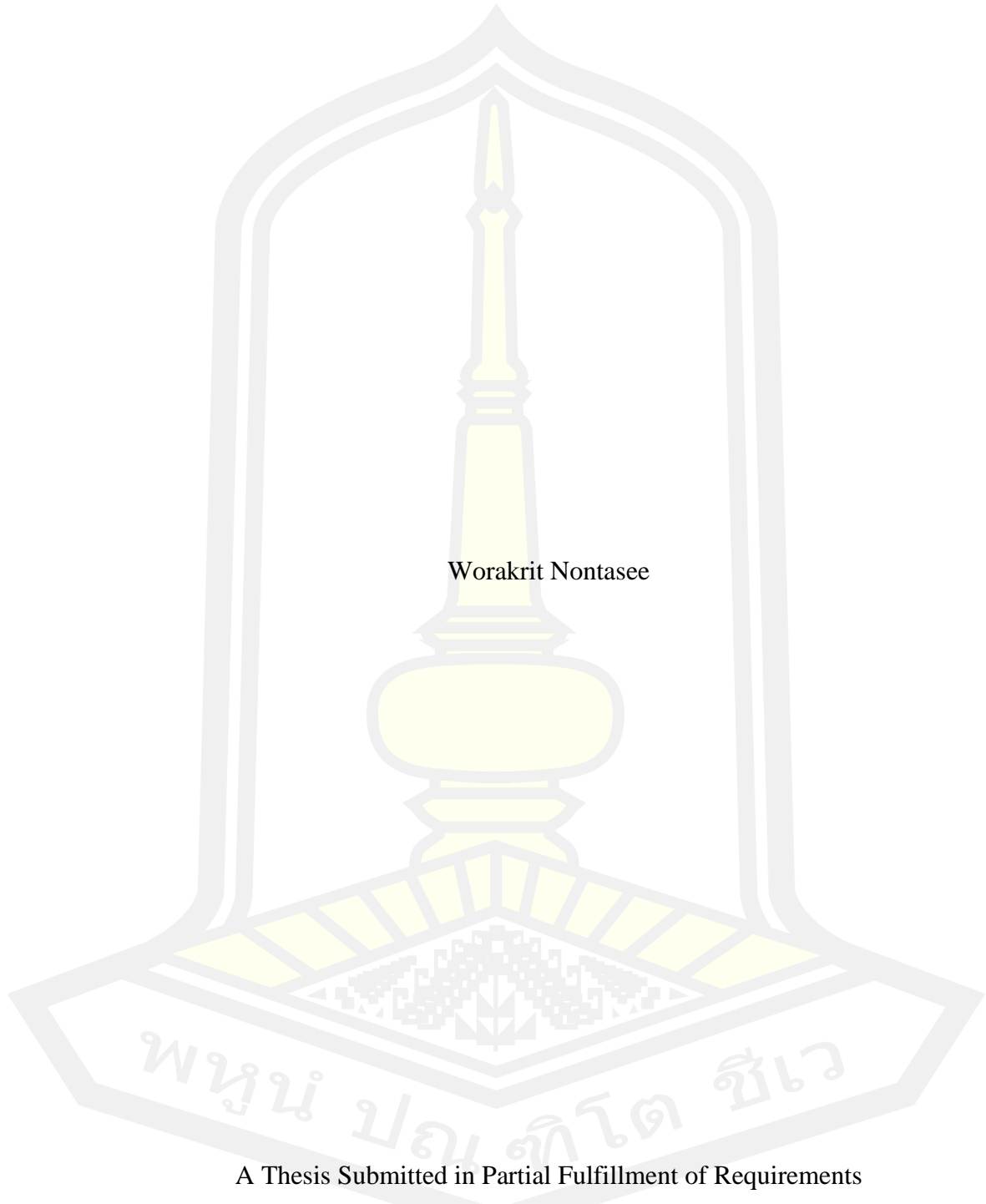


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ลิขสิทธิ์เป็นของมหาวิทยาลัยมหาสารคาม

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ABSTRACT

Vocabulary knowledge is a multi-aspect construct that is acquired through an incremental learning process (Henriksen, 1999; Read, 2000; Milton & Fitzpatrick, 2014; Nation, 2013; Schmitt, 2010, 2014). It is precise that research on vocabulary acquisition has found that vocabulary aspects are continually known at varying rates, which the receptive-productive foundation regulates (e.g., González-Fernández & Schmitt, 2019; Laufer & Goldstein, 2004; Nontasee & Sukying, 2020, 2021; Schmitt & Meara, 1997; Zhong, 2018). While the various aspects are related to one another, they are not always known simultaneously. The precise stages of the vocabulary acquisition process are still unknown, particularly in terms of the various developmental rates for vocabulary aspects (e.g., Chui, 2006; Chen & Truscott, 2010; Li & Kirby, 2015; Milton & Hopkins, 2006; Schmitt, 2008; Schmitt & Zimmerman, 2002; Webb, 2005). Various aspects of vocabulary knowledge in development have been fragmentarily investigated (Nation, 2013; Schmitt, 1995), but studies that examine vocabulary knowledge as a whole construct remain rare. It is also unclear how different vocabulary knowledge aspects are acquired and fit together (González-Fernández & Schmitt, 2019; Schmitt, 2014).

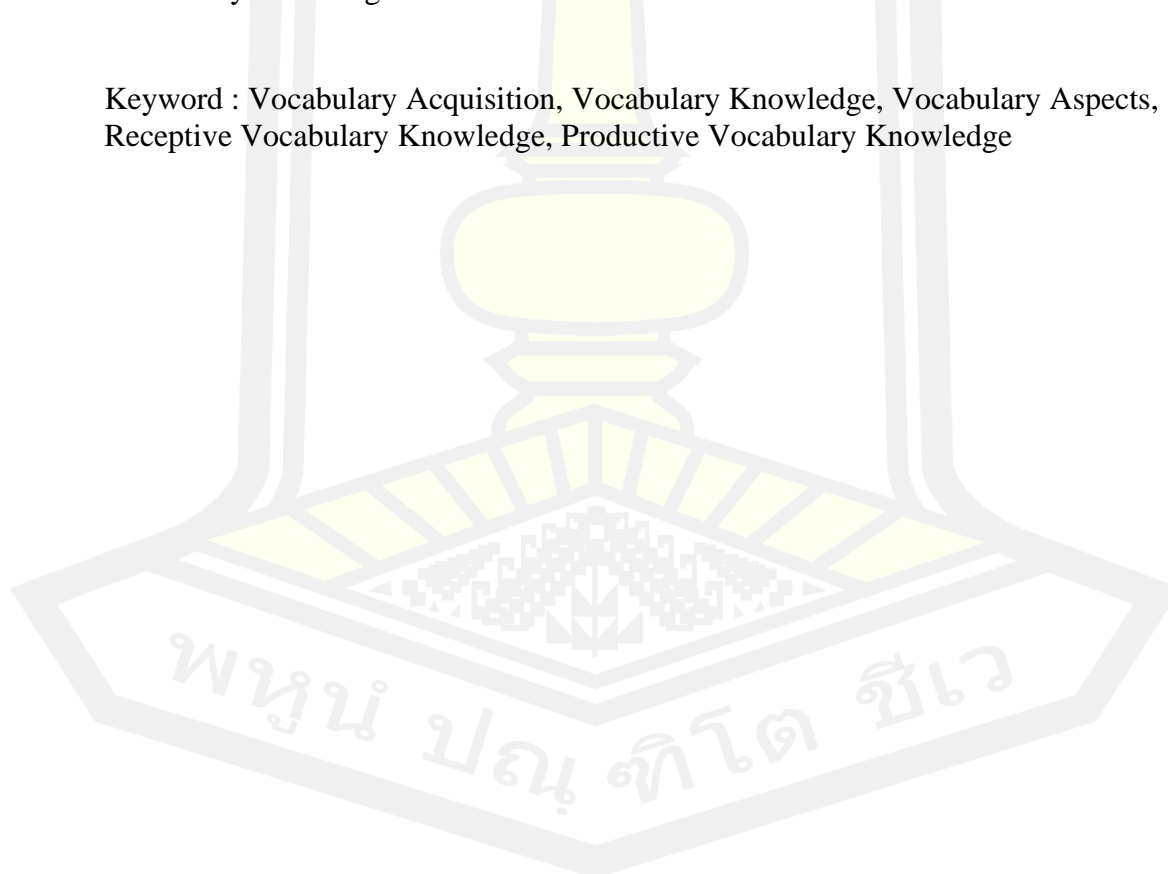
The present study thus aims to fill these gaps in the literature by exploring the construct of vocabulary knowledge as a multi-aspect framework. It will advance our understanding of the role of different vocabulary knowledge aspects and the nature of vocabulary acquisition and development and address the conceptualization of vocabulary knowledge aspects as the primary acquisition pattern in English as a foreign language (EFL) learners in Thailand.

This study investigated the multi-aspect nature of vocabulary knowledge by analyzing the acquisition order of different vocabulary knowledge aspects and their conceptualized relationships. Specifically, the study first measures different vocabulary aspects (written form, word part, form-meaning link, association, grammatical function, and collocation, at both reception and production), examines these aspects' acquisition order, and at last, models the relationships between these various vocabulary aspects. The twelve vocabulary tests were individually used to

assess any vocabulary aspects.

A battery test of vocabulary knowledge aspects based on Nation's (2013) framework was conducted on 500 English as a Foreign Language (EFL) learners in Thailand. The results indicated that the receptive tests were scored higher than the productive tests in any knowledge aspect, showing significant differences, and all aspects were overall shown to be significant differences as well. There were also positive correlations between knowledge of the different aspects, varying degrees from small to large. Furthermore, an Implicational Scaling (IS) analysis illustrated an implicational pattern of vocabulary knowledge aspects and found that productive knowledge could be known without complete mastery of all aspects of receptive knowledge. Finally, Structural Equation Modeling (SEM) demonstrated the benefit of the various vocabulary aspects to acquiring vocabulary knowledge. Overall, this research corroborates previous evidence for the vocabulary acquisition pattern and the conceptualization of vocabulary knowledge and provides empirical evidence in a Thai EFL context. It also implies that vocabulary knowledge is acquired along a developmental learning continuum. A need for a longitudinal research design is to examine and give a consistent or better picture of the acquisition pattern of vocabulary knowledge in Thai EFL learners.

Keyword : Vocabulary Acquisition, Vocabulary Knowledge, Vocabulary Aspects, Receptive Vocabulary Knowledge, Productive Vocabulary Knowledge



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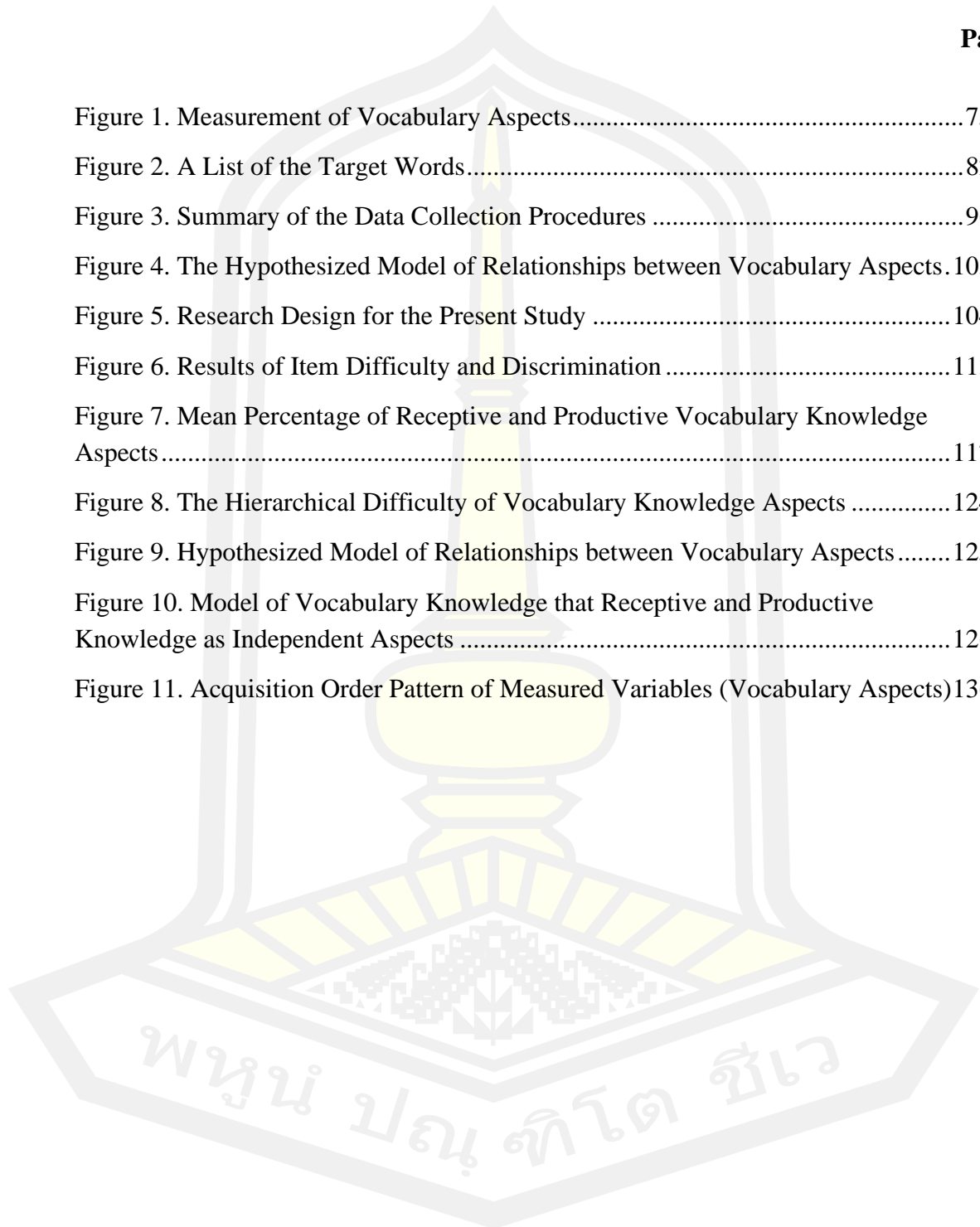
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CHAPTER I

INTRODUCTION

1.1 Research Background

Vocabulary knowledge is a complex construct that involves acquiring multiple vocabulary knowledge aspects (Henriksen, 1999; Read, 2000; Nation, 2013; Schmitt, 2014) and is an incremental learning process that occurs along a multi-aspect continuum (Coxhead, 2007; Milton & Fitzpatrick, 2014; Schmitt, 2000, 2010). That is, learners may have varying degrees of knowledge regarding different vocabulary knowledge aspects, from zero to partial to precise (Henriksen, 1999; Laufer, 1998; Schmitt, 2010). The extent of such knowledge applies to all learners, including native (L1) speakers, second language (L2) learners, and English as a Foreign Language (EFL) learners (Laufer & Goldstein, 2004).

Vocabulary knowledge is considered a crucial scaffolding mechanism for English language acquisition and achievement in both native and non-native speakers (e.g., Astika, 1993; Hu & Nation, 2000; Laufer, 1994; Laufer & Nation, 1995; Lee & Munice, 2006; Nation, 1998, 2013; van Zeeland & Schmitt, 2013), precisely English language skills (listening, reading, writing, and speaking) (e.g., Alqahtani, 2015; Moghadam, Zainal, & Ghaderpour, 2012; Nation, 2015). Krashen (1989, p. 25) remarked that “vocabulary knowledge appears to be a valid indication of language ability because learners typically use a dictionary rather than a grammar book.” Wilkins (1972, p. 97) further indicated that “nothing can be conveyed without vocabulary.” Nation (1998) argued that vocabulary learning is the most critical process in advancing learners’ language knowledge. The acquisition of sufficient vocabulary is crucial for effective English language use because learners cannot use the structures and functions if they do not have a rich vocabulary (Nation, 2013). Vocabulary knowledge indeed underpins all other language skills and fosters high-level language use.

However, in the domain of vocabulary acquisition, vocabulary knowledge is seen as the result of a lengthy and challenging learning process (e.g., Ellis & Beaton, 1993; Nation, 2013; Schmitt, 2008; Schneider, Healy, & Bourne, 2002). This process entails

the conceptualization of vocabulary knowledge in the acquisition, involving the complexity of various vocabulary knowledge aspects. Vocabulary researchers have found the multi-aspect construct and impediment of vocabulary knowledge, indicating that knowing a word should eventually encompass various kinds of linguistic knowledge ranging from pronunciation, spelling, and morphology to the knowledge of the word's syntactic and semantic relationships with other words in the language, involving knowledge of antonym, synonymy, hyponym, and collocational meanings (Chapelle, 1998; Haastrup & Henriksen, 2000; Henriksen, 1999; Meara, 1996; Nation, 1990, 2013; Read, 2000; Richards, 1976).

Various studies have attempted to conceptualize vocabulary knowledge. In 1976, Richards presented the first detailed components list and defined it as a range of interrelated aspects of knowledge, which Nation further advanced in 1990. Later, Nation (2001; 2013) proposed the most comprehensive vocabulary knowledge framework, which several vocabulary researchers have now accepted. This framework includes nine different aspects of a word: spoken form, written form, word part, form-meaning link, association, conceptual referent, grammatical function, collocation, and constraint on use. Each of these aspects is broken down into receptive and productive knowledge dimensions. Receptive vocabulary knowledge is defined as the ability to recognize the word form (Laufer & Goldstein, 2004; Nation, 2013; Mochida & Harrington, 2006), perceive the word meaning (Webb, 2008a), and provide the word synonym or translation in a learner's first language (Waring, 1997a; Webb, 2009). By contrast, productive vocabulary knowledge is defined as the ability to retrieve the word form and meaning (Laufer & Goldstein, 2004; Webb, 2008a) or to produce the word according to its L1 equivalent (Waring, 1997a; Webb, 2009).

Although Nation's list presents the most inclusive explanation of vocabulary knowledge to date and the detailed entirety of what learners must know, it is unspecified how different vocabulary aspects are acquired and fit together. Specifically, the framework does not mention any acquisition order, such as which aspects are typically learned before others or should be taught before others. This restricts its educational effectiveness because it is unclear how multiple aspects relate

to one another and how to prioritize them while teaching effectively. This leaves important questions unanswered, such as the relative contribution of the different aspects to the vocabulary knowledge construct (e.g., does the form-meaning link explain the majority of the variation in vocabulary?) and whether some aspects are generally acquired before some others (e.g., are the derivative forms of a word often achieved before its collocations?).

Vocabulary researchers have explored the acquisition and development of vocabulary knowledge to better understand the complex nature of this knowledge and its developmental learning process. It is precisely known that the various aspects of vocabulary 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 vocabulary acquisition process are still unknown clearly, particularly in terms of the various developmental rates for vocabulary 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 vocabulary knowledge in development have been fragmentarily investigated and have inconsistent results (Nation, 2013; Schmitt, 1995), but studies that examine vocabulary knowledge as a whole construct remain rare. However, the multi-aspect conceptualization of vocabulary knowledge and how different vocabulary 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 EFL context.

Studies in vocabulary acquisition have provided a vibrant description of work knowledge as a multi-aspect construct. They provide empirical evidence that vocabulary knowledge is commonly known as an incremental learning process (e.g., Schmitt & Meara, 1997; Sukying & Nontasee, 2022; Webb, 2020), and all vocabulary 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; 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 vocabulary 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. Vocabulary aspects develop more or less in an equivalent manner (González-Fernández & Schmitt, 2020). Furthermore, exposure to the English language influences vocabulary knowledge development and probably requires explicit instruction (Bubchaiya & Sukying, 2022; Magnussen & Sukying, 2021; Sukying, 2020; Webb, 2005, 2020; Yowaboot & Sukying, 2022).

Researchers have argued that vocabulary 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 learners 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 vocabulary knowledge and suggested that the production of vocabulary knowledge was likely more difficult than the reception of vocabulary 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 learners; 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 learners 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 vocabulary knowledge (Sukyning, 2017, 2018a, 2018b; Nontasee & Sukyning, 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 learners 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 vocabulary 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 vocabulary knowledge across multiple learning modes benefits overall vocabulary development than a single learning mode alone. Furthermore, Sukyning (2020) investigated vocabulary knowledge through morphological awareness instruction in Thai EFL university learners and suggested that deliberating instructional methods helped learners harness their vocabulary knowledge more successfully. Together, these prior studies point out that vocabulary knowledge is developed over exposure to multiple related aspects, raises questions about the impact of English vocabulary 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; Sukyning & Nontasee, 2022). Nontasee and Sukyning (2020, 2021), for example, explored the vocabulary knowledge acquisition within different word aspects, which were the reception and production of word part, form-meaning link, and collocation, in Thai learners and unveiled a positive relationship between vocabulary aspects. Specifically, it was shown that learners first acquire word part, followed by a 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 acquisition order of vocabulary aspects in different-grade learners and found a valid implication acquisition pattern. Yet, the different grades showed different patterns. These previous studies reveal the progression of vocabulary 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 vocabulary knowledge to theorize a precise acquisition pattern.

Similarly, González-Fernández and Schmitt (2020) studied the nature of the vocabulary knowledge construct within the various aspects [form–meaning link, derivative, multiple-meaning, and collocation (reception and production)] in Spanish EFL learners and clarified that the reception and production of vocabulary 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 vocabulary 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 vocabulary aspects. As González-Fernández and Schmitt studied the nature of vocabulary knowledge as a holistic construct and revealed clearly valuable details, this study, 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 vocabulary knowledge acquisition by exploring a different L1 group and assessing different types of vocabulary knowledge with different tests. More recently, González-Fernández (2022) further investigated the nature of L2 vocabulary knowledge by examining the hypothesis of how various vocabulary 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 vocabulary knowledge, which highlights the need for further refinement of the conceptualization of the construct. Therefore, this study replicates and extends the conceptualization of vocabulary knowledge as a multi-aspect, particularly in a Thai EFL context.

While vocabulary researchers have argued for the growth process of vocabulary knowledge, there is limited evidence to illustrate the acquisition order of vocabulary 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 vocabulary 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 vocabulary knowledge is yet to be developed. More particularly, this study is premeditated based on prior findings of multi-aspect vocabulary knowledge studies (i.e., González-Fernández, 2022; González-Fernández & Schmitt, 2020; Sukying & Nontasee, 2022) to prove the hypothesized concept of vocabulary knowledge in a Thai EFL context.

This study thus aims to gain deeper insight into the rich, multifaceted nature of vocabulary knowledge by investigating the vocabulary knowledge construct as a multi-aspect framework based on Nation's (2013) description. The current study first measures different vocabulary 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 study also examines the acquisition order of these aspects and models the relationships between the various vocabulary aspects. This study advances our comprehension of the role of different vocabulary aspects and the nature of the vocabulary knowledge construct. Also, it posits the conceptualization of

vocabulary aspects as the primary acquisition order configuration and their relationships in EFL learners in Thailand.

1.2 Research Purposes and Questions

This study intends to explore the construct of vocabulary 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 study aims to measure different vocabulary aspects, examine these aspects' acquisition order, and then model the relationships between various vocabulary aspects. The following research questions were formed to guide the research:

1. What is the acquisition order of different vocabulary knowledge aspects in Thai EFL high school learners?
2. What is the relationship model of the various vocabulary knowledge aspects to acquire a word in Thai EFL high school learners?

1.3 Scope of the Present Study

The present study explored the overall nature of the vocabulary knowledge construct as a multi-aspect construct by examining the acquisition order and modeling the relationships between vocabulary aspects. The objective of the study was to better understand the acquisition and development of the vocabulary knowledge construct based on the vocabulary knowledge framework proposed by Nation (2013). The participants were Thai EFL senior high school learners at a local high school under the government university administration in the northeast of Thailand, who had received English lessons for at least ten years of systematic schooling, could all use high-frequency vocabulary, and had the ability to continue their English studies at a higher level of academic education. A cross-sectional research design measured learners' receptive and productive vocabulary knowledge at a single point in time. Based on vocabulary testing theory (Read, 2000), different tests were used to measure different lexical knowledge. While specific research instruments for vocabulary testing were developed, no attempt was made to establish general and practical

receptive and productive vocabulary knowledge measures that might be used for other types of research or pedagogical purposes.

1.4 Significance of the Present Study

The present study provided a better comprehension of the nature of vocabulary acquisition and development, particularly in Thai EFL senior high school learners. More specifically, it provided insights into the roles of vocabulary aspects in vocabulary acquisition and development. This study gathered empirical evidence for the theoretical vocabulary construct proposed by Nation (2013). The findings related to the relationships among vocabulary aspects contributed to describing vocabulary knowledge construct as a network of interrelated components. The methodological design provided empirical evidence for the vocabulary acquisition process as a systematic multi-aspect framework and revealed a preliminary developmental pattern for different aspects of vocabulary knowledge.

The present study also provided a better perspective on measuring vocabulary knowledge. It highlighted the importance of the instruments used to measure learners' vocabulary knowledge and discussed the theoretical constructs of the vocabulary instruments used. In addition, this study revealed the extent to which the research instruments evoked these theoretical constructs. The present study further served to remind future vocabulary researchers and test designers that the design of a vocabulary instrument required both theoretical-based analysis and empirical evaluation to generate a vibrant and reliable interpretation of research findings retrieved from test performance.

Furthermore, the present study provided critical information regarding the conceptualized model of vocabulary knowledge, which was the hierarchy of L2 vocabulary knowledge in acquisition (acquisition order). The results might serve as a primary model of vocabulary acquisition. As such, the findings of this study might facilitate vocabulary teaching and learning in English language instruction and might inspire the development of new activities and curriculum designs, particularly in an EFL context.

1.5 Definitions of Terms

Vocabulary aspects in the present study refer to various vocabulary knowledge components that learners need to know in Nation's (2013) word knowledge framework [word part, written form, form-meaning link, association, collocation, and grammatical function (reception and production)].

Acquisition order is the natural conceptualization of the aspects of vocabulary knowledge, indicating that the hierarchical pattern of the difficulty in acquiring vocabulary knowledge aspects, i.e., word part, written form, form-meaning link, association, collocation, and grammatical function, both receptively and productively, in learners.

Receptive vocabulary knowledge refers to the ability to recognize and know a word, at least to some extent, based on the test contexts in the knowledge of written form, word part, form-meaning link, association, collocation, and grammatical function.

Productive vocabulary knowledge is the ability to recall and retrieve a word and use it in test contexts in the knowledge of written form, word part, form-meaning link, association, collocation, and grammatical function.

Thai EFL senior high school learners refer to Grade 10, 11, and 12 learners at a high school in northeastern Thailand.

1.6 Organization of the Thesis

There are six chapters to this thesis. The current chapter provides the readers with the overall picture of the study. It gives the readers the rationales and motivation to carry out the present research.

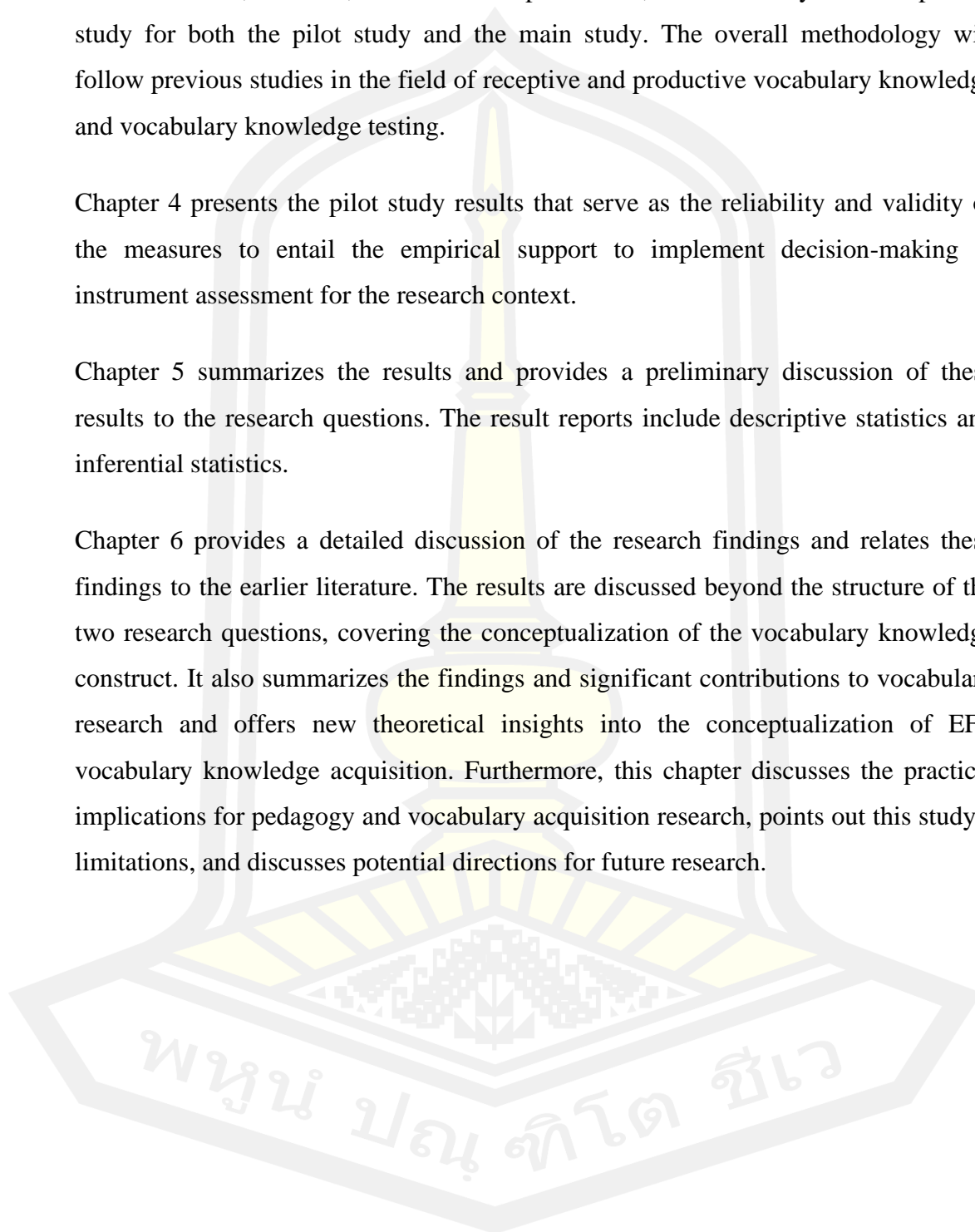
Chapter 2 reviews the theoretical framework for the present study. First, it describes the construct of vocabulary knowledge as a multi-aspect concept and defines receptive and productive knowledge. Then the chapter critically reviews the relevant studies on multidimensional vocabulary acquisition. At last, some commonly used instruments measuring receptive and productive vocabulary knowledge are censoriously reviewed.

Chapter 3 outlines the research methodology. The chapter describes in detail the instrumentation, methods, data collection procedures, and data analysis of the present study for both the pilot study and the main study. The overall methodology will follow previous studies in the field of receptive and productive vocabulary knowledge and vocabulary knowledge testing.

Chapter 4 presents the pilot study results that serve as the reliability and validity of the measures to entail the empirical support to implement decision-making in instrument assessment for the research context.

Chapter 5 summarizes the results and provides a preliminary discussion of these results to the research questions. The result reports include descriptive statistics and inferential statistics.

Chapter 6 provides a detailed discussion of the research findings and relates these findings to the earlier literature. The results are discussed beyond the structure of the two research questions, covering the conceptualization of the vocabulary knowledge construct. It also summarizes the findings and significant contributions to vocabulary research and offers new theoretical insights into the conceptualization of EFL vocabulary knowledge acquisition. Furthermore, this chapter discusses the practical implications for pedagogy and vocabulary acquisition research, points out this study's limitations, and discusses potential directions for future research.



CHAPTER II

LITERATURE REVIEW

This chapter introduces the construct of vocabulary knowledge and reviews existing research into vocabulary knowledge acquisition and development. It also reviews the instruments used to measure different aspects of vocabulary knowledge. The chapter will begin with the construct of vocabulary knowledge and its aspects, followed by definitions of the reception and production of vocabulary knowledge and the acquisition of vocabulary knowledge. Then it will review the previous studies on the acquisition of vocabulary knowledge. The final section of the chapter will review some instruments for measuring different aspects of vocabulary knowledge. The rationale for selecting the instruments used will be discussed based on contextual research purposes.

2.1 Construct of Vocabulary Knowledge

Vocabulary knowledge, which is referred to as lexical knowledge (Laufer & Goldstein, 2004; Schmitt, 2014), and word knowledge (Laufer, 1990; Nation, 2013), can be defined variously, hinging on specific purposes of the study (Nation, 2013). Some researchers have defined it as a continuum (Faerch, Haastrup, & Phillipson, 1984; Henriksen, 1999; Palmberg, 1987), and others have described it as a multi-sub-knowledge construct (Coxhead, 2007; Laufer, 1990; Nation, 1990, 2001, 2013; Richards, 1976). Others argue that knowing a word entails the receptive-productive knowledge process (Laufer & Paribakht, 1998) and involves various degrees, starting with a superficial familiarity with the word and ending with the ability to use it in context (Ellis, 2013; Schmitt, 1998; Laufer & Goldstein, 2004). Vocabulary is posited as a developmental continuum of knowledge. It is not an ‘all-or-nothing’ phenomenon (Laufer, 1998), but it starts from the unknown to partially known and develops to a fully mastered level (Laufer & Goldstein, 2004; Zhong, 2012a).

The continuum perspective of vocabulary knowledge is defined as a range of interrelated aspects of knowledge. First, Richards (1976) proposed eight components to knowing a word: the spoken form of a word; the written form of a word; the grammatical behavior of the word; the collocational behavior of the word; the frequency of the word; the stylistic register constraints of a word; the conceptual meaning of a word; and the associations a word has with other related words. Later, Palmberg (1987) clarified two poles of the incremental continuum, including the concept of 'real' and 'potential' that originated from Berman, Buchbinder, and Beznedezych (1968, cited in Palmberg, 1987). Real vocabulary is referred to the words that learners have learned. Potential vocabulary is referred to the possibility of learning the words by encountering them even if they are not known.

Next, Laufer (1990) specified that vocabulary knowledge includes form, word structure, syntactic pattern, meaning, lexical relations, and common collocations. The word structures are referred to as morphological knowledge of a word, and lexical relations are reflected in the relations of the words with their synonyms, antonyms, and hyponyms. The syntactic pattern is related to the use of a word in phrases or sentences. Further, Henriksen (1999) offered a three-dimension vocabulary continuum to reflect the progressing process of knowing a word. First, a partial-to-precise knowledge dimension indicates the degree of meaning comprehension. Second, a depth-of-knowledge dimension represents the knowledge association of a word. Finally, a receptive-productive dimension reflects learners' control and access to word knowledge. Plus, Nation (2001: 2013) posited a comprehensive list of vocabulary aspects. Knowing a word includes the 18 sub-knowledge aspects within the receptive-productive learning process.

Table 1. Aspects of Vocabulary Knowledge (Nation, 2013, p. 49)

Form	spoken	R	What does the word sound like?
		P	How is the word pronounced?
	written	R	What does the word look like?
		P	How is the word written and spelled?
	Word parts	R	What parts are recognizable in this word?
		P	What word parts are needed to express the meaning?
Meaning	Form and meaning	R	What meaning does this word form signal?
		P	What word form can be used to express this meaning?
	Concepts and referents	R	What is included in this concept?
		P	What items can the concept refer to?
	Associations	R	What other words does this make people think of?
		P	What other words could people use instead of this one?
Use	Grammatical functions	R	In what patterns does the word occur?
		P	In what patterns must people use this word?
	Collocations	R	What words or types of words occur with this one?
		P	What words or types of words must people use with this one?
	Constraints on use	R	Where, when, and how often would people expect to meet this word?
		P	Where, when, how often can people use this word?

Notes: R = receptive knowledge, P = productive knowledge

To date, Henriksen's (1999) framework and Nation's (2013) list are widely accepted in the exploration of the vocabulary knowledge construct. Indeed, they are partially overlapped. Form and meaning knowledge in Nation's (2013) framework is relatively similar to the partial-precise dimension in Henriksen's (1999) model that both perspectives highlight the importance of mapping form to meaning in vocabulary knowledge. Clark (1993) also indicated this process as mapping written form or phonological form to the meaning. The form and meaning process is regarded as the initial stage of vocabulary acquisition (Elgort, 2011; Henriksen, 1999; Jiang, 2002; Miller, 1999) and the fundamental knowledge (Laufer & Goldstein, 2004). The retrieval of the word for use depends on the strength of the association between form and meaning knowledge (Nation, 2013). Jiang (2002) further described that the form and meaning connection is defined as the process of vocabulary learning by L2 learners; for example, they usually use the L1 meaning or concepts with the L2 form in the process of their vocabulary learning.

Nation does not specify the extent of depth in vocabulary knowledge, but the construct does cover a depth concept. The conceptualization of depth by Henriksen (1999) and Meara (1996a, 1996b) described the vocabulary acquisition process in the

depth dimension as a network-building process. As illustrated, the conceptualization for depth of vocabulary knowledge lies in the connections or links between words and any connections between the new words and the acquired words. The connection between two known words should be related to certain knowledge from different vocabulary aspects, especially and fundamentally on form and meaning. That is, language learners have mastered the aspects of knowledge at an individual word level.

The basic perception of their meaning should be acquired to produce a simple link between words. Another more complicated example in producing the link between contract and agreement, a learner has first to understand the meaning of the words; second, to know their grammatical functions; and third, in the association task, to know their constraints of use. Indeed, the concept of network building is a comprehensive understanding of multiple aspects and returns to the mastery of different aspects of vocabulary knowledge.

In terms of vocabulary use, Henriksen clarified the dimension of the continuum from receptive to productive knowledge and viewed receptive and productive vocabulary use as an individual dimension from the comprehension of vocabulary knowledge (partial-precise and depth of vocabulary knowledge). While Nation considered word use as a dimension of knowing a word, and each of the word aspects can be learned receptively and productively, such as incorporating the receptive-productive dimension into every aspect of vocabulary knowledge makes it more comprehensible.

Melka (1997) hypothesized about the transfer from receptive to productive vocabulary knowledge that when a learner acquired a word receptively but not yet productively, some word features could have been productively known. The features could refer to any of the word aspects in Nation's (2013) framework. Therefore, the 'continuum' nature of receptive and productive knowledge is applied to all aspects. Put simply, each aspect of vocabulary knowledge can be positioned at a certain point in the receptive and productive continuum for any one of the language learners. Furthermore, Qian (2002) pointed out that the acquisition of these word properties has much higher requirements than size, in which learners may only have some superficial knowledge of the word meaning. Indeed, exploring various aspects of

vocabulary knowledge along receptive and productive dimensions better explains vocabulary knowledge acquisition.

Exploring vocabulary knowledge has been interested by researchers in how words are stored, activated, processed, and retrieved by language users (Aitchison, 2012; Elman, 2004; Meara, 2009; Wolter, 2001). Read (2004a, 2004b) recommended that the comprehensive depth concept will direct the assessment to capture all aspects of vocabulary knowledge in the vocabulary knowledge construct. The present study thus employs the comprehensive concept of vocabulary knowledge proposed by Nation (2013). It is relatively suitable for the research setting in exploring the acquisition order and relationships between multi-aspects of vocabulary knowledge. Nation's (2013) framework is widely accepted by most vocabulary researchers and is considered the most comprehensive and exhaustive description of vocabulary knowledge to date. The following section presents the different aspects of vocabulary knowledge constructed by Nation (2001: 2013).

Although Nation's list presents the most inclusive explanation of word knowledge to date and the detailed entirety of what learners 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.

2.1.1 Aspects of Vocabulary Knowledge

The aspects of vocabulary knowledge are described based on the word knowledge framework proposed by Nation (2001: 2013). Nation indicates that knowing a word includes three main continuum aspects: form, meaning, and use, and all forms of vocabulary knowledge require both receptive and productive knowledge of knowing. These aspects of reception and production, classified into 18 aspects, are then explained in detail.

The word form includes spoken forms, written forms, and word parts knowledge. The spoken form of a word represents the ability to recognize a word when it is pronounced and is referred to as receptive knowledge of the spoken form; on the other hand, the ability to create it in a speech to express meaning is referred to as productive spoken form knowledge. Recognizing a word separated from other words may be difficult in speech because the words are run together and not separated by gaps. In addition, speech is usually only heard once, with a limited chance to go back and review the speech. Instead, a listener may rely on context and accurate prediction of meaning in streams of sounds that may have several possible interpretations (Brown & McNeill, 1966).

Receptive knowledge of the written form, written word reception, refers to the ability of the reader to recognize words accurately and quickly when they are encountered, while productive knowledge of the written form, written word production, is the ability to write words correctly. Nation (2013) defined spelling as the process of converting sounds into graphemes. However, this may be difficult when more than one language is involved, and these languages do not share the same alphabet. Alternatively, when a new word is encountered, the learner must comprehend its meaning, including the context and morphology of the word.

The aspect of word parts is regarded as morphemes. Morphological knowledge is made up of numerous morphemes. In English, word parts are defined as affixes, including prefixes and suffixes (Nation, 2013). Affixes attached to a base form might add to the word's overall meaning. Although word parts knowledge is rarely explicitly taught, language learners typically acquire word parts implicitly through grammatical knowledge. Recognizing word parts is receptive knowledge, and expressing a given meaning is productive knowledge. This knowledge might benefit vocabulary knowledge learning (Nation, 2013; Thornbury, 2002).

The word meaning includes the receptive and productive aspects of form-meaning links, conceptual referents, and word associations. The aspect of form-meaning links knowledge consists of the reception and production of a word. An early stage of learning a new word is understanding the relationship between word form and

meaning. Involving morphemes to convey semantic information, L2 learners create this link in part based on their morphological knowledge of the new word (Henderson, 1982); for example, before being able to construct a form of a word, learners must first know its meaning (Laufer & Goldstein, 2004; Schmitt, 2000). Receptive knowledge of the form-meaning link would involve linking an L2 form to the concept and meaning, while productive knowledge of the form-meaning link would require a link in the other direction, that is, the meaning or concept to its form in the L2.

Conceptual reference knowledge is also included in the meaning of a word. Concepts and referents are knowledge and meaning networks that have been formed in L1 and do not need to be re-formed and reconstructed for L2 knowledge. However, the creation of concepts and referents in L1 takes considerable time. Learners may not have wholly acquired this skill in L1 before attempting to add it in L2 (Nation, 2013). These words may share the same form and part of speech and are sometimes derived from different sources, Old Norse and Latin. Words that have the same form but have unrelated meanings are called homonyms (the same written and spoken forms), homographs (the same written form but different spoken forms), and homophones (the same spoken form but different written forms).

The two last word meaning aspects are receptive and productive knowledge of word association. The aspect of word association is the ability to recognize and recall the associated word (Nation, 2013). Word associations are the semantic relationships that exist between a large number of English words (Miller & Fellbaum, 1991). It is necessary to differentiate between parts of speech to describe the organizational structure of the word. Some conventional associations, such as opposites, synonyms, and hyponyms, can be established through deliberating learning, but there is likely little value in teaching them (Webb, 2020). The most pervasive and vital relationship is synonymy, but nouns, adjectives, and verbs, each use preferred semantic relations and have their own kind of organization.

Finally, the word use aspect, also known as the function of a word, includes the reception and production of the grammatical functions, collocations, and constraints on use knowledge. The grammatical function aspect, including receptive and

productive knowledge, is frequently based on parallels between L2 and L1 and similarities in the grammatical role of words with related meanings. If the grammatical patterns in L1 and L2 are similar, the learning burden will be reduced. Similarly, if words with associated meanings, such as run and walk, follow similar patterns, the learning burden of one of these words will be lighter because prior knowledge of the other word will be a useful guideline.

Word collocation includes the reception and production ability and is typically regarded as an aspect of “idiomatic” English. Some expressions produced by L2 or EFL learners may be described as “grammatical” but not necessarily as “idiomatic.” Collocations represent two or more words that are typically used together. Such combinations sound “natural” to native English speakers and are judged “correct,” whereas other combinations sound “unnatural” and are deemed “wrong.” The collocated words are classified as lexical or grammatical dimensions. Lexical collocation is the combination of two or more content words, such as nouns, verbs, adjectives, and adverbs, such as do business, make mistakes, heavy rain, look carefully, and definitely wrong. Grammatical collocation refers to the association of these words with a particular preposition, such as wake up, relate to, insist on, fascinated in, and happy with.

The constraint on use requires the ability to understand and use the words and involves several factors that limit where and when specific words can be used (Nation, 2013). How the word is translated into the first language, and the context in which it is employed can impose restrictions on its usage. In some languages, the words used to refer to people are severely constrained, particularly in indicating the speakers’ relationship to the person to whom they refer. Learners may anticipate this and be especially cautious in this aspect when using a second language (Henriksen, 2013).

In conclusion, form knowledge encompasses the ability to identify the phonological and morphological features of a word in both written and spoken modes. Meaning knowledge entails a learner having insight into form and meaning, concepts and referents, and word associations. Finally, use knowledge describes the places in which

each word can be used and the company the word is likely to keep; for example, if a word is an adjective, it will generally be followed by a noun, or it follows the verb to be. If it is a noun, it is then likely to be preceded by an article. Alternatively, some lexical items are likely to occur together, while others are not (e.g., be familiar with or similar to). Accordingly, a learner must understand the unique behavior of a particular word since its use may sometimes entail inappropriate grammatical functions. A thorough perception of a word necessitates comprehending all nine aspects of word knowledge, both receptively and productively.

Nonetheless, Nation (2013) points out that different word aspects are acquired in various stages and at different rates. For example, learners may gain knowledge of some word aspects, such as its spoken and written forms, before or after understanding its meaning. Learners may learn a single meaning in a context and then gradually acquire other meanings. The word use aspect may be the most difficult knowledge to master because the learner must first need to complete other aspects of word knowledge (Nation, 2013; Schmitt, 2010). This kind of word knowledge, such as register, pragmatic constraints, and collocations, may demand basic information of lexical and grammatical knowledge. Henriksen (1999) also describes the incremental development of vocabulary knowledge in that learners know any word aspect, which ranges from zero to partial to precise; that is, all word knowledge aspects go on a continuum rather than being known versus unknown. The extent of such knowledge applies to all learners, including native (L1) speakers and second language (L2) learners (Laufer & Goldstein, 2004).

Therefore, the six-word aspects [written form, word part, form-meaning link, association, grammatical function, and collocation (both in receptive and productive knowledge)] are measured in the present study based on the consideration that represents the entire construct of knowing a word, starting from knowing that a given form is an existing word to full mastery of all aspects of a word (Laufer, 1998; Nation, 2013; Schmitt, 2010). Read (2004a, 2004b) recommended that the comprehensive depth concept would direct the assessment to capture all aspects of vocabulary knowledge in Nation's (2001: 2013) vocabulary knowledge framework.

The following section describes receptive and productive vocabulary knowledge definitions concerning their operationalization.

2.1.2 Definitions of Receptive and Productive Vocabulary Knowledge

Laufer and Goldstein (2004) and Nation (2001, 2013) indicate that knowing a word has been dissected into receptive and productive knowledge. Receptive and productive vocabulary knowledge is defined differently depending on the research purposes (Read, 2000). Many researchers have proposed various definitions of these two dimensions.

Receptive and productive components are the third dimension of vocabulary knowledge proposed by Henriksen (1999). In contradiction to the other two dimensions that are associated with the understanding of vocabulary knowledge, the receptive-productive dimension indicates the ability to acquire and then use vocabulary knowledge. Receptive and productive vocabulary knowledge is also known as passive and active vocabulary (Corson, 1995; Laufer, 1998; Laufer & Paribakht, 1998; Meara, 1990), recognition and recall (Schmitt, 2010), or comprehension and production (Melka, 1997). The term “passive” refers to listening and reading, and “active” refers to speaking and writing. They can be used interchangeably for receptive and productive knowledge. The terms ‘meaning recognition’ and ‘meaning recall’ are additionally used for receptive knowledge, and ‘form recognition’ and ‘form recall’ are used for productive knowledge (Schmitt, 2010). Indeed, receptive vocabulary use entails perceiving a word’s form while listening and reading and retrieving its meaning. Productive vocabulary use entails intending to express meaning through speaking or writing and retrieving and producing the proper spoken and written word form. Therefore, there is a need to specify these terms and propose a generally agreed conceptualization of what ability of vocabulary use should be referred to by receptive and productive vocabulary knowledge (Melka, 1997; Schmitt, 2010). The distinction between comprehension and production is defined differently in different studies. The differentiation between receptive and productive vocabulary knowledge is generally accepted by vocabulary researchers and is defined differently in different studies.

The receptive aspect is defined as receiving input from others through listening or reading and trying to comprehend it, while the productive aspect is producing language forms by speaking and writing to convey messages to others (Laufer & Goldstein, 2004; Nation, 2001, 2013). In most cases, the validity of the receptive versus productive differentiation is determined by the contrast between receptive skills, such as listening and reading, and productive skills, such as speaking and writing (Crow, 1986).

Laufer and Paribakht (1998) point out that one of the most important aspects of learning vocabulary is the interaction between receptive and productive vocabulary knowledge. Receptive vocabulary knowledge is used to understand a word, while productive vocabulary knowledge is used to produce a word (Henriksen, 1999; Zareva, Schwanenflugel, & Nikolova, 2005). Gairns and Redman (1986) define receptive vocabulary knowledge as language items that can be recognized and comprehended in the context of reading and listening information and productive vocabulary knowledge as language items that learners can recall and use effectively in speech and writing.

Nation (1990, 2013) clarifies that receptive knowledge is related to listening and reading activities that involve the awareness of the form and meaning of the word, while productive knowledge is related to speaking and writing in the context. More specifically, receptive and productive vocabulary knowledge in relation to language use; as demonstrated, receptive vocabulary use involves perceiving the word form and retrieving the word meaning in listening or reading, and productive vocabulary use is the capability of retrieving and producing the appropriateness of the spoken and written form of a word in expressing meaning in speaking or writing. The receptive and productive dimensions represent a continuum in vocabulary learning. Indeed, receptive and productive skills are interconnected; receptive skills can enhance productive use, while productive skills can be fostered in receptive skills (Corson, 1995; Nation, 2013). Learners do not enable to master all features of word knowledge simultaneously. Rather, learners acquire each aspect of word knowledge at different degrees at any point in time. Receptive learning and use precede before productive

learning and use. Productive learning is more difficult because new spoken or written output patterns must be mastered (Crow, 1986). Learners may only need to know a few distinctive features of the form of the item for receptive use. Productive use demands more accuracy in the form of vocabulary knowledge. Furthermore, productive knowledge encompasses all of the knowledge required for receptive use (DeKeyser & Sokalski, 1996). There is evidence that receptive and productive learning requires particular practice (Laufer & Goldstein, 2004).

Henriksen (1999) distinguishes between receptive and productive vocabulary knowledge in terms of measurement tasks, implying that receptive vocabulary is typically measured by recognition tasks such as multiple-choice tests. In contrast, productive vocabulary knowledge is regularly measured by retrieval tasks such as interviews, description, translation, or retelling. Melka (1997) attempted to define the distance between receptive and productive vocabulary knowledge from the mental lexicon perspective. The distinction between receptive and productive knowledge may be located in the information stored in the learners' mental lexicon. Some incomplete information about a word could evoke receptive ability, yet incomplete information could not stimulate productive ability. It implies that there may be a threshold along the receptive and productive vocabulary knowledge continuum and that receptive words may be translated to productive use when learners reach this barrier. Melka (1997) suggests that recognition is an important stage that reflects receptive ability and might entail varying degrees of recognition. When the level of recognition reaches a specific degree, indicating mastery of receptive vocabulary knowledge, productive vocabulary knowledge occurs, resulting in successful retrieval of the word. Melka emphasized that the transition from receptive to productive vocabulary knowledge is not clear-cut because when a feature of the word crosses over from receptive to productive use along the continuum, some other receptively known features of the word are incomplete to activate the word for productive use. For example, even if the meaning of a newly acquired word, such as eliminate, has progressed to the productive use level, collocation knowledge, such as eliminate waste, may still be at the receptive stage.

Meara (1997, 2009), on the other hand, does not divide between receptive and productive vocabulary knowledge when vocabulary knowledge is viewed as a mental lexicon. Meara hypothesized that a word is ready to be activated for productive use because one or more of the linkages to this word facilitate retrieving the word. Meara's hypothesis helps to explain a circumstance in which a person may experience a tip-of-the-tongue condition while searching for a word but failing to retrieve it. However, the word may suddenly come to mind later due to a certain context activating it. Meara (1990) hypothesized that words regarded as receptively acquired could be triggered by external stimulation, while internal stimuli can only activate words available for productive use. According to Meara's (1990) proposal, a target word comes to mind due to the context stimulating specific receptively acquired words that relate to this target word, making it available for productive use.

Conversely, the tip-of-the-tongue state might be induced by a lack of connection between the target word and certain other receptive words prompted by the context at the time. Meara suggests that only an internal relationship exists between receptively acquired words and the target word activated for productive use. Meara (1990, 1997, 2009) identified the differences between receptive and productive vocabulary knowledge as the number of connections the target word has with other words. The more links a target term has to other words, the more likely and easily it will be transferred for productive use. Meara's assumption explains not only why a word is sometimes ready for productive use in some contexts and sometimes not in others but also why some learners require minimal features of a word to master it productively while others may require more knowledge about the word to generate it.

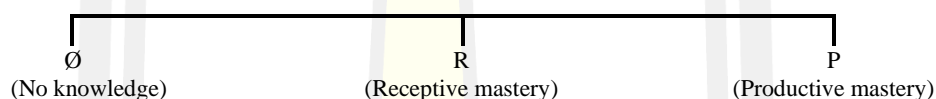
Meara and his colleagues' mental lexicon viewpoint on vocabulary knowledge (Meara & Wolter, 2004; Meara, 1997, 2007, 2009; Wilks & Meara, 2002) used a simple concept of word connections to represent a complicated construct of vocabulary knowledge. Language learners' and users' word association behavior may reveal a number of valuable information about what they know about words. Meara (2009) conceded that it is difficult to "exploit this richness" that the word association can generate. Zareva (2005) acknowledged this difficulty and proposed that the

association measures “need to be re-examined in an assessment context” if their potential to be uncovered and employed as valid instruments to represent learners’ complex vocabulary knowledge is to be realized. Furthermore, Webb (2008a, 2008b) proposed that “knowing learners’ receptive vocabulary size gives teachers an indication of whether those learners will be able to comprehend a text or a listening task, whereas knowing their productive vocabulary size gives some indication of the degree to which learners will be able to speak or write.”

Jiang (2000) differentiated the definition between receptive and productive vocabulary knowledge in relation to L2 vocabulary acquisition, indicating semantic transfer and growth in L2 vocabulary acquisition. From this viewpoint, receptive vocabulary knowledge for L2 learners is the recognition of a word’s form and linking it to the equivalent L1 translation. In contrast, productive vocabulary knowledge for L2 learners is the retrieval of the L2 word form based on conceptual or semantic comprehension in the L1. Specifically, if L1 and L2 are similar, the error rate in the receptive and productive use of the L2 word will be diminished (Jiang, 2000, 2004a, 2004b). Therefore, translation from L1 to L2 and L2 to L1 is used to define receptive and productive vocabulary knowledge (Waring, 1997a, Webb, 2009).

To summarize, receptive vocabulary knowledge is defined as the ability to recognize the word form (Laufer & Goldstein, 2004; Nation, 2013; Mochida & Harrington, 2006), perceive the word meaning (Webb, 2008a), and provide the word synonym or translation in a learner’s first language (Waring, 1997b; Webb, 2009), whereas productive vocabulary knowledge is defined as the ability to retrieve the word form and meaning (Laufer & Goldstein, 2004; Webb, 2008a), or to produce the word according to its L1 equivalent (Waring, 1997b; Webb, 2009). Restriction: All of the definitions of receptive and productive vocabulary knowledge discussed herein constrain receptive and productive vocabulary knowledge in the word aspects of form and meaning (Zhong, 2014, 2018). Thus, the present study defines receptive vocabulary knowledge as the ability to recognize and know a word, at least to some extent, and productive vocabulary knowledge as the ability to recall, retrieve, and use it in context.

The first point is about understanding many different aspects of vocabulary knowledge and how they relate to one another. This point is mainly concerned with the acquisition, specifically how to enhance student knowledge to a more advanced productive level. There is plenty of evidence, along with the teacher's experience, to demonstrate that receptive mastery of a lexical item which is the ability to comprehend it while listening or reading, is typically stronger than productive mastery referring to the ability to produce it in one's own speech or writing (Schmitt, 2019). Almost all studies incorporating receptive and productive measures indicate greater receptive scores (e.g., Laufer & Goldstein, 2004; Webb, 2005). However, most studies just report the receptive and productive scores without considering their relationship. Using a continuum-based illustration, the interrelationship may be shown in basic terms (Meara, 1997).



It seems to be believed that the intervals (i.e., learning burden) between \emptyset to R and R to P are roughly similar for most words, as illustrated above. It also may be believed that the main learning occurs in the first instance of learning the word to receptive mastery and that productive mastery follows without too much difficulty, as shown below.



According to prior research, acquiring most words to receptive mastery is relatively uncomplicated; the actual problem is increasing such knowledge to productive mastery.



Based on Schmitt (2014), it is not difficult to comprehend why this is the case. To understand a word while reading, it may be sufficient to recognize the spelling of a word and recall its meaning. All or most of the other word knowledge components

(e.g., collocation and derivative form) are already presented in the text and may or may not be used to enhance comprehension. However, when writing, a person must be aware of and generate all of the various components spontaneously and without prompts. The same is true for listening and speaking.

The interface between these two aspects of vocabulary knowledge may appear difficult to describe and relate to one another. Melka (1997) pointed out that a critical factor would be to establish how familiarity reaches the point that knowledge is no longer receptive but productive and sought to break down the distance between reception and production into four stages: imitation or reproduction without assimilation, comprehension, reproduction with assimilation, and production. The pattern from receptive to productive vocabulary knowledge is not clear and neat, and in a few cases, production began before the complete reception of the word. This reflected the notion that they are not watertight compartments that overlap and interact. The argument that the concepts belong to two distinct systems should be discarded in favor of visualizing the gap between receptive and productive as a line, a continuum of knowledge. The assumption is that the gap between the reception and production of vocabulary may therefore be decreased by enhancing knowledge of reception or increasing the range of the reception of the target words.

2.2 Acquisition of Vocabulary Knowledge

Paul Meara noted the lack of an overall vocabulary acquisition theory in 1983, and this remains the case today (González-Fernández & Schmitt, 2020; Nontasee & Sukying, 2021; Schmitt, 2008). Moreover, various theories have addressed only a part of vocabulary aspects in vocabulary learning. The Revised Hierarchical Model (Kroll & Stewart, 1994) proposed, for example, that the psycholinguistic approach to L2 meaning begins with L1 translation equivalents. Ellis (2002) examined how frequency influences language acquisition in various ways, including individual words and formulaic language. Brown and Payne (1994, as cited in Hatch and Brown, 1995) suggest a five-step model of vocabulary learning, although it only addresses form and meaning. In fact, few existing theories and models have attempted to explain how basic form-meaning links are formed (sometimes about L1 lexicon entries). However,

there are still no explanations for how the different components of lexical mastery are developed. This is partly due to the fact that vocabulary knowledge is still an incredibly complicated construct that defies straightforward explanation. This comprises a huge number of individual words with their inflections, derivatives, and formulaic sequences. Each lexical item has unique features that may make it easier or more difficult for a specific learner to acquire, with L1 being a major factor (Laufer, 1997). It is likely difficult to construct an explanation of acquisition that can accurately describe how each intrinsically distinct lexical item is acquired by learners of different L1s (Schmitt, 2019).

Additionally, the most well-known and extensively utilized framework is Nation's (2013) breakdown of vocabulary knowledge into nine aspects of vocabulary knowledge. The framework has been conducive in explaining the whole of what learners must know but makes no mention of any hierarchical ordering, such as which components are typically learned before others or should be taught before others. This restricts its educational effectiveness because it is unclear how the many components relate to one another and how to effectively prioritize them while teaching. Indeed, vocabulary knowledge acquisition and development is not an "all-or-nothing matter" (Meara, 1982, cited in Palmberg, 1987) because it actually occurs on a continuum from unknown to known while the paradigmatic and syntagmatic features of the words are simultaneously learned. The further learners progressed along the continuum, the better they knew a word.

Without a doubt, vocabulary knowledge acquisition necessitates varying levels of comprehension. For example, acquiring a new word begins with recognizing the word's form in the target language, followed by phonological awareness, and then moving to a hazy comprehension of the word's meaning. This partial knowledge of the word progresses gradually along the continuum to precise comprehension, referred to as the knowledge continuum (Henriksen, 1999). Schmitt (2000) found evidence for these levels of knowledge in a study of university-level L2 learners. Rather than being known versus unknown, knowledge of any lexical feature progressed along a continuum from zero to partial to precise as the first dimension.

The second dimension involves knowing the various components of word knowledge as defined by Richards (1976), Nation (2001; 2013), Schmitt (2000), Meara (1997), and Thornbury (1997). This dimension concerns the development of the semantic network, which entails being aware of the words' morphologic, syntactic, and collocation patterns. It denotes the learner's ability to make connections with related syntagmatic and paradigmatic lexical items. During learning the various items from comparable lexical sets, the knowledge of the first dimension progresses toward precise comprehension—the learner's vocabulary knowledge progression results in the learner's capability to store and retrieve the words. The third dimension, the control continuum, relates to control over the learned vocabulary in terms of comprehension and production of the words in the required contexts. The range of declarative knowledge of a lexical item determines the extent of control over that word in terms of retention and accessibility. As a result, the three dimensions of vocabulary are inextricably linked. Knowledge of the particular word expands as it interacts with other words and their interactions with others.

Alternatively, the acquisition of vocabulary knowledge can be indicated as the ability to recognize and produce a word by understanding the conceptual roles of vocabulary knowledge, including different vocabulary aspects. Vocabulary aspects result from a long and complex learning process (e.g., Ellis & Beaton, 1993; Nation, 2013; Schmitt, 2008; Schneider, Healy, & Bourne, 2002). This process involves the learnability of a word or the ease or difficulty of learning a word (Bogaards & Laufer, 2004). Laufer (2013) reveals that knowing the specific construction of vocabulary knowledge is vital for understanding vocabulary difficulty. For example, various interrelated aspects of vocabulary knowledge may lead the word to be learned with difficulty and incompletely, especially for L2 learners. The ease or difficulty of acquiring a word thus depends on the natural role of the word itself. Indeed, comprehending the critical roles and functions of vocabulary aspects can help to recognize and/or recall a word more efficiently and enhance vocabulary growth.

Research on a second language (L2) vocabulary acquisition shows that learning a word is an incremental continuum of knowing different receptive and productive vocabulary aspects. Specifically, vocabulary knowledge involves different degrees of knowing, starting with a superficial familiarity with the word and ending with the ability to use it in context (Laufer & Goldstein, 2004). From this perspective, vocabulary aspects are assumed to be acquired at different developmental stages and at different rates from various viewpoints (Nation, 2013; Schmitt, 2000). Some aspects may be acquired before others. For example, L2 learners may achieve the spoken and written form of a word and/or the meaning of a word before the function of a word (Nation, 2013). This implies that the property of receptive vocabulary knowledge is represented as fundamental knowledge, and productive vocabulary knowledge is referred to the recall and production of a word influenced by receptive vocabulary knowledge (González-Fernández & Schmitt, 2020; Laufer & Goldstein, 2004; Lin, 2015a, 2015b; Nation, 2013; Schmitt & Meara, 1997; Sukying, 2017, 2018a). Also, English language exposure can increase receptive to productive vocabulary knowledge (Nontasee & Sukying, 2020, 2021; Sukying, 2020; Webb, 2005, 2009; Zhong, 2014, 2018). Therefore, the capability of the reception and production of multiple related word aspects reflects and benefits the acquisition of vocabulary knowledge. Indeed, vocabulary knowledge acquisition is an incremental learning process, including recognizing and producing vocabulary aspects. The receptive and productive dimensions are separate constructs, and the distinction between receptive and productive knowledge is fundamental to the conceptualization of the acquisition and development of vocabulary knowledge (e.g., González-Fernández & Schmitt, 2020; Nontasee & Sukying, 2021; Schmitt, 2010; Schmitt & Meara, 1997; Zhong, 2014).

A plethora of studies has focused on the relationship between receptive and productive mastery of vocabulary 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 learners 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 acquiring a word. 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 vocabulary knowledge across multiple learning modes benefits overall vocabulary development than a single learning mode alone. Furthermore, Sukying (2020) investigated vocabulary knowledge through morphological awareness instruction in Thai EFL university learners and suggested that deliberating instructional methods helped learners harness their vocabulary knowledge more successfully. Together, these prior studies point out that vocabulary knowledge is developed over exposure to multiple related aspects, raises questions about the impact of English vocabulary knowledge on vocabulary acquisition, and has pedagogical inferences for language classrooms.

2.3 Acquisition Order of Vocabulary Knowledge Aspects

Studies in the field of vocabulary acquisition and development are largely unexplored in the nature of vocabulary knowledge as an entire construct. Vocabulary knowledge hardly posits its conceptualization. Most previous studies limited the aspects of vocabulary knowledge in exploration. They revealed only the acquisition order of receptive and productive vocabulary knowledge aspects. However, there was no clear acquisition order of the 18 vocabulary knowledge aspects in Nation's (2013) framework. More specifically, it is difficult to explain the processes of acquisition for the different aspects of vocabulary knowledge and the mechanisms by which they interrelate. This is because there is no generally accepted model or pattern of how vocabulary is acquired. Then, 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.

It can be claimed that vocabulary knowledge is not an all-or-nothing relationship but a systematic procedure in which various types of knowledge are learned until all aspects of knowledge are known for an item. Obtaining comprehensive knowledge of a word needs substantial takings in all nine aspects of knowledge. Consequently, a large number of words, specifically the less frequent ones, may only be partially learned. It also seems likely that some aspects of knowledge are acquired before others. Schmitt and McCarthy (1997) and Schmitt (1998) proposed that knowledge of form and meaning may be obtained before some of the other aspects, such as collocation and register.

At present, there is no consensus in the literature regarding the acquisition order of the various aspects. Previous studies have shown that form knowledge is acquired before other aspects of knowledge (Nontasee & Sukying, 2020, 2021; Sukying, 2017; Webb, 2005). Although form knowledge was the most accessible aspect, word-class knowledge is more difficult than meaning and association knowledge (Zhong, 2018). González-Fernández and Schmitt (2020) also demonstrated that the form-meaning link is better known than others. Indeed, word form knowledge related to the syntactic constrained knowledge of word family members seems challenging for learners and is acquired relatively late in the process (Chui, 2006; Nagy, Diakidoy, & Anderson, 1993; Sukying, 2022). Form knowledge is one of the most challenging aspects to acquire and probably requires more explicit instruction, particularly in an EFL context (Barcroft, 2002; Sukying, 2020; Webb, 2005).

Some previous studies showed that the form-meaning link is the best-known aspect and appeared before other knowledge aspects (González-Fernández & Schmitt, 2019; Pellicer-Sanchez & Schmitt, 2010; Tannenbaum, Torgesen, & Wagner, 2006). However, others showed that the form-meaning link is acquired after affix (Nontasee & Sukying, 2020, 2021), orthography, part of speech, and association (Chen & Truscott, 2010), spelling, and word class (Webb, 2005). Wolter (2001) noted that meaning knowledge is an aspect generally learned late. It has also been reported that association is demanding for learners and is likely acquired after other aspects, such as verbal suffix knowledge (Schmitt & Meara, 1997). Supasiraprapa (2019) later

clarified that word association acquisition depends on the learning environment, which is difficult for Thai EFL learners.

Most previous studies consistently show that word use knowledge, i.e., collocation, grammatical function, and constraint on use, is the most difficult to be acquired because these knowledge aspects require language exposure and mastery of the other knowledge aspects, such as form and meaning of vocabulary knowledge (e.g., Jeensuk & Sukying, 2021a, 2021b; Laufer & Goldstein, 2004; Nation, 2013; Nontasee & Sukying, 2020, 2021; Supasiraprapa, 2019; Webb, 2020; Zhong, 2014, 2018).

Recent studies in the multi-aspect construct of vocabulary knowledge provide primary evidence in vocabulary acquisition order patterns as a multi-aspect construct. Nontasee and Sukying (2020, 2021), for example, explored the vocabulary knowledge acquisition within different vocabulary aspects, which were the reception and production of word parts, form-meaning links, and collocation, in Thai learners and unveiled a positive relationship between vocabulary aspects. Specifically, it was shown that learners first acquire word parts, followed by the 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 vocabulary aspects in different-grade learners and found a valid implication of acquisition patterns. Yet, the different grades showed different patterns. These previous studies reveal the progression of vocabulary 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 prove the statistically valid findings. It indeed requires more research to further investigate the multi-aspect nature of vocabulary knowledge to theorize a precise acquisition pattern.

Similarly, González-Fernández and Schmitt (2020) studied the nature of the vocabulary knowledge construct within the various aspects [form-meaning link, derivative, multiple-meaning, and collocation (reception and production)] in Spanish EFL learners and clarified that the reception and production of vocabulary 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 vocabulary 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. Some other aspects seem to be known initially, i.e., written forms and grammatical functions, while other L2 or EFL contexts need to be explored. However, they employed valid methodology to prove the data and illustrated a primarily hierarchical relationship of vocabulary aspects. Since González-Fernández and Schmitt studied the nature of vocabulary 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 vocabulary knowledge acquisition by exploring a different L1 group and assessing different types of vocabulary knowledge with different tests.

More recently, González-Fernández (2022) further investigated the nature of L2 vocabulary knowledge by examining the hypothesis of how various vocabulary 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 vocabulary knowledge, highlighting the need for further refinement of the conceptualization of the construct. Therefore, this research purposely replicates and extends the conceptualization of vocabulary knowledge as a multi-aspect, particularly in a Thai EFL context.

Moreover, vocabulary studies in a Thai EFL context are also limited in a few aspects of vocabulary knowledge in exploration, indicating unclear of how the various vocabulary aspects are acquired and their relationships in the entire construct as a multi-aspect construct. They also reveal the relatively low performance of vocabulary knowledge in various education levels of Thai participants (e.g., Bubchaiya & Sukying, 2022; Jeensuk & Sukying, 2021a, 2021b; Magnussen & Sukying, 2021;

Sukying & Matwangsang, 2022; Nontasee & Sukying, 2020, 2021; Sukying, 2017, 2018a, 2018b; Yowaboot & Sukying, 2022). Therefore, understanding the overall nature of vocabulary knowledge construct (the acquisition order of vocabulary aspects and their relationships) may provide a better picture of vocabulary knowledge conceptualization. It also provides an indication of vocabulary teaching and learning and contributes to Thai learners learning vocabulary knowledge more successfully, specifically comprehension and use of vocabulary knowledge.

According to these prior studies, it is clear that all receptive aspects are achieved before all productive aspects. Still, there are different acquisition order patterns of vocabulary knowledge aspects, such as collocation, form-meaning links, and derivative forms or word parts. The different results might be reflected by measuring different aspects of vocabulary knowledge and contexts. However, some previous studies exposed significant evidence for a multi-aspect conceptualization of vocabulary knowledge and the acquisition order of these aspects (González-Fernández, 2022; González-Fernández & Schmitt, 2020). However, it is necessary 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. Therefore, the present study aims to develop based on González-Fernández and Schmitt's model. González-Fernández and Schmitt (2020) primarily proposed the hierarchical model of vocabulary knowledge, including form-meaning links, derivatives, multiple-meaning, and collocation (both in receptive and productive knowledge). The hypothesized model in the present study adds more knowledge aspects to have a clearer picture of the vocabulary knowledge construct. The six-vocabulary aspects [written forms, word parts, form-meaning links, association, grammatical functions, and collocation (both in receptive and productive knowledge)] are measured to determine whether the accepted fit model is in the research context.

2.4 Perspective of Acquisition of Vocabulary Knowledge through Instructional Interventions

Vocabulary knowledge, including multiple related aspects, involves different acquisition and learning processes (Laufer & Goldstein, 2004; Nation, 2013). The acquisition and development of vocabulary knowledge can be impacted by many various factors, such as time in language exposure and receiving language instructions. Moreover, since not all vocabulary aspects are acquired intentionally or incidentally (Nation, 2013), these various aspects are acquired to different degrees; more specifically, some may be taught or acquired incidentally, while some others may need to be taught or learned intentionally (González-Fernández & Schmitt, 2020; Lin, 2015a; Nontasee & Sukying, 2020, 2021; Schmitt & Meara, 1997; Sukying, 2017; Zhong, 2014, 2018).

Schmitt (2000) suggests that there are two approaches to vocabulary acquisition. The first approach is intentional learning (explicit learning), relating to the attention drawn toward the information to be acquired. The second approach is incidental learning (implicit learning), involving language used for communicative purposes and not focusing exclusively on new words in the text. Webb (2020) alternatively points out that intentional and incidental vocabulary learning is often discussed as the only two approaches to vocabulary learning. Exercises and activities designed explicitly to focus learners on learning a word are defined as intentional vocabulary learning, whereas activities involving learning a word through encountering meaning-focused input are considered incidental vocabulary learning. The difference between incidental and intentional learning has proven crucial in vocabulary studies. The basic issue is the extent to which learners might gain vocabulary knowledge incidentally, as a benefit of their primary learning activity inside or outside the classroom, rather than through the activity that is specifically intended to improve their vocabulary knowledge. As applied in the literature, the difference entails both where the learner's attention is focused and the instructional context in which the learner has the chance to learn. There is no doubt that incidental learning happens, especially through extensive reading in high-input circumstances, but at a relatively slow rate. The concept of incidental learning, popularized during the heyday of the communicative

approach to language teaching, offered the alluring prospect that, as long as learners had access to enough comprehensible input, L2 vocabulary acquisition would essentially take care of itself without the need for any significant pedagogical intervention.

The research, however, shows that this strong stance is no longer valid. There is no empirical evidence of which learning condition is better and more effective or worse and less effective. It should not be thought of as intentional and incidental vocabulary learning as a competition but rather as useful complements to each other. Regarding the complexity of varying degrees of word acquisition, while providing explicit vocabulary teaching associated directly with intentional vocabulary learning, incidental learning can co-occur (Nation, 2013; Pulido, 2003; Vidal, 2003; Webb, 2020; Wesche & Paribakht, 1996, 1999).

According to prior research, L2 vocabulary acquisition may be made in the classroom without requiring any substantial pedagogical intervention but at a slower rate (Read, 2004b; Zhong, 2012a, 2014). Vocabulary knowledge needs to be accompanied by learning through use (Webb, 2020). The word learning task can benefit receptive and productive vocabulary knowledge acquisition more effectively and quickly (Laufer & Goldstein, 2004; Kremmel & Schmitt, 2016; Read, 2004b; Schmitt, 2010, 2019; Webb, 2005, 2009). More particularly, Laufer and Hulstijn (2001) show that the learning tasks can be used to evaluate based on vocabulary level and provide learners access to sufficient comprehensible input. In addition, the learning tasks can lead to better retention of the target vocabulary. For example, learners who write compositions using a set of target words remember them better than those who encounter the words in a reading comprehension task. The learners who write the missing words in gaps in the reading text retain more of the words than those who only read marginal glosses.

As illustrated, the effects of receptive and productive vocabulary acquisition on vocabulary knowledge were investigated by Webb (2005). Sixty-six Japanese university learners were split into two groups, each with a different learning condition. Reading (receptive) and writing (productive) learning tasks were used in

two experiments. Receptive and productive tests were used to assess five components of vocabulary knowledge: orthography, syntax, association, grammatical functions, and meaning and form. According to the first experiment, the receptive task was superior when the same amount of time was spent on both tasks. The second experiment revealed more success when the productive task was given more time to complete. These findings imply that vocabulary intervention may aid in acquiring and developing receptive and productive vocabulary knowledge and that developing receptive and productive vocabulary knowledge may need practice.

Although learners acquire vocabulary knowledge incidentally while participating in various language-learning activities, more direct language-learning tasks provide learners with more opportunities to develop their vocabulary knowledge (Read, 2004b). Instructional methods that integrate vocabulary knowledge interventions may benefit learners of English (Bowers & Kirby, 2010; Colovic-Markovic, 2017; Kirby, Bowers, & Deacon, 2009; Nation, 2013). Sukying (2020) and Vincy (2020) further show that explicit vocabulary instructions can assist learners in acquiring vocabulary knowledge specifically in an EFL context. According to Vidal (2003), words explicitly elaborated by the lecturer through naming, definition, or description create influentially understandable knowledge. As such, explication of word aspects and rehearsing can aid in acquiring vocabulary knowledge (Hulstijn, 2001).

As demonstrated, Sukying (2020) investigated the effects of explicit affix instruction on the acquisition of a word. Together, Vincy (2020) explored the importance of direct instruction and repeated exposure to the target vocabulary for adequate reception and production of new words. The findings of these studies demonstrated that the instructions had a favorable influence on the participants' reception and production performance. The studies' conclusions also revealed that explicit vocabulary instruction influences receptive-productive vocabulary acquisition and helps to close the gap between receptive and productive vocabulary knowledge. Direct instruction in English vocabulary is regarded as an effective method that outperforms the EFL context (Rossiter, Abbott & Kushnir, 2016). Consistently, deliberate (intentional) teaching can result in more accurate and rapid learning and acquisition

(Sukyng, 2020), and instructional methods that integrate vocabulary knowledge interventions may benefit English learners (Bowers & Kirby, 2010; Colovic-Markovic, 2017; Kirby, Bowers, & Deacon, 2009; Nation, 2013). As a result, providing vocabulary instruction with the explication of vocabulary knowledge may aid in the transition from receptive to productive levels.

Furthermore, Schmitt (2019) reviewed the involved papers on vocabulary knowledge acquisition. The paper suggests six areas of vocabulary research, including (1) improving a practical model of vocabulary acquisition, (2) comprehending how vocabulary knowledge develops from receptive to productive level, (3) addressing lexical teaching and learning principles in vocabulary and language textbooks, (4) exploring extramural language exposure and how it can best facilitate vocabulary acquisition, (5) improving more informative measures of vocabulary knowledge, and (6) assessing fluency as part of vocabulary competence. Finally, Schmitt provides suggestions for further research that an under-researched area of how to advance learners' knowledge beyond receptive mastery and into the ability to independently apply lexical items fluently and correctly in their own production is particularly interesting, such as exploring various vocabulary learning exercises and activities to examine which best improve vocabulary knowledge from receptive to productive mastery. It is important to note that the purpose of the study (Schmitt, 2019) is not to determine which vocabulary learning tasks are best for the learning process. Still, those rather are best for enhancing partially learned vocabulary. These issues will very certainly necessitate a pretest-treatment-posttest design, with target lexical items examined receptively and productively.

According to prior research, building up to a productive mastery level takes time. Read (2000) points out an intriguing question: 'Is a definite minimum amount of word knowledge necessary before productive use is possible?' As such, a longitudinal and/or experimental research design would most likely be required to answer the developmental process of vocabulary knowledge and receptive-productive issues. In response to the most effective methodology, the entailed utilization of a learning activity is likely to result in really productive mastery; research is also required to

employ the learning tasks for learners practicing to advance knowledge to the productive level (e.g., Laufer, 2005; Schmitt, 2019). For example, the learning tasks under consideration would almost definitely demand learners to produce output rather than just practice receptively.

The results of earlier studies on the 'depth of processing hypothesis' reinforce the effectiveness of the instruction. According to earlier studies, the extent of engagement with a certain word, i.e., the amount of information, associations, and mental images formed with the target terms, is directly related to the ability to retrieve the word for later processing. The availability of a supplemental entirely on the target vocabulary with practice sections allows learners to learn new vocabulary in a natural way explicitly. Based on prior positive results, vocabulary learning tasks may enhance learners' input and output of vocabulary knowledge in practice. A detailed explanation of vocabulary information, in particular, can fully comprehend vocabulary knowledge. To put it simply, given instruction, which includes vocabulary learning tasks and comprehensive elaboration on various areas of vocabulary knowledge, facilitates learners to achieve vocabulary knowledge more successfully. Indeed, one of the significant purposes of vocabulary research is to explore if these vocabulary teaching and learning modalities yield better results in developing vocabulary knowledge throughout the continuum.

However, the present study initially aims to explore the general nature of vocabulary knowledge construct to better understand the roles of vocabulary aspects and the general theory of vocabulary knowledge acquisition. The results of this study may posit a vibrant picture of the conceptualization of vocabulary knowledge, specifically the acquisition order pattern of vocabulary aspects and the model of the relationship of vocabulary aspects, and further benefit the instructional methods of vocabulary knowledge in Thai EFL education. The other perspectives influencing learners' vocabulary knowledge, such as longitudinal and/or experimental research design, can be considered and planned for further research. The following section reviews the studies regarding vocabulary acquisition and development under the multi-dimensional framework of vocabulary knowledge.

2.5 Relevant Studies on the Nature of Vocabulary Knowledge Acquisition and Development

2.5.1 Results from Relevant Studies on Vocabulary Knowledge Acquisition and Development

Qian (1999) studied the relationships between vocabulary size, depth, and reading comprehension. Three different decontextualized tasks were used to measure the vocabulary breadth and depth of 74 Chinese and Korean ESL learners. The Vocabulary Levels Test (VLT) by Nation (1983, 1990) was used to capture size, and the Depth of Vocabulary Knowledge Measure (DVK) by Read (1993, 1995) was used to measure association and collocation. The Morphological Knowledge Test (MK) by Quin (1999) was used to assess the learners' knowledge of morphology. The results revealed a positive and significant relationship between vocabulary size and depth.

More recently, Zareva (2005) explored the correlation between several dimensions of vocabulary knowledge using Henriksen's (1999) model of a three-dimensional vocabulary continuum, which includes a partial-to-precise knowledge dimension, a depth-of-knowledge dimension, and a receptive-productive dimension. The study used a revised Vocabulary Knowledge Scale (Wesche & Paribakht, 1996) with 73 target words of a comparable proportion across different vocabulary frequency levels to investigate native and non-native speakers at immediate to advanced levels of English proficiency. Actual vocabulary knowledge, self-reported vocabulary knowledge, vocabulary size, vocabulary frequency effect, native-like commonality of associations, and a number of associations were among the features of vocabulary knowledge studied. The correlational analysis revealed a positive relationship between all measured variables. In addition, regression analysis revealed a statistically significant relationship between learners' actual vocabulary knowledge and the other aspects of vocabulary knowledge. Self-reported vocabulary knowledge and vocabulary size were the greatest indicators of actual vocabulary knowledge.

Together, these two studies provide a quantitative perspective for exploring the internal relations between three dimensions of vocabulary knowledge and the methodological implications of the inter-relationships between multiple receptive and

productive aspects (Zareva, 2005; Qian, 1999). However, these studies do not reflect directly on the multi-aspect constructs of vocabulary knowledge and the interface between receptive and productive vocabulary knowledge. Indeed, the receptive and productive vocabulary constructs should be clearly specified, and the internal relationships between receptive and productive vocabulary knowledge components should be investigated using a multi-task approach. Specifically, a hierarchical multiple regression can enable the disclosure of an individual contribution of different receptive predictor variables to different productive language word aspects.

Enayat, Amirian, Zareian, and Ghaniabadi (2018) explored the correlations between three measures of written receptive vocabulary size and second language (L2) depth of vocabulary knowledge to determine the most reliable test of vocabulary size. The participants were 122 Iranian EFL learners who had been categorized into three language proficiency levels via the Oxford Quick Placement Test. They completed the Word Associates Test (WAT), Vocabulary Levels Test (VLT), monolingual Vocabulary Size Test (VST), and its bilingual Persian version. The results showed that the VLT and the WAT performance were the most highly correlated, and the VLT was the strongest predictor of performance on the WAT. More recently, Enayat and Amirian (2020) also investigated the association between vocabulary size and depth of Iranian EFL learners at different language proficiency levels. The findings revealed that vocabulary size and depth were significantly correlated for lower-intermediate learners, had a moderate association for upper-intermediate participants, and were not significantly correlated for advanced EFL learners. In addition, the relationship between the higher-frequency bands of vocabulary size and depth was significant for lower proficiency levels, and the lower-frequency vocabulary size was not correlated with vocabulary depth for any of the proficiency levels. Overall, the findings indicated that the VLT outperforms the other two measures of vocabulary size.

Masrai, Milton, El-Dakhs, and Elmenshaw (2021) examined whether specialist subject vocabulary knowledge could have a substantial and measurable influence on academic achievement, in addition to and separate from the impact of general and

academic vocabulary knowledge. The Egyptian university learners were asked to complete three tests of vocabulary knowledge, including general, academic, and specialist business vocabulary. Test scores were compared against GPA and business module scores. The findings revealed that, whereas general vocabulary size explained the most variance in academic success factors, the other two components - academic and specialist business vocabulary - made separate and additional contributions. Importantly, this contribution was greater than academic vocabulary knowledge.

The studies of Enayat and colleagues (2018; 2020) and Masrai et al. (2021) reveal that vocabulary aspects are positively correlated and may influence vocabulary achievement and production. Nevertheless, these studies do not directly examine the receptive-productive knowledge continuum of vocabulary aspects nor mention the overall nature of the vocabulary knowledge construct.

Laufer and Goldstein (2004) studied vocabulary knowledge testing. The study focused on word form and meaning knowledge to test four aspects: passive recognition, active recognition, passive recall, and active recall. The results showed that passive recall was the best predictor of classroom language performance. It was also shown that the four different aspects of knowledge were closely related, and the productive measures were more advanced than the receptive measures. These results support indicate a hierarchical development of receptive and productive vocabulary knowledge with word form and meaning.

Relatedly, Lin (2015) investigated a hypothesized relationship between multiple features of a lexical item and their impact on L2 word acquisition. The study focused on the written form of a word, including morphology, orthography, and word length. The participants were 54 Chinese, 44 Japanese, and 43 Spanish learners. The instruments included metalinguistic knowledge of morphology and orthography tests, an L1-to-L2 receptive knowledge of orthography test, and an L1-to-L2 productive translation test. The results revealed that morphological knowledge contributed more to new word recognition and production than orthographic knowledge. The combination of these two features contributed more to L2 word learning receptively and productively. The analysis also demonstrated that the recognition and production

of English words were better among logographic L1 compared to alphabetic L1 participants. That is, logographic participants may be able to manipulate orthographical knowledge to enable the learnability of shorter words and use morphological knowledge to facilitate the learnability of longer words. The findings suggest that multiple related word features facilitate L2 receptive and productive word acquisition. However, it must be noted that this study was limited to the written form of a word.

Schmitt and Meara (1997) investigated how two types of word knowledge, association, and grammatical suffix knowledge, change, both receptively and productively over time. The participants were 95 Japanese high school and university learners who were assessed on three-word associations and inflectional and derivational suffix knowledge of 20 verbs. The results revealed that the learners had rather poor knowledge of the verb's permitted suffixes, particularly the derivative suffixes, and poor comprehension of the verbs' word associations. The results also revealed that word association and suffix knowledge were related to each other and total vocabulary size. Furthermore, the learners possessed more receptive than productive knowledge. The results suggest that word association and grammatical suffix knowledge are correlated and can change over time. In a follow-up study, Schmitt (1998) studied three university learners' vocabulary acquisition over one academic year. The participants' knowledge of the target words, including form, association, word class, and meaning, was assessed over three interviews. The findings indicated that the participants' vocabulary knowledge improved throughout the assessed period. The growth of form, meaning, word class, and association may all contribute to the development of vocabulary knowledge. The study also revealed that the aspects of vocabulary knowledge were differentially interrelated.

Zhong (2014) investigated the interface between receptive and productive vocabulary knowledge along with a multi-aspect construct in 513 junior high school learners. The study contained two identical sets of five separate vocabulary tests in a pretest and posttest design with a four-month gap between tests, during which the participants received regular classroom English instruction. The relationship between receptive

knowledge of meaning, form, morphology, collocation, and association and productive knowledge of use was investigated. The results demonstrated a positive correlation between receptive word aspects and productive word use. Regression analysis was also used to examine the individual contribution of the five receptive aspects to productive word use. It was found that the contribution of receptive knowledge to productive use changes significantly over time, and the extent to which receptive knowledge facilitates productive word use varies depending on the learner's level of vocabulary knowledge. Zhong (2018) also explored the relationship between receptive and productive vocabulary knowledge in 620 junior high school learners and found a significant correlation between receptive aspects and productive word use.

Together, these studies illustrate a positive relationship between receptive and productive vocabulary knowledge (Schmitt & Meara, 1997; Zhong, 2014; 2018). Each receptive word aspect contributes to productive word aspects, and the improved knowledge depends on the learners' language exposure level. However, the study by Schmitt and Meara (1997) was limited to two-word aspects, whereas Zhong (2014, 2016) focused on only one productive word aspect within a multidimensional framework of vocabulary knowledge. These studies also indicate that the incremental vocabulary acquisition process necessitates a longitudinal research design, including multidimensional vocabulary aspects, to explore the receptive-productive interaction and better understand the learning progress.

Nizonkiza (2016) explored the receptive and productive use of academic vocabulary by using the Academic Word List (Coxhead, 2000). The participants (204 first-year university learners) were given a test battery, including the PVLT, to measure the productive ability of collocations and the VLT to test receptive vocabulary knowledge. The results revealed that receptive vocabulary knowledge readily increased, but productive knowledge lagged behind and remained problematic. The findings also showed that the relationship between receptive and productive knowledge was slightly above 50%, which lends empirical support to previous

findings that the relationship between the two aspects of vocabulary knowledge is positively correlated (Milton, 2009).

González-Fernández and Schmitt also (2020) explored the relationships between vocabulary knowledge components and their order of acquisition. A total of 144 Spanish English learners were assessed on their receptive and productive knowledge of form-meaning links, derivatives, multiple meanings, and collocations. It was found that all word components were closely interrelated and shared a similar pattern of acquisition, such that receptive knowledge was acquired before productive knowledge for all components. The findings indicate that the receptive and productive components are distinct constructs, and the distinction between receptive and productive knowledge is fundamental to the conceptualization of the development of vocabulary knowledge. It was also shown that all of the aspects measured were known at the recognition level before any of those aspects were known at the recall level (González-Fernández & Schmitt, 2020). This implies that the main descriptor of vocabulary knowledge may be the transfer from receptive to productive mastery of those aspects rather than the word knowledge aspects themselves (as suggested by Nation's framework). It would be useful to extend the study by González-Fernández and Schmitt (2020) to include other aspects, such as spelling, pronunciation, word parts, associations, grammatical functions, and constraints of use.

Overall, it appears that knowledge of the word aspects follows an implicational scale, indicating that some aspects are learned before others (González-Fernández & Schmitt, 2020). If this acquisition order is proven to be generalizable, this will provide teachers and testers with a blueprint for how vocabulary knowledge is acquired. However, other aspects of word knowledge and other L1s need to be studied. The present study aims to explore additional aspects of vocabulary knowledge to better understand the general nature of the vocabulary knowledge construct under a multidimensional framework.

2.5.2 Results from Relevant Studies on Vocabulary Knowledge Acquisition and Development in a Thai EFL Context

Sukying (2017) investigated the relationship between receptive and productive affix knowledge and vocabulary size. The 486 Thai EFL participants were tested with the two existing vocabulary size tests and three different measures of affix knowledge. The findings revealed a positive relationship between learners' receptive and productive affix knowledge and their vocabulary size, both receptively and productively. The findings also showed that receptive affix knowledge improves productive affix knowledge and that receptive and productive affix knowledge increases vocabulary size. This indicates that affix learning is essential for vocabulary acquisition and growth. Indeed, affix knowledge is complex and incremental and acquired at different speeds and degrees. In a related study, Sukying (2018a) examined whether and to what extent receptive and productive affix knowledge contributes to vocabulary size in an EFL context. Specifically, this study tested the Affix Knowledge-Vocabulary Size Hypothesis, which proposes that one's affix knowledge is directly proportionate to one's lexicon (Nation, 2013). A correlational analysis revealed that all aspects of participants' affix knowledge were positively associated with their vocabulary size. Specifically, receptive knowledge of affixes had a moderate association with receptive vocabulary size. A positive relationship was also detected between productive affix knowledge and productive vocabulary size, as well as combined affix knowledge and overall vocabulary size. The results support prior claims that affix knowledge is positively related to vocabulary size, both receptively and productively (Hayashi & Murphy, 2011; Mochizuki & Aizawa, 2000).

In another study, Sukying (2018b) investigated the acquisition of English affix knowledge in L2 learners, with a particular focus on productive knowledge of 32-word families and the relationship between productive affix knowledge and vocabulary in a Thai university context. The findings revealed that recall of all forms of the word family was rare, and this knowledge was incremental. This suggests that L2 affix knowledge is developmental and requires various degrees of metalinguistic knowledge, including explicit knowledge of affixes. The findings also revealed that participants performed poorly on affix knowledge, both receptively and productively,

implying that productive word knowledge requires more knowledge strategies and demands than receptive word knowledge. This is consistent with previous claims that receptive knowledge alone is insufficient for productive knowledge (Hayashi & Murphy, 2011).

A recent series of studies aimed to better understand the roles of vocabulary knowledge by researching the acquisition and relationship of various word aspects (Nontasee & Sukying, 2020; 2021). First, Nontasee and Sukying (2020) studied word knowledge acquisition in 154 Thai EFL learners in grades 10 to 12. The results showed that the learners' language exposure level reflected their word knowledge. Indeed, the 12th-grade learners performed better than the 10th-grade learners in all word tests. Second, Nontasee and Sukying (2021) investigated the learnability of vocabulary knowledge. The participants, 261 Thai senior high school learners, were examined on their receptive and productive knowledge of word aspects, including word part, form-meaning link, and collocation knowledge. The results revealed that the participants performed better on word parts, followed by a form-meaning link and collocation, and that performance was higher on all receptive tests compared to the productive tests.

These studies illustrate the significant relationship between receptive and productive word knowledge and indicate that receptive knowledge is acquired before productive knowledge across all aspects (Laufer & Goldstein, 2004; Nontasee & Sukying, 2020, 2021). Exposure to vocabulary, in particular, has a beneficial influence on vocabulary acquisition, and each word knowledge aspect contributes to the development of receptive and productive vocabulary knowledge.

Supasiraprapa (2019) investigated the effects of two types of English L2 learning environments (formal English classrooms in Thailand and English exposure in an English-speaking country) on adult Thai speakers' English vocabulary depth. The 29 participants were asked to complete the Word Associates Test (Read, 1998), which measured the depth of their receptive vocabulary knowledge, and the elicitation test, which measured their English collocational knowledge. A regression analysis revealed that participants' vocabulary depth was significantly predicted by their

length of stay in an English-speaking country but not by their length of English education in Thailand. The findings demonstrate the superiority of an L2 immersion environment over an environment where an L2 is a foreign language in facilitating the depth dimension of L2 word knowledge.

Bueraheng and Laohawiriyanon (2016) investigated the relationship between English language exposure and learners' receptive and productive collocations (verb + noun and adjective + noun collocations). There were two groups of participants, fourth-year university learners in an international program and English major learners. Using the COLLMATCH 3 receptive and productive collocation tests, the study revealed that both groups had significantly higher receptive knowledge test scores than productive knowledge test scores, and international program learners outperformed major English learners on verb + noun collocations and adjective + noun collocations. Therefore, it was proposed that teachers should emphasize productive skills using collocations, such as essay writing and conversation exercises, with a concentration on verb + noun and adjective + noun collocations.

Suwitchanphan and Phoocharoensil (2014) explored EFL regular and English program learners' knowledge of collocations, particularly on adjective + noun collocations. The purpose of the study was to examine the relationship between the school curriculum and knowledge of collocations. A private school has 60 learners from regular and English programs. The gap-filling test, the collocation selection test, and the descriptive written task were used in this study. The results revealed that the regular program learners performed better than the English program learners in the gap-filling test. However, there was no significant difference between the school curricula and the collocation selection test. In addition, regular program learners were more likely than English program learners to use adjective + noun collocations in the descriptive written task. In contrast to earlier research (Cowie, 1998; Brashi, 2009; Obilisteanu, 2009), more exposure to a language improves fluent language use. Probably, regular program learners' opportunities to use the language through speaking and writing were constrained in the classroom.

Dokchandra (2019) researched Thai EFL learners' collocational knowledge and their perceived difficulties in using collocations. The findings revealed that participants' knowledge of collocations was generally poor to moderate, and collocational knowledge did not differ among participants in different academic years. Overall, participants at all proficiency levels considered idiomatic collocations to be the most difficult. Again, these findings are consistent with prior research and provide further evidence that learners of English at all proficiency levels struggle to acquire and use collocations, and Thai learners of English lack adequate knowledge of collocations (Hsu & Chiu, 2008; Mallikamas & Pongpairroj, 2005; Yumanee & Phoocharoensil, 2013).

A recent series of studies aimed to better understand the roles of collocations knowledge by investigating the acquisition of receptive and productive knowledge of collocations (Jeensuk & Sukying, 2021a; 2021b). First, Jeensuk and Sukying (2021a) investigated Thai EFL high school learners' receptive and productive knowledge of English lexical and grammatical collocations. Four different tests were used to measure the 314 participants' receptive and productive knowledge of English collocations. The results revealed that Thai EFL high school participants had relatively weak knowledge of English collocations but performed better on receptive collocation tests than on productive tests. Indeed, receptive knowledge of grammatical collocations seems to be acquired first, followed by receptive knowledge of lexical collocations, productive knowledge of lexical collocations, and at least, productive knowledge of grammatical collocations. A correlational analysis also indicated that receptive and productive collocations knowledge were interrelated. Second, Jeensuk and Sukying (2021b) investigated Thai EFL high school learners' receptive and productive knowledge of English collocations. Two different tests of receptive and productive knowledge of English collocations were used. The results indicated that the collocation knowledge of the participants was relatively low. Indeed, the participants performed better on the receptive English collocation test than on the productive test. The correlational analysis alternatively revealed that receptive and productive knowledge of English collocations was related. Taken together, these findings are consistent with earlier studies showing that, like vocabulary, receptive

collocation knowledge is acquired before productive collocation knowledge. These studies provide insights into vocabulary acquisition and development along the receptive and productive continuum.

Many studies have examined the importance of vocabulary acquisition and word knowledge in a Thai setting (e.g., Kittigosin & Phoocharoensil, 2015; Liangpanit, 2014; Nontasee & Sukying, 2020, 2021; Phoocharoensil, 2013, 2014; Sukying, 2017, 2018a, 2018b, 2020; Supasiraprapa, 2019). The school curriculum in Thailand requires that all Thai learners take English as a compulsory subject by learning English as a foreign language (EFL) from primary school to university. However, despite learning English for many years, many learners seem to experience problems using all English skills and lack knowledge of vocabulary, grammar, and pronunciation (Mungkonwong, 2017). Indeed, the most significant difficulty in English language use faced by Thai learners is a lack of word knowledge (e.g., Chawwang, 2008; Jamtawee, 2000; Supatranont, 2005). Previous studies of Thai EFL learners' receptive and productive vocabulary sizes revealed that learners' receptive vocabulary size was nearly double their productive vocabulary size (Kotchana & Tongpoon-Patanasorn, 2015; Srisawat & Poonpon, 2014). Notably, Thai EFL learners had a smaller vocabulary size, both receptive and productive, than the English curriculum requirements in Thailand (Supatranont, 2005; Sukying, 2018a, 2018b). As such, Thai learners remain a challenge to pedagogues and researchers, and understanding the roles of vocabulary knowledge (including vocabulary acquisition and development) may prove useful for pedagogies and for learners.

The vocabulary knowledge acquisition process is complex. There is no generally accepted model of vocabulary acquisition (Meara, 1984), and vocabulary knowledge as a multi-aspect construct has not been widely explored in a Thai context. Indeed, most studies in a Thai context are constrained to only a few aspects of vocabulary knowledge, such as collocation only or affixation only, or receptive and productive knowledge of a single aspect (e.g., Laufer & Goldstein, 2004; Lin, 2015; Schmitt & Meara, 1997; Sukying, 2017). Therefore, the study of vocabulary acquisition within a multidimensional framework is still required, particularly in a Thai context, to

describe the acquisition of vocabulary knowledge and how different aspects are related and acquired entirely.

2.5.3 Results from Relevant Studies on Vocabulary Knowledge Acquisition and Development through Instructional Interventions

It is typical for learners to assume that knowing a word entails just knowing its meaning and form. However, according to the multi-dimensional vocabulary knowledge construct (Coxhead 2007; Henriksen 1999; Nation 2001), to fully know a word, knowledge of many aspects must be acquired to enable the proper productive use in context. The two fundamental aspects of word knowledge are, first and foremost, meaning and form (Laufer & Goldstein, 2004). Mapping a word's form to its meaning occurs relatively early in vocabulary acquisition (Henriksen 1999; Jiang 2002); consequently, meaning and form are the two aspects that receive the most attention.

Tang and Nesi (2003) examined approximately ten hours of class recordings delivered by two English as a foreign language (EFL) junior high school teachers in Hong Kong and Guangzhou, China. All the instructors' vocabulary teaching methods focused on the meaning and form of the words, particularly the phonological form. All words were drilled and practiced in a limited context that was the same or comparable to the context in which the target word appeared. Brown (2010) also evaluated nine general English textbooks ranging from beginner to intermediate level and found six textbooks dedicated more than half of the activities to practicing form-meaning connections. Collocation exercises were the second most prevalent among the nine textbooks, accounting for 29 percent, with spoken form exercises accounting for 14.8 percent, placing third. None of the textbooks reviewed provided continuous activities that addressed all areas of vocabulary knowledge. The findings of these two studies indicate that learners might not be exposed to all aspects of a word in the classroom. Though it is not obvious how much each aspect accounts for the productive use of a word, these two studies in vocabulary instruction show that teachers and textbooks typically focus on meaning, form, and collocation.

Several studies have explored the interface between receptive and productive vocabulary knowledge by measuring the efficiency of receptive and productive learning in the development of vocabulary knowledge in primary school (Mondria & Wiersma, 2004), high school (Griffin & Harley, 1996), university (Waring, 1997b; Webb, 2005, 2009) and American college learners (Schneider, Healy, & Bourne Jr, 2002). One consistent finding of these studies is that the receptive learning condition benefits both receptive and productive vocabulary knowledge and, likewise, productive learning positively contributes to both receptive and productive vocabulary knowledge. Moreover, productive vocabulary knowledge decreases more quickly than receptive vocabulary knowledge.

Mondria and Wiersma (2004) assessed the influence of combining receptive and productive learning conditions on receptive and productive retention. The study examined whether adding a new learning activity would improve vocabulary learning outcomes. Three learning conditions were compared in terms of their impact on receptive and productive vocabulary knowledge retention in 198 Dutch pupil learners of French. The three learning conditions were receptive learning only, productive learning only, and receptive plus productive learning tasks. The findings demonstrated that receptive learning led to a large increase in productive vocabulary knowledge, while productive learning led to a considerable development in receptive vocabulary knowledge. Nevertheless, as compared to the receptive-only and productive-only learning conditions, the combination of receptive and productive learning conditions did not improve either receptive or productive retention. The findings suggest that the combined learning condition may not provide additional benefits than those gained in the single learning condition. This is partly because the receptive or productive treatments in the combined learning condition are administered only half the time compared to the single learning condition.

Webb (2005; 2009) used a multi-task design to test five vocabulary dimensions of orthography, meaning, grammatical function, association, and syntax, both receptively and productively. The participants were Japanese university learners assigned to either a receptive learning group or a productive learning group. The

results illustrated that learners in the receptive learning group achieved higher mean scores in receptive and productive orthographic tests and productive meaning, association, and syntax than in the productive learning group. This suggests that receptive learning tasks may contribute not only to the development of receptive knowledge but also to a significantly greater increase in productive knowledge. The second experiment explored the efficacy of these tasks at various time durations. The findings revealed that learners in the productive learning group surpassed those in the receptive learning group on all receptive and productive vocabulary knowledge dimensions. Similarly, using receptive and productive word pair tasks, Webb (2009) demonstrated that receptive learning resulted in greater increases in receptive meaning, but productive learning resulted in greater advances in both receptive and productive form and in-depth productive knowledge.

Together, Webb's (2005, 2009) studies indicate that, in practice, both receptive and productive tasks should be incorporated to teach vocabulary. Receptive vocabulary learning tasks, for example, can only be employed in the classroom for a limited duration, but productive vocabulary learning tasks are a better choice for home assignments since they benefit from stronger growth in more aspects of vocabulary knowledge. However, these studies do not clearly describe the relationship among various vocabulary aspects and how different aspects influence one another.

Sukying (2020) examined the effects of affix instruction on the acquisition of a word. The receptive and productive affix knowledge measures were administered to 92 participants. Participants in the treatment group were provided with explicit instruction on English affixes (Bauer & Nation, 1993), while the participants in the control group were not. The results illustrated a positive effect of affix instruction in English language classrooms. Specifically, the affix features involving linguistic and semantic transparency helped improve participants' receptive and productive performance. This suggests that the explicit instruction of affix knowledge can help English learners to understand words and facilitate their vocabulary acquisition. However, learners may require more time to understand the meaning of the affixes and practice affixations.

Vincy (2020) also examined the importance of explicit instruction and repeated exposure to the target vocabulary for adequate reception and production of new words among second-language learners of English. The experimental study, which lasted three months, involved 62 sixth-grade learners. The findings revealed that explicit instruction and repeated exposure to the target vocabulary significantly influenced vocabulary knowledge compared to the conventional approach to vocabulary instruction. Receptive vocabulary was found to have an average of 8 percent influence on production knowledge in the conventional mode of vocabulary instruction, whereas it amounted to 72 percent in the experimental group. The findings of this study suggest that the receptive-productive gap may be significantly reduced with explicit instruction and repeated exposure to the target vocabulary.

The findings of these two studies (Sukyng, 2020; Vincy, 2020) show that affix instruction has a positive effect on participants' affix reception and production performance. This indicates that explicit instruction contributes to English learners' comprehension and use of a word and that, through explicit instruction and repeated exposure to the target vocabulary, the receptive-productive gap is significantly reduced. As such, deliberate vocabulary teaching may help learners acquire and grow their vocabulary knowledge more successfully. However, it should be noted that the scope of these studies is restricted to affixations. Future studies on vocabulary acquisition should incorporate a larger number of vocabulary components.

Webb (2007a) examined how Japanese EFL learners acquired 10–20 non-words from various exposures. An extensive battery of written tests was used to measure five aspects of word knowledge, both productively and receptively [orthography (written form), form-meaning link, syntax (syntagmatic associations), grammatical functions (word class), and associations (paradigmatic)]. It was found that the aspect with the largest improvements was orthography, while improvement in the other aspects varied depending on exposure to the words. Overall, the different aspects evolved in parallel but at slightly different rates. Building on this research, Chen and Truscott (2010) explored the acquisition of four-word knowledge aspects in Taiwanese university learners, including orthography, parts of speech, associations (both receptively and

productively), and form-meaning link (receptively only). They found that vastly increased repetitions resulted in better knowledge in all the different aspects, although the development in knowledge varied depending on each aspect.

In summary, research on L2 vocabulary acquisition shows that learners typically have a low level of vocabulary knowledge, both receptively and productively (e.g., Schmitt & Meara, 1997; Sukying, 2017; Nontasee & Sukying, 2020, 2021). For instance, L2 senior high school and first-year university learners in various countries know approximately 2,100 words, broadly ranging from 1,400 to 4,000 words, despite more than 1,000 hours of systematic schooling (Laufer, 2000, 2010; Nation, 2006; Schmitt, 2014). Therefore, the vocabulary size of the EFL learners lags far behind that necessary for adequate comprehension of written tests and spoken discourses. Specifically, the receptive vocabulary knowledge of learners appears to be insufficient for the development of productive vocabulary knowledge (Henriksen, 1999; Vincy, 2020).

Overall, vocabulary researchers have proposed that vocabulary knowledge is a process that grows over time. Nevertheless, the distinct aspects of a word are acquired at different developmental rates, and it is difficult to conclude an overall pattern. Indeed, one apparent reason for the lack of a general theory of vocabulary acquisition and development is that the construct of vocabulary knowledge as a whole remains largely unexplored. Research is needed that explores the developmental pattern of vocabulary knowledge within a multidimensional framework. Understanding the conceptualization of vocabulary knowledge acquisition and development can influence pedagogues, learners, and researchers in the EFL context.

2.6 Measuring Vocabulary Knowledge

Words are the fundamental components of language, the units of meaning from which larger structures (e.g., sentences, paragraphs, and whole texts) are formed. For learners, vocabulary learning is often a conscious and demanding process. Even at an advanced level, learners are aware of limitations in their knowledge of L2 words, and learners often experience lexical gaps; that is, words they read that they simply do not understand or concepts that they cannot express as adequately as they could in their

native or first language (L1). Indeed, many learners view L2 acquisition as a matter of learning vocabulary. As such, learners devote a large amount of time to memorizing lists of L2 words and rely heavily on the bilingual dictionary as a fundamental communicative resource. After a lengthy period focused on the development of grammatical competence, language teachers and researchers now realize the importance of vocabulary learning and have started exploring approaches to improve vocabulary learning. Vocabulary is therefore considered a priority area in language teaching and learning, requiring tests to monitor learners' progress in vocabulary learning and to assess whether their lexical knowledge is sufficient to meet their communication needs.

Measuring vocabulary knowledge is essential for assessing and evaluating learners' language proficiency in terms of word knowledge and also for teaching and learning a second language (Anderson & Freebody, 1981; Nation, 2013; Palmberg, 1987; Staehr, 2008; Vermeer, 2001). There are various measures designed to capture learners' vocabulary knowledge, and various researchers have advocated for different tests based on their view of vocabulary knowledge (Laufer & Goldstein, 2004; Laufer & Paribakht, 1998; Read, 2000; Schmitt, Nation, & Kremmel, 2020; Webb, 2013). Some measures attempt to measure multiple aspects of knowledge simultaneously (Read, 1988; Schmitt, 1999), while others seek to assess learners' progress along a knowledge continuum (Wesche & Paribakht, 1996).

Word knowledge can be separated into receptive and productive knowledge (Read, 2000, 2004a). Receptive knowledge, also known as recognition, refers to the ability to recognize and comprehend words, whereas productive knowledge, also known as recall, refers to the ability to retrieve and produce words. Reception and production of vocabulary knowledge are typically separated from comprehension and use. In particular, comprehension relates to how well learners grasp the target words in the test context, such as reading comprehension, while use refers to learners' recall of vocabulary knowledge.

To date, there has been no consensus on which aspects of word knowledge a vocabulary test should actually measure. Bachman (1990) viewed language

proficiency as a set of communicative skills and proposed a model of communicative language ability. This model included communicative functions in language competence in addition to lexical knowledge. Similarly, Read (2000) contended that the lexical model should incorporate lexical communicative competence in addition to the knowledge of discrete lexical items. Furthermore, Read and Chapelle (2001) argued that vocabulary assessment should estimate vocabulary size, also known as a breadth of lexical knowledge (the number of words known), and argued that most vocabulary tests do not give learners the incentive to deepen their knowledge of lexical items, also referred to as depth of lexical knowledge (how well a particular word is known or depth of knowledge). It has also been suggested that vocabulary tests should go beyond decontextualized word lists to generate positive washback on the teaching and learning process (Read & Chapelle, 2001).

Vocabulary learning is incremental, and mastery of different aspects of a word tends to vary on a continuum stretching from 'no knowledge' at one end to 'full knowledge' at the other (Wesche & Paribakht, 1996). This continuum affects test design and test items, and tests need to be designed to suit their purposes. For example, if the test's purpose is to provide an overall picture of learners' vocabulary size and give credit for partial knowledge, a test of breadth of lexical knowledge is required (Cameron, 2002). On the other hand, if the purpose is to determine if learners have gained 'full knowledge' of the word, a test to elicit such knowledge needs to be developed. Most vocabulary tests purposely measure one aspect of word knowledge (e.g., knowing word meaning, form, or use). Yet, from the viewpoint of a receptive and productive continuum, earlier studies seem to capture aspects of either receptive or productive knowledge (e.g., Harrington & Carey, 2009; Hilton, 2008; Laufer & Goldstein, 2004; Laufer & Paribakht, 1998; Lin, 2012; Nation, 2006; Schmitt & Meara, 1997; Sukying, 2017; Yu, 2010). Using only receptive or productive tests to capture such knowledge learning may produce misleading information (Read, 2000; Webb, 2005, 2008). Thus, the present study used various tests to measure different aspects of vocabulary knowledge, and each aspect assessed both reception and production.

Schmitt (2010) identified three difficulties in investigating the interface between receptive and productive vocabulary knowledge: (1) the feasibility of measuring all aspects of vocabulary; (2) the practicality of assessment, such as time and the number of words to be measured; and (3) the cross-test effect, which referred to the influence of completing one test on the others because of the interrelated types of vocabulary knowledge. A multi-task approach was used to capture different aspects of vocabulary knowledge (Read, 2000; Nation, 2013). Moreover, each aspect might necessitate distinct receptive and productive measurements, and it was necessary to use equivalent test items (Laufer & Goldstein, 2004; Read, 2000; Webb, 2005). Given the developmental nature of the vocabulary acquisition process, research was required that tracked the same words and followed the same group of learners to better reveal the learning process (González-Fernández & Schmitt, 2020; Schmitt & Meara, 1997; Sukying, 2017, 2020; Zhong, 2014). A test should be able to capture one's vocabulary knowledge and adhere to what was being tested (Coxhead, 2007; Nation, 2013). The concept of receptive and productive vocabulary knowledge should also be clear and concise (Read, 2000). Therefore, the twelve tests are designed independently based on previous measures of vocabulary knowledge and separately used to measure twelve different vocabulary knowledge aspects.

2.6.1 Measures of Receptive Vocabulary Knowledge

Receptive vocabulary knowledge can be assessed through matching, multiple-choice, and yes/no formats, such as the Vocabulary Levels Test (VLT), the Vocabulary Size Test (VST), and the Eurocentres Vocabulary Size Test (EVST). The VLT was designed by Nation (1983, 1990) and validated by Beglar and Hunt (1999) and Schmitt, Schmitt, and Clapham (2001). It involves matching word definitions, and test-takers must match the target words with the provided connotations at four frequency levels and an academic vocabulary level. All target words are delivered in the same part of speech to prevent offering any indications on the connection of the word category. The information obtained from the VLT is useful for individuals working in pedagogical contexts since it shows whether learners reach the lexical thresholds of comprehension required to deal with specific language production, such as speaking and reading comprehension. The VLT test words are taken from the

2,000-word, 3,000-word, 5,000-word, 10,000-word bands and the University Word List (Guoyi & Nation, 1984) or the Academic Word List (Coxhead, 2000). Examples are shown below (Schmitt, Schmitt, & Clapham, 2001, pp. 82-83):

1. business	
2. clock	part of a house
3. horse	
4. pencil	animal with four legs
5. shoe	
6. wall	something used for writing

The Vocabulary Size Test (VST), designed by Nation and Beglar (2007) and validated by Beglar (2010), is presented as a multiple-choice format with target words embedded in a non-defining context. Test takers must select the proper meaning from four alternatives, one correct meaning, and three distractors. It is commonly used to assess lexical knowledge, particularly written and spoken forms (Anderson & Freebody, 1981; Read, 2000). The word selection criteria are the same as the VLT except that the VST uses 14-word bands from Nation's (2006) word list. Nation (2006) classified groups of words in frequency bands of 1,000 words each. The initial frequency list comprised 14 bands, but it was later updated to 25 bands. An example question from the VST is shown below (Nation & Beglar, 2007, p.75):

-
1. poor: we are poor.
 - a. have no money
 - b. feel happy
 - c. are very interested
 - d. do not like to work hard
-

Most studies have used multiple-choice items as their receptive format, although this format is not the best option as correct guesses likely inflate the scores (Gyllstad, Vilkaite, & Schmitt, 2015). Instead, it is recommended that meaning recall formats and form recall formats are used.

The Eurocentres Vocabulary Size Test (EVST) was designed as a yes-no test or as a checklist test (Read, 2000; Schmitt, 1994) and has been validated in different versions (Meara & Buxton, 1987; Meara & Jones, 1988; Meara, 1996b). It presents a

representative sample of words in a range of frequency levels and requires test-takers to tick or mark Yes or No to indicate whether the given words are known or not. The Yes/No vocabulary test presents a large number of lexical items in the test battery (Meara & Buxton, 1987; Read, 1988; Wesche & Paribakht, 1996). However, test-takers may tend to overestimate their knowledge by selecting uncertain words as known (Schmitt & Meara, 1997; Schmitt, 1994; Sukying, 2017). As such, non-words are contained in the list of target words. An example is illustrated below (Meara & Buxton, 1987, p. 154):

(Tick the words you know the meaning of, e.g., forecast)

1. gathering
 2. strap
 3. untarned
 4. royalment
 5. flane
 6. article
 7. risent
 8. instructness
-

The three tests are described above target the receptive ability of meaning and form recognition. These tests are simple to administer, score, and analyze. However, one common weakness of these tests is the possibility for the test-taker to guess the correct answers.

The translation test is also widely used to capture meaning comprehension and form recognition (Laufer & Goldstein, 2004; Webb, 2005, 2009). The translation test can be either receptive or productive depending on the direction of translating (Read, 2000). Receptive meaning comprehension and form recognition, for example, require learners to translate the word meaning from the target language to their first language. In contrast, the productive meaning comprehension and form recognition version of the test requires learners to translate the word meaning from their first language to their target language. This test design is advantageous for learners who do not have sufficient proficiency in the target language to express their knowledge of word meaning in the target language (Read, 2000).

There are also other receptive measures that assess a specific feature of lexical knowledge, such as the receptive orthography task and Word Segmentation (WS) task. The receptive orthography task, designed by Webb (2005, 2009), requires learners to choose the correctly spelled target words among three distractors, which resemble the target words phonetically and orthographically. An example is shown below (Zhong, 2014, p. 88):

Please select the word that is spelled correctly.

- a. dirrect b. diret c. direct d. derict
-

The Word Segmentation (WS) Task (Hayashi & Murphy, 2011) is used to measure receptive knowledge of morphological awareness and involves breaking down word components into morphemic parts. The WS task comprises 34 target words and includes both class-changing and class-maintaining derivational affixes and inflectional suffixes. The lexical items contain different numbers of affixes, depending on the internal morphological structure of the word. For instance, the “unkind” term has one prefix (un- + kind), while the “unkindly” term has two affixes (un- + kind + -ly). All the target affixed elements, including their frequency bands, are examined against the frequency data from Francis and Kucera (1982).

Association knowledge is defined as the associations between words (Nation, 2013) and is largely developed incidentally through receptive and productive language use (Miller & Fellbaum, 1991). Conventional associations include opposites, synonyms, and hyponyms that can be established through deliberate learning, but there is likely little value in teaching them (Webb, 2020). The Word Association Task (WAT), designed by Read (1995, 1998), measures receptive association knowledge, defined by its synonym. The WAT can capture the receptive knowledge of both semantic association and collocational aspects. The test requires learners to select four out of eight words that associate with the target word. The eight associates are divided into two groups, one reflecting semantic association of the target word and the other testing knowledge of frequent collocates. An example item from the WAT (Read, 1998) is shown below:

BEAUTIFUL

enjoyable	expensive	free	loud	education	face	music	weather
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All of the tests described above have been standardized as placement indicators. With empirical evidence proving an association between the number of words known and full linguistic proficiency, the tests may assign learners to different levels of language competence and estimate the receptive knowledge required for various activities. These tests can be further modified to fit various study objectives or aims.

2.6.2 Measures of Productive Vocabulary Knowledge

Measuring productive vocabulary knowledge typically requires learners to recall and produce target words. Thus, productive measures include both controlled and free productive knowledge. Controlled productive knowledge can be measured through the Productive Vocabulary Levels Test (PVLТ), designed by Laufer and Nation (1995, 1999). The test is formed as a sentence-writing task or, in a controlled context, a 'fill-in-task,' in which the missing word within a predefined sentence must be provided. To prevent non-target words that may fit semantically in the assigned sentence, the initial letters of the target word may be given. Examples are shown below (Laufer & Nation, 1995, pp. 320):

-
1. They will restore the house to its orig_____state.
 2. The tot_____ number of students at the university is 12,347.
-

Similar to the PVLТ, Laufer (2013) proposed the newly developed Productive Vocabulary Size Test. The task provides a sentence context as well as the meaning of the target words. It requires test-takers to retrieve a word form in response to the target word. However, empirical evidence on the reliability and validity of this new format of productive measure is yet to be demonstrated. An example item from the PVLТ is shown below (Zhong, 2014, p. 100):

He lost his pa_____. (artist's board for mixing colour).
(Answer: *palette*)

A sentence writing test can also be used to measure both controlled and free productive vocabulary knowledge. The controlled version asks learners to create a sentence using the target word provided, whereas the free productive version demands learners write a sentence without the target word. The production of the word form is not required for the controlled receptive vocabulary measure of sentence writing, but the requirement for sentence writing might vary. Test-takers can, for example, produce a variant form of the target word (Read, 2000). An example is shown below (Zhong, 2014, p. 100):

Write a sentence for each of the following words.

DIRECT

Read (2000) proposed a sentence writing task without restriction on the form of the target word, which allows learners to demonstrate different aspects of their productive vocabulary knowledge. For example, the task assesses whether learners 1) understand the meaning of the target word, 2) know how the word functions grammatically within a sentence, 3) know its correct form, 4) how the word collocates appropriately with other words, and 5) can use the word productively in their writing. Indeed, learners may not know the meaning of a word but can write a grammatically accurate sentence in the context in which the word is used (Bruton, 2009; Laufer & Goldstein, 2004; Read, 2000). Additionally, learners may tend to adopt the form with which they are most familiar. Zhong (2012b) also introduced a sentence writing version that allows learners to use the form of the target word and compose more than one sentence. This may provide a rich context for learners to better demonstrate their ability to use the words in context and may prevent learners from fitting a word into context without knowing its meaning.

Free productive knowledge can be captured via lexical richness and association tasks. The Lexical Frequency Profile (LFP), designed by Laufer and Nation (1995 and Schmitt (2010), is one of the most widely used frequency-based tests. It is a measure of lexical richness in writing that counts the number of word tokens in a text and

distributes these word tokens among four frequency levels, which are derived from standardized word frequency lists. The LFP is used to measure the proportion of words that a learner can use in free production, including the most common 1,000 words in English and the most common 1,000 English words in the Academic Word List (Coxhead, 2000). Test-takers must write an essay, and the essay is assessed via a computerized system - the more words from infrequent bands that are used, the more proficient the learner. However, learners may avoid using words they know but cannot master, and producing essays of such length is a time-consuming and demanding task for learners of low language proficiency.

Lex30 can be used to measure productive knowledge of word associations (Meara & Fitzpatrick, 2000). The test requires a set of word associations to be produced. Lex30 consists of 30 words, all from the first 1,000 most frequent words on Nation's list (1984). Test-takers are required to provide at least three associates of the target word. The associated words produced by test-takers are lemmatized through a computerized system that reports the frequency of each word. Meara and Fitzpatrick (2000) noted that, although the Lex30 test appeared to be measuring the recall dimension of productive vocabulary (Read, 2000), it provided no information regarding learners' ability to use that vocabulary. Nevertheless, the Lex30 test is useful for providing information about one aspect (productive recall) of vocabulary knowledge and is appropriate for using alongside other vocabulary knowledge tests. Fitzpatrick (2007, 2012) further refined the Lex30 such that the words elicited could be categorized into different types of association (e.g., meaning-based or form-based association) or into different aspects (e.g., productive word form, receptive form-meaning links, productive morphology).

Both the LFP and Lex30 have been validated and shown to discriminate the linguistic proficiency levels (Laufer, 2005 for the LFP and Fitzpatrick & Clenton, 2010; Walters, 2012 for Lex30). However, they have not been assessed in their ability to assess collocations, which is an important aspect of production knowledge. Furthermore, neither of the tests has been standardized because of the breadth of the generalizability of their results (Nizonkiza & Van de Poel, 2014).

Other common productive measures include the Affix Elicitation (AE) task and productive morphology task. Building on Nation's (2001) morphological task, the Affix Elicitation (AE) Task, designed by Hayashi and Murphy (2011), is used to measure productive morphological knowledge. The test is comprised of 34 items, including ten inflectional suffixes, 12 class-changing derivational affixes, and 12 class-remaining derivational affixes. It includes an equal number of grammatical functions (i.e., six adjectives, six adverbs, six verbs, and six nouns). Examples are shown below (Hayashi & Murphy, 2011, pp. 119):

-
1. I went to the doctor for a consultation. (consult)
 2. Normally she intensifies the effect by turning off the lights. (intensify)
-

The productive morphology task, designed by Schmitt and Zimmerman (2002), is a sentence completion task that provides a context for the target words. Test-takers are required to judge whether there is a form for the word class of the target word and also write the correct word class of the target word, as shown in the following example (Schmitt & Zimmerman, 2000, p. 169):

ASSUME	
Noun	He made an _____ that she likes meat.
Verb	He can _____ that she likes meat.
Adjective	He had an _____ idea that she likes meat.
Adverb	He decided _____ that she likes meat.

The productive morphology task (Schmitt & Zimmerman, 2000) is designed to assess the contextualized use of words. It also measures the receptive ability of the non-target words because learners must know these words in order to understand the context. Building on this task, Ishii, and colleagues (Ishii, 2005; Ishii & Schmitt, 2009) proposed a simple and decontextualized task to assess morphological knowledge. Specifically, the adverb column was removed because of its low reliability. Indeed, it was found that the completion of adverbs was largely associated with knowledge of adjectives. The reliability of the test without the adverb column was 0.94 (Ishii, 2005). An example from the modified productive morphology task is shown below (Ishii & Schmitt, 2009, p. 2009):

Target word	Noun	Verb	Adjective
stimulate	<i>stimulation</i>	<i>stimulate</i>	<i>stimulating</i>
educate			

The present study measures receptive and productive vocabulary knowledge using the comprehensive concept of word knowledge by Nation (2013), namely word parts, written forms, form-meaning links, associations, collocations, and grammatical functions knowledge. All of the tests used in this study were developed using previous standardized tests as placement indications (e.g., Beglar, 2010; Beglar & Hunt, 1999; Ishii, 2005; Ishii & Schmitt, 2009; Laufer & Goldstein, 2004; Laufer & Nation, 1995, 1999; Nation, 1983, 1990; Nation & Beglar, 2007; Nontasee & Sukying, 2020, 2021; Read, 1995, 1998, 2000; Schmitt, 2010, 2014; Schmitt, Schmitt, & Clapham, 2001; Simpson, 1987; Webb, 2005, 2009; Zhong, 2014). The vocabulary knowledge framework (Nation, 2013) shows that assessing all 18 lexical knowledge components was preferable. Indeed, learning a word entails various attributes, each imposing a different burden on learners. Together, these attributes encompass the three main aspects of learning a word: form, meaning, and use. These three aspects are possibly gained through incidental and intentional learning. Some parts may come naturally to native speakers, while non-native speakers may learn via experience. As a result, the environment and the opportunity to be exposed to a language are crucial for learning.

Word parts knowledge, also known as affix or morphological knowledge (Bauer & Nation, 1993), encompasses the derivation and inflection of a word. Derivative knowledge is word class knowledge, while inflective knowledge is regarded as grammatical knowledge (Schmitt & Meara, 1997). Schmitt and Meara (1997) further note that learners may be familiar with a root word and understand its meaning but may not identify a derivative word. The present study assesses word-class knowledge as grammatical knowledge is thought to have a stronger relationship with learners' language proficiency in general and grammatical function knowledge in another aspect. Knowing the basic form or the frequently used word classes (noun or verb) of a word will often facilitate comprehension of the meaning of its adverb or adjective (Schmitt & Zimmerman, 2002).

Measuring receptive word part knowledge aims at recognizing different word classes of a word, whereas measuring productive word part knowledge relies on producing the different word classes of a word. If the learner understands the basic form of a word or often used word classes (noun or verb), this can help them to know the meaning of its adverb or adjective; for example, knowing one word in a family receptively facilitates the learning of other members (Schmitt & Zimmerman, 2002). In the present study, the receptive and productive word part measures were developed based on the morphology task by Ishii and Schmitt (2009), Ishii (2005), and Zhong (2014).

Knowledge of written forms can include phonological and orthographic word knowledge (Nation, 2013); that is, what the word looks like and how it is written and spelled. The writing system is systematically connected to the spoken language through an alphabetic or syllabic writing system. Phonological awareness is required early in the learning process in order to read an alphabetic language, such as English. This is the realization that words can be divided into individual sounds, which may be combined to form words. Webb (2020) argues that learning the written form of words should indeed occur across the four strands of meaning-focused input (learning by reading texts at the appropriate level), meaning-focused output (having to write words and sentences), language-focused learning (deliberately learning letter shapes, sound-spelling correspondences, and word attack skills, and memorizing irregular words), and analytic learning (doing plenty of very easy reading). The present study aims to measure word spelling knowledge, both receptively and productively. The receptive written form measure is developed based on the format of Webb (2005, 2009) and Zhong (2014) and captures learners' receptive knowledge of word spelling. The productive written form measure is developed based on the productive knowledge of orthography task (Webb, 2005) and is used to assess learners' productive knowledge of word spelling.

Form-meaning link knowledge is a crucial aspect of vocabulary knowledge for EFL learners in recognizing and producing a word (Webb, 2020). In order to begin reading and listening, learners must be able to recognize the word form and its attached

meaning. The form-meaning link connects a known form to a known meaning. However, it is possible to know the form of a word and its meaning without realizing the two are associated. This phenomenon is widespread in EFL learning since the first language concepts are usually in the form of translations in the early stages of EFL learning (Laufer & Goldstein, 2004). Form-meaning link measures based on translation tests (Laufer & Goldstein, 2004; Nontasee & Sukying, 2020, 2021; Webb, 2005, 2009) are widely used to capture meaning comprehension and form recognition (Schmitt, 2010; 2014; 2016).

Translation can be a productive or receptive task (Read, 2000). Although test-takers are expected to create output in their first language, the translation task from the target language to L1 is seen as utilizing productive knowledge in L1 as evidence for receptive vocabulary knowledge in the target language. A translation test design is beneficial for learners with low proficiency in the target language, as it allows them to express their understanding of word meaning in the target language (Read, 2000). The receptive version relies on L2-to-L1 translation, which requires learners to recognize the English target words based on their L1 words. The productive measure is L1-to-L2 translation, which requires learners to recall their knowledge of L2 English words, specifically by linking the form and meaning of the target words.

Word association knowledge is primarily acquired incidentally via receptive and productive language use (Nation, 2013). Some conventional associations, such as opposites, synonyms, and hyponyms, can be created via purposeful learning, although teaching them is unlikely to be beneficial. In addition, various activities involve grouping words and arranging them into semantic maps, which may be viewed as a type of elaboration that can enhance learning. A receptive measure of word association knowledge was developed based on Read's (1998) validated version of the Word Associates Test (WAT). This test encourages the participant's ability to recognize the semantic association of the word (synonym). A productive measure of word association knowledge was also developed based on the active recall task by Laufer and Goldstein (2004). This test encourages the participant's ability to recall the semantic association of the word (synonym).

Collocations knowledge refers to understanding and recognizing that multiple words occur, fit naturally together, and are commonly seen in English. Knowing collocated words will enable learners to use the English language more naturally. That is, in addition to looking at words as units, learners must also consider how words function in larger units. Multiword units consist of parts that contribute to the meaning of the whole, and these parts behave grammatically and semantically in ways consistent with their use in other contexts (Liu, 2010). That is, collocations are not random word groupings but relatively regular, predictable combinations.

Encouraging learners to restructure their knowledge to deal with larger units of language, such as words rather than letters and phrases rather than words, is a very effective learning approach (Joe, 1998; McLaughlin, 1990). However, collocations are difficult to acquire and are sometimes never mastered. Read (1995, 1998) developed a validated Word Association Test (WAT) version to assess semantic association and collocation knowledge. The present study adapted the WAT to evaluate receptive knowledge of collocation. The productive version of the Vocabulary Levels Test (PVLVT) (Laufer & Nation, 1999) was also adapted to measure learners' ability to produce collocations. Together, these tests measure receptive and productive competence of collocations, particularly adjective + noun collocations.

Knowledge of grammatical functions can relate to language systems (systematic knowledge) and particular words (grammatical knowledge). Within systematic knowledge, English nouns may be countable or uncountable, which affects whether they can have singular and plural forms or be used with numerals, articles, determiners, and subject-verb agreement. English verbs can be transitive and intransitive, which affects their passive use and what can occur after the verb. Grammar knowledge is word-based. That is, it relates to particular words. It is at this point that grammatical knowledge and collocational knowledge overlap. In the present study, the receptive and productive tests were designed to correctly measure learners' grammatical functions knowledge. The receptive grammatical functions test is based on The Vocabulary Size Test (VST) designed by Nation and Beglar (2007)

and validated by Beglar (2010) and also on the receptive grammatical functions test by Webb (2005). It is presented in a multiple-choice format and is used to measure receptive knowledge of grammatical functions. This test encourages participants to recognize the grammatical accuracy of the word in the context. The productive grammatical functions test is based on the productive grammatical functions test by Webb (2005). This test assesses participants' ability to produce the word with the correct grammar in the context sentence.

2.7 Word List for the Present Study

2.7.1 General Service Word List (GSL)

The General Service List (GSL) was established by West (1953). The GSL represents a list of the classic collection of the first 2,000 most frequently used words based on 5,000,000 running words (tokens) in English printed texts. The lexical items of the GSL are placed in alphabetic order and are used as a basis for many series of simplified literature and English courses. The GSL provides coverage of around 80% of the total tokens in most written texts.

2.7.2 New General Service List (NGSL)

The New General Service List (NGSL) was created by Browne, Culligan, and Phillips (2013). The NGSL provides core high-frequency words for ESL learners (L2). The list includes the essential high-frequency words and provides over 92% coverage for most general English texts. Additionally, it contains a list of approximately 2,800 high-frequency words by combining the objective scientific principles of the corpus and the vocabulary list creation with useful pedagogic insights. Finally, the list's generalizability and validity have been updated, and the size of the corpus expanded by comparing the 273 million words to the 2.5-million-word corpus in the original GSL by West (1953).

2.7.3 Academic Word List (AWL)

The Academic Word List (AWL) was created by Coxhead (2000) and listed 570-word families by analyzing a corpus of millions of words from over 400 academic texts. The words are relevant to all areas of academic study, covering commerce, law, science, and arts. The list of 570 words is divided into ten sub-lists; the most frequent

60 words are allocated to Sub-list 1 and the least frequent words to Sub-list 10. Given its relevance to all fields of study, teachers can use the AWL as part of a program preparing learners for tertiary-level education, or it can be used by learners working alone to learn the words most needed to study at tertiary institutions. The New Academic Word List (NAWL) was further developed (Coxhead, 2012). The NGSL was a list of 2,801 words comprising English's most important high-frequency words, giving over 90 percent coverage. The educational use of the NGSL was found in the semantic foundation of its selection and presentation.

2.7.4 British National Corpus (BNC) Word List

The British National Corpus (BNC) Word List, developed by Nation (2006), uses lexical items from the BNC that covers 1,000,000 running words of English, including 90% of printed materials and 10% of spoken discourses. The lexical profile is established following the frequency and range of occurrence and dispersion. The BNC consists of 14 sub-lists of the 14,000 most frequent word families established at Level 6 regarding the classification of word families by Bauer and Nation (1993).

Senior high school learners typically have approximately ten years of classroom English language instruction in an EFL context. Therefore, they are at a stage where they should be able to use high-frequency vocabulary and continue studying English at a higher level of academic study. Based on the Ministry of Education of Thailand (2008), graduates in grade 12 should have a vocabulary size of around 3,600-3,750 words. However, it is not clear if they reach the requirement of Thailand's Basic Education Curriculum B.E. 2544 (A.D. 2001) after 12 years of English study. Previous findings indicate that the vocabulary needed for EFL learners is 86% of high-frequency words (86%) and 10% of academic words, but it appears that EFL learners may not have sufficient work knowledge to achieve this level (Hayashi & Murphy, 2011; Sukying, 2017).

Nation and Waring (1997) found that ESL and EFL learners have a command of 2,000 words, and these learners typically concentrate on the high-frequency words of the language. Accumulating high-frequency words is a critical stage that language learners must master to progress in daily English conversations before moving on to

academic studies. Laufer (1992) found that knowing a minimum of approximately 3,000 words is required for effective reading at the university level, whereas knowing 5,000 words indicates likely academic success. Furthermore, Nation (2006) suggested that learners would need to acquire a knowledge of 3,000 to 4,000-word families, plus marginal words, proper nouns, and transparent compounds to deal with a wide variety of texts. This provides a convenient threshold for a sufficient understanding of a text. In the present study, the target words were selected from the New General Service List (NGSL) (Browne, Culligan, & Phillips, 2013) and the Academic Word List (AWL), and were considered to be common in daily life and in the area of academic study.

2.8 Summary of the Chapter

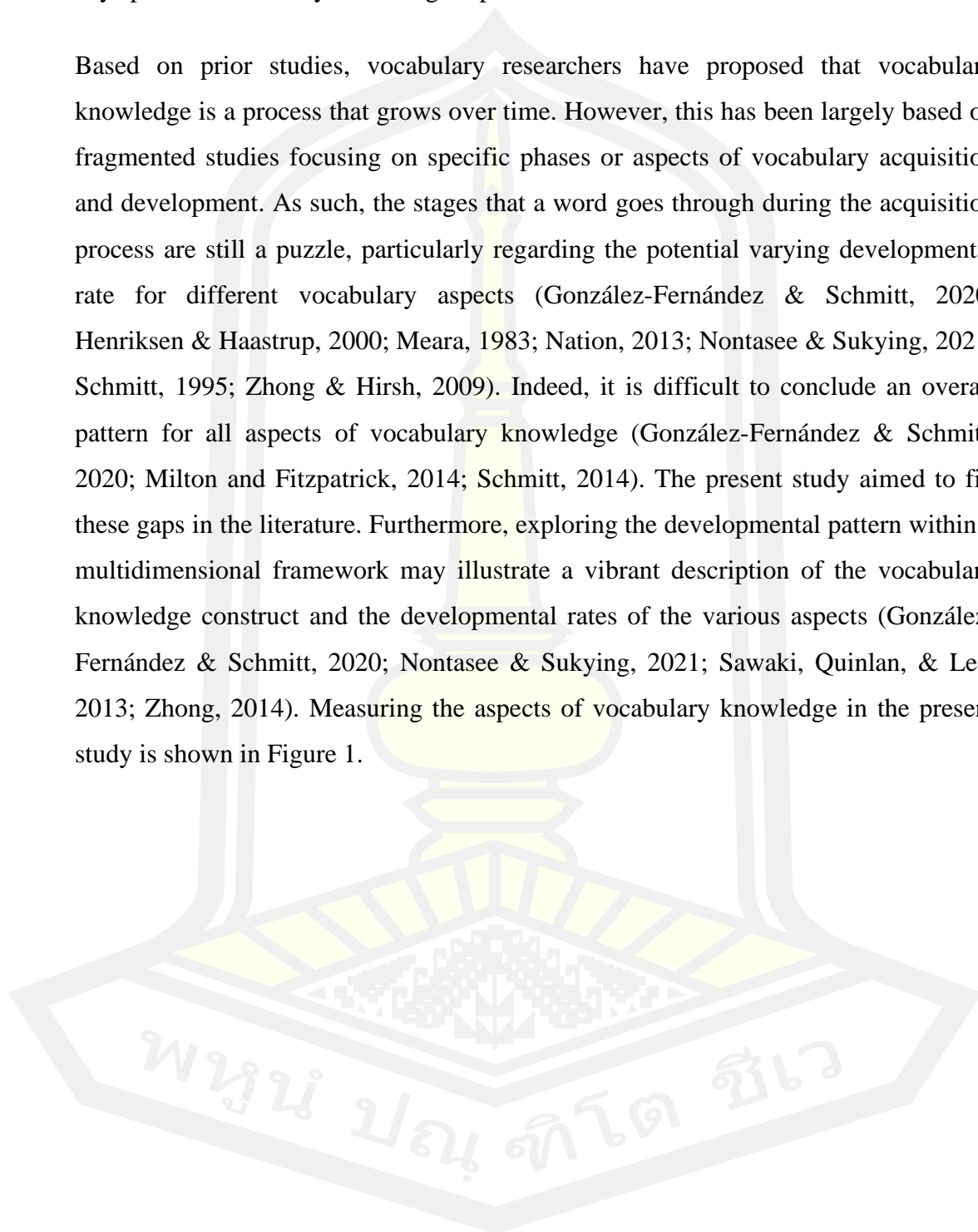
The present study investigated the general nature of the vocabulary knowledge construct with a multidimensional framework. First, it measured the acquisition order of different vocabulary aspects, including written forms, word parts, form-meaning links, associations, collocations, and grammatical functions, both receptively and productively. The relationships between these various vocabulary aspects were examined. Three research questions were developed to guide the study:

1. What is the acquisition order of different vocabulary knowledge aspects in Thai EFL high school learners?
2. What is the relationship model of the various vocabulary knowledge aspects to acquire a word in Thai EFL high school learners?

Within the word knowledge framework proposed by Nation (2013), vocabulary knowledge was a multi-aspect construct. The distinction between receptive and productive knowledge existed along a continuum, and vocabulary growth progressed from reception to production. A multi-task approach was used to capture different aspects of vocabulary knowledge, and the tests were designed and developed based on previous measures. Each aspect was measured both receptively and productively. Based on Read's (2000) theory of vocabulary assessment, different aspects of vocabulary knowledge should be assessed by different measures or tests, and both reception and production of vocabulary knowledge should also be captured.

Therefore, each of the twelve vocabulary tests was specifically designed to measure any specific vocabulary knowledge aspect.

Based on prior studies, vocabulary researchers have proposed that vocabulary knowledge is a process that grows over time. However, this has been largely based on fragmented studies focusing on specific phases or aspects of vocabulary acquisition and development. As such, the stages that a word goes through during the acquisition process are still a puzzle, particularly regarding the potential varying developmental rate for different vocabulary aspects (González-Fernández & Schmitt, 2020; Henriksen & Haastrup, 2000; Meara, 1983; Nation, 2013; Nontasee & Sukying, 2021; Schmitt, 1995; Zhong & Hirsh, 2009). Indeed, it is difficult to conclude an overall pattern for all aspects of vocabulary knowledge (González-Fernández & Schmitt, 2020; Milton and Fitzpatrick, 2014; Schmitt, 2014). The present study aimed to fill these gaps in the literature. Furthermore, exploring the developmental pattern within a multidimensional framework may illustrate a vibrant description of the vocabulary knowledge construct and the developmental rates of the various aspects (González-Fernández & Schmitt, 2020; Nontasee & Sukying, 2021; Sawaki, Quinlan, & Lee, 2013; Zhong, 2014). Measuring the aspects of vocabulary knowledge in the present study is shown in Figure 1.



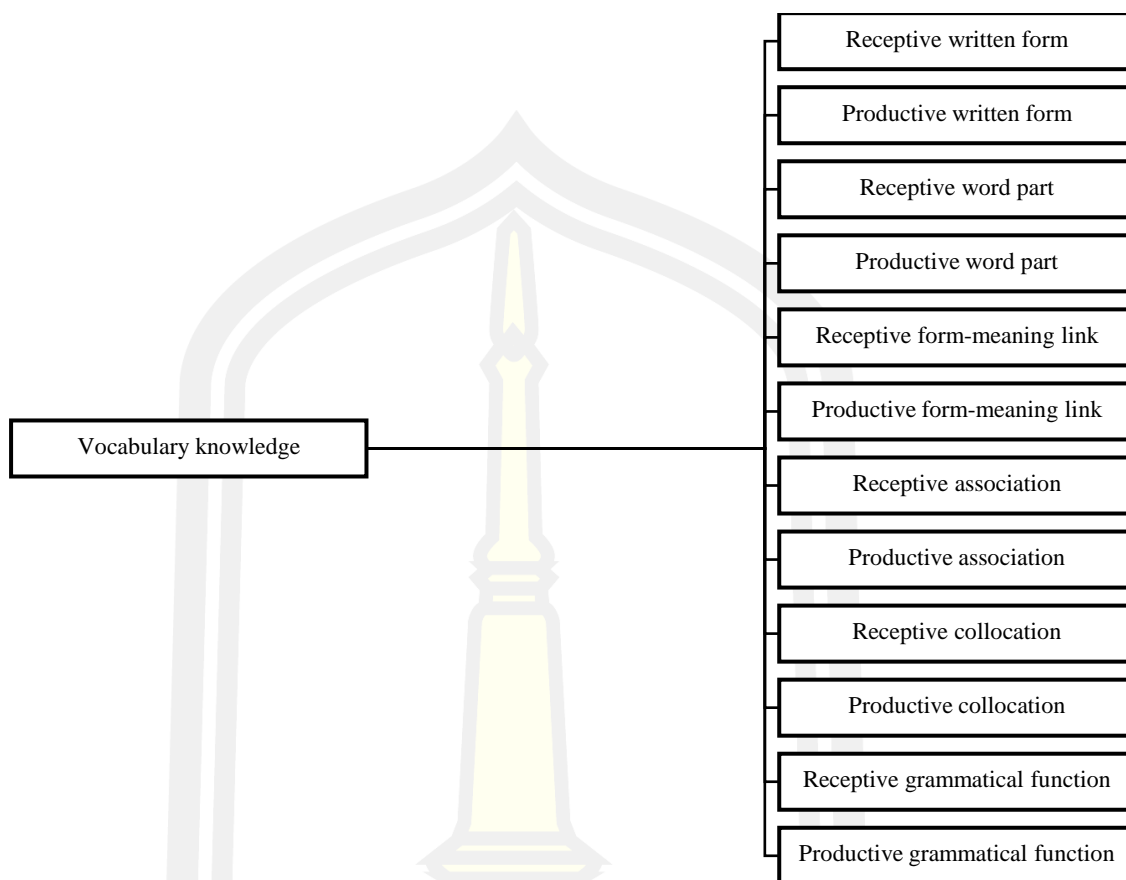


Figure 1. Measurement of Vocabulary Aspects

The present study measured Thai EFL senior high school learners' vocabulary knowledge [including written form, word part, form-meaning link, association, collocation, and grammatical function (both reception and production)].

This chapter presents the vocabulary knowledge framework as a multi-aspect construct and reviews the relevant studies involving the interface between receptive and productive vocabulary aspects. The literature discussion identifies a gap in exploring the interrelatedness of receptive and productive vocabulary aspects and implies the methodology design to address the gap. This chapter also reviews some existing vocabulary instruments leveling different receptive and productive vocabulary aspects. Finally, rationalization has been presented in the selection of instruments fit for the present study.

CHAPTER III

RESEARCH METHODS

The rationale of the present study is to investigate the general nature of the vocabulary knowledge construct involving a multidimensional framework by examining the acquisition order and interrelatedness of various word knowledge aspects in English as a Foreign Language (EFL) learners. This chapter presents a full account of the context of the study. It describes the setting and its participants, instrumentation, methods, procedures, and data analysis. The methodology follows the vocabulary testing theory to measure learners' receptive and productive vocabulary knowledge.

3.1 Research Design and Approach

Cross-sectional research is based on postpositivist assumptions, and these assumptions hold true more for quantitative research. According to Creswell (2014), a postpositivist believes in a philosophy that causes determines the effects of the variables studied, and reality can be perceived objectively. A set of immutable laws or theories govern reality (Guba & Lincoln, 2005). That is, reality is viewed as quantifiable and measurable. The research should be defined and controlled variables and manipulate the research setting. Therefore, the problems investigated by the researchers reflect the need to identify and assess the causes that influence outcomes, such as those found in the research. Additionally, it is reductionistic. The intent is to reduce the notions into a small set to test, such as the variables that consist of hypotheses and research questions.

The knowledge that develops through a postpositivist lens is based on careful observation and measurement of the objective reality that exists in the world. Hence, developing numeric measures of observations and investigating the behaviors of individuals or language learners becomes paramount for a postpositivist. Finally, some theories govern the world, which need to be tested, verified, and refined to understand the world. In this regard, a quantitative researcher often begins with a theory, collects data that either supports or refutes the theory, and then makes necessary revisions and conducts additional tests. Therefore, research instruments and

data collection procedures must be validated before being used in the main study. Based on the assumptions mentioned above, the present study is a cross-sectional research design focusing on numeric data analysis. The underlying rationale of this study is to determine the general nature of vocabulary knowledge construct to understand the roles of vocabulary aspects and the conceptualization of their relationships.

3.2 Participants and Setting

The present study included participants in the pilot and main study. The participants in both groups were considered to be similar education level learners (Thai EFL senior high school learners) but were separately set aims. First, the pilot participants were 150 Thai EFL senior high school learners and were used to conduct the reliability and validity of the vocabulary tests in the research context. Second, the main participants were approximately 500 Thai EFL senior high school learners and were aimed to conduct vocabulary tests to complete the research questions.

3.2.1 Participants in the Pilot Study

The pilot study was defined as a test validation. Therefore, before the test conducting, the content validity of the twelve tests was assessed by five experts in the area of English education who had taught English in Thai EFL contexts for more than ten years, including one native speaker, one university teacher, and three high school teachers.

All twelve tests were piloted with 150 senior high school learners to determine test reliability. The pilot participants were senior high school learners from a high school in northeast Thailand. They had a similar level of English proficiency as the participants in the main study, which influenced the research setting. In their study, they had been learning English as a compulsory subject for at least ten years. The tests were administered to pilot study participants. A list of 30 items was contained in each test, and the pilot participants were provided 20 minutes for each productive test and 15 minutes for each receptive test. The test scores were analyzed to identify the test reliability (Cronbach's Alpha). Furthermore, the analysis of the difficulty level of the items in any tests indicated the rationale for selecting the target words and finalizing

instruments for the main study. This analysis was also used to discriminate the suitable items for participants.

3.2.2 Participants in the Main Study

The study had 721 senior high school learners participate, and their parents consented to their involvement, but only learners who completed all twelve tests were included in the data analysis. The learners who did not participate in the tests by providing patterned responses to multiple choice questions, handing in blank tests or more than 50% missing data, or writing answers unrelated to the questions were excluded from the analysis during the data cleaning procedure. The data analysis and results of the main study reported in this study were based on 500 participants, showing a 69.35% successful participation rate.

Therefore, the present study included 500 senior high school learners as participants. The participants varied in age from 16 to 18 and comprised the tenth-grade ($n = 165$), eleventh-grade ($n = 198$), and twelfth-grade ($n = 137$) learners. All were Thai native speakers who used their L1 to communicate in general; none had studied in an English-speaking nation. All participants had learned English as a Foreign Language (EFL) and had received English lessons for at least ten years of systematic schooling.

The participants were at a local high school under the government university administration in the northeast of Thailand, and their English language abilities ranged from advanced beginners to upper-intermediate. Furthermore, their families represented a variety of socioeconomic and occupational backgrounds. Consistent with the Office of the Basic Education Commission (Ministry of Education in Thailand, 2001, 2008, 2017), all participants had been enrolled in EFL classes as a mandatory subject for a minimum of ten years. Thus, they have been studying English as a compulsory subject. The participating high school scheduled four 50-minute English sessions with EFL teachers and one 40-minute session with native English speaker teachers weekly. The class size at this school varied from 30 to 50 learners. The senior high school learners were categorized as the intermediate level of English proficiency based on the Ministry of Education in Thailand, and their English vocabulary size based on the Common European Framework of Reference for

Languages (CEFR) in Thailand developed based on the Council of Europe (2001: 2016) (Ministry of Education in Thailand, 2014). Senior high school learners 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 (Ministry of Education in Thailand, 2008). Therefore, the learners could use high-frequency vocabulary and plan to continue their English studies at a higher level of academic education. The vocabulary knowledge of this group was considered consistent with their education level. Indeed, earlier results illustrated the requirement of vocabulary for EFL learners: high-frequency words (86%) and academic words (10%) (Hayashi & Murphy, 2011; Sukying, 2017). Nation and Waring (1997) suggested that ESL and EFL learners had a command of 2,000 words and concentrated on the high-frequency words of the language. Nation (2006) pointed out that the learners needed to be familiar with knowledge of 3,000 to 4,000-word families, including marginal words, proper nouns, and transparent compounds, to comply with a wide variety of texts. This gave a convenient threshold for an adequate understanding of a text. Accumulating high-frequency words was a vital stage for language learners to advance to basic daily English conversations before moving on to academic studies.

Notably, the participants could access English from media and Internet resources. However, their language proficiency, in general, might have rarely enabled them to understand articles, movies, or TV programs independently; as such, their primary comprehensible English input was assumed to be restricted to the classroom instruction environment.

3.2.3 Ethical Consideration

The present study necessitated gaining approval from the Ethics Committee of Mahasarakham University. Therefore, all participants were recruited based on a series of formal procedures. First, ethical approval was obtained from the school principals, including the Participation Information Sheet and Consent Form for Principals. Second, prior to the commencement of the study, all potential participants were

supplied with a Participant Information Sheet regarding the research and a form of consent for participation. Third, the study was conducted amongst learners who submitted the informed consent forms in writing with their signatures and their parents' signatures.

The ethics committee approval of this study was received, which was an exemption review method according to the research integrity rules in their country (Date of Confirmation: January 18, 2022).

3.3 Selecting the Target Words for the Present Study

Nation (2013) indicated the frequency principle that the target words of assessment needed be relevant to the learners' current vocabulary knowledge level. Specifically, the appropriate words of learners provided the best return for the effort invested in learning these items and possibly were retained in long-term memory (Hulstijn, 2001; Webb, 2020; Webb & Nation, 2017). Alternatively, Nation and Waring (1997) recommended that ESL and EFL learners have a command of 2,000 words and concentrate on the high-frequency words of the language. English learners obviously benefited from focusing on the 2000 most frequent words initially because they had been demonstrated to account for at least 80 percent of the running words in any written or spoken text (Read, 2004; Schmitt & Zimmerman, 2002). Based on the Thai Ministry of Education, senior high school learners would have learned 2000 most frequent and academic words in English classrooms by the time they graduate from high school. Therefore, the target words should be familiar to the learners.

According to previous studies, the suggestions have revealed that the vocabulary needed for language learners is 86 percent for high-frequency words and 10 percent for academic words (Hayashi & Murphy, 2011; Sukying, 2017). The learners may be comfortable with high-frequency words, but they may find academic words at the high school level to be a little bit of a challenge. This is because they rarely meet a lot of kind of academic words. To ensure that the target words were sufficiently familiar, the words selected were common in daily life and the area of academic study. The target words were chosen from the New General Service List (NGSL) (Browne, Culligan, & Phillips, 2013) and the New Academic Word List (NAWL) (Coxhead,

2012). The NGSL was a list of 2,801 words comprising English's most important high-frequency words, giving over 90 percent coverage. The educational use of the NGSL was found in the semantic foundation of its selection and presentation. The words were chosen not solely on the basis of frequency but also to ensure adequate coverage of the meanings that learners were likely to need to express. Furthermore, the vocabulary was organized into word families, which included stem words and their inflected and derived forms (Bauer & Nation, 1993). The relative frequency of different meanings of the word forms was noted. The AWL was listed 570-word families by analyzing a corpus of millions of words from over 400 academic texts and used by teachers as part of a program preparing learners for tertiary-level education or learners working alone to learn the words most needed study at tertiary institutions. The texts included 28 topic areas, and the words were chosen not just for frequency but also for range: they had to appear a minimum number of times in more than half of the subject areas. According to Coxhead's analysis, the word list covered 10 percent of the running words in the corpus, compared to the NGSL's 76 percent coverage.

The frequency of the target words was cross-checked with high-frequency lists in the British National Corpus (BNC). It was also cross-checked with the Common European Framework of Reference for Languages (CEFR) to an international standard for describing language ability 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 87 senior high school learners excluding the main study and then used to verify the appropriateness of the target words in the research context. An additional consideration was that the words should be neutral in terms of difficulty, being neither the easiest nor the most difficult (Bruton, 2009; Morgan & Bonham, 1944; Palmberg, 1987; Paribakht & Wesche, 1993). Unknown and well-known words were not chosen based on participants' scores. The target words were also derived as a word family based on Bauer and Nation (1993). Notably, the collocational words were checked on the websites, including the Longman Dictionary of Contemporary English and the Online Oxford Collocation Dictionary. The meanings, definitions, and synonyms of

the target words are checked through the Longman Basic English-Thai Dictionary, Cambridge English-Thai Dictionary, and Oxford English-Thai Dictionary.

A list of the 30 target words for the twelve tests, 19 selected from the NGSL and eleven selected from the AWL, was based on the results of the Meaning Comprehension Test. The range of 40 to 60 percent in each word that the learners know was considerably selected (Bruton, 2009; Morgan & Bonham, 1944; Palmberg, 1987; Paribakht & Wesche, 1993). Then, the difficult discrimination property was analyzed to examine the difficulty estimates of each word for all tests. The words highlighted below and above the average threshold (0.30-0.70) were removed (Hopkins & Antes, 1990). Consequently, a final list of target words for the twelve tests was regarded as appropriate to assess senior high school learners' word knowledge in the research setting, and specifically, 19 high-frequency words and 11 academic words were recruited to be familiar to the participants in this study. All of the items were flexed to the types of word knowledge aspects (see Figure 2). 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

3.4 Research Instruments

Twelve different tests, consisting of the Word Recognition Test (WRT), Recall Word Test (RWT), From Recognition Test (FRT), Recall Form Test (FPT), L2 Translation Test (L2TT), L1 Translation Test (L1TT), Association Recognition Test (ART), Association Production Test (APT), Collocation Recognition Test (CRT), Collocation Production Test (CPT), Grammatical Recognition Test (GRT), and Grammatical

Production Test (GPT), were used to measure learners' receptive and productive vocabulary aspects, including written form, word part, form-meaning link, association, collocation, and grammatical function, both receptively and productively (see Table 2). Based on Read's (2000) theory of vocabulary assessment, different aspects of vocabulary knowledge should be assessed by different measures or tests, and both reception and production of vocabulary knowledge should also be captured.

Many vocabulary knowledge tests might reflect participants' heavy burden and fatigue in administering; as such, every test included 30 items. Each of the productive tests was provided for 20 minutes, whereas each of the receptive tests was given for 15 minutes. Indeed, the productive test necessitated more demanding knowledge strategies than the receptive test (Hayashi & Murphy, 2011; Laufer & Goldstein, 2004; Sukying, 2017), and the productive test outperformed the receptive test when there was a time extension (Webb, 2005); therefore, the productive test was given more time than the receptive test. In the alternative, the identical items used in all tests regarding the same words used over time could provide a clearer picture of the learning progress of learners (Zhong, 2014).

3.4.1 The Form Recognition Test (FRT)

The FRT developed based on the format of Webb (2005, 2009) and Zhong (2014) was employed to measure receptive knowledge of written form. The format version of the form recognition task was validated by producing a reliability of 0.77 on Cronbach's Alpha for internal consistency, indicating acceptable reliability (Zhong, 2014). Notably, the written form aspect partially included word spelling knowledge (Nation, 2013; Webb, 2020). Therefore, this test measured the receptive ability of written form (word spelling knowledge).

The test required participants to choose the correctly spelled target words from three distractors. Each item captured one target word. Each item had one correct form of the target word and three pseudo-words as distractors. The distractors were created to resemble the target words both phonetically and orthographically. It was assumed that the accurate choice was made by discerning between correct and incorrect word forms. Despite the possibility of learners guessing while completing the task, this

format of form recognition task was chosen for the present study because it only assessed receptive word form knowledge. No points were awarded for a blank or an incorrect answer. Instead, one point was awarded for each correct response. An example is shown below.

Instructions: Please select the word that is spelled correctly.					Point	
(c)	1.	a. happyness	b. hapiness	c. happiness	d. happeness	1
(a)	2.	a. carefuly	b. cariffuly	c. carefully	d. careffuly	0

3.4.2 The Recall Form Test (FPT)

The FPT, developed based on the productive knowledge of orthography task by Webb (2005), measured productive knowledge of written form, particularly word spelling knowledge (Nation, 2013; Webb, 2020). The test format version was considered an isolated measure of productive spelling knowledge. Therefore, the test was designed appropriately to measure the participants who were assumed as intermediate-level learners (Webb, 2005) and likely to have learned and seen high-frequency words (Nation & Waring, 1997). At least, that was enough to lead them to recall a close approximation of the target words. This test independently measured learners' productive knowledge of word spelling.

The test required participants to rewrite or reproduce the misspelling of the target word into the correct form. This test encouraged participants' ability to recall the word and produce it correctly in the form. All of the target words were provided as derivative forms to prevent the recognition of knowledge from other tests. No points were awarded for a blank or an incorrect answer. Instead, one point was awarded for each correct response. An example is shown as follows.

Instructions: Please write the correct form of the misspelled given word.		
Target word	Answer	Point
1. strate	start	1
2. definitoin	defininition	0

3.4.3 The Word Recognition Test (WRT)

The WRT was designed and developed based on the morphology task by Ishii and Schmitt (2009), Ishii (2005), and Zhong (2014). The validation of the morphology task format produced high reliability of 0.90 (Zhong, 2014). Therefore, this test format was chosen and developed to measure receptive knowledge of word parts, specifically word-class knowledge, in the present study.

The test was presented as a receptive measure and formatted as a fill-in-the-table task. The test measured receptive knowledge of word parts (word class knowledge). This test encouraged participants to recognize the different word classes of the word. The test included 20 items. Participants were required to correctly match the target words with their parts of speech, including nouns, verbs, adjectives, and adverbs. The test contained eleven nouns, eight verbs, eight adjectives, and three adverbs. The target words' different numbers of the category (noun, verb, adjective, and adverb) were used to prevent guessing the word in selecting the answer.

Regarding scoring, one answer was awarded one point. No points were awarded for no answer or an incorrect answer. An example is shown below.

Instructions: Please fill the given word in the correct part of speech [noun, verb, adjective, and adverb].

Target words

Available	Accept	Ability	
Noun	Verb	Adjective	Adverb
Ability	Accept		Available
1 point	1 point	0 point	0 point

3.4.4 The Recall Word Test (RWT)

The RWT was designed and developed based on the morphology task by Ishii and Schmitt (2009), Ishii (2005), and Zhong (2014). It was presented as a productive measure and formatted as a fill-in-the-table task. The test was used to measure productive knowledge of word-class knowledge. This test encouraged participants to

recall the different word classes of the word. The test included 30 items. Participants were required to supply a correct derived form of a word with its part of speech, including noun, verb, and adjective. The adverb column was removed because its low reliability concerning the completion of adverbs was largely linked with knowledge of adjectives. The reliability of the test without the adverb column was 0.94 (Ishii, 2005). No points were awarded for no answer or an incorrect answer. Instead, one point was awarded for each correct response, such as one for giving a correct type of a derived word. An example is shown as follows.

Instructions: Please write the correct derivative form of the given word in each part of speech. To be noted, if some of the given words have no form in any part of speech, such as noun or adjective, please leave an answer blank.

Target word	Noun	Verb	Adjective
Stimulate	Stimulation 1 point	Stimulating 0 point	0 point
Develop	Development 1 point	Develop 1 point	Developmental 1 point

3.4.5 The L2 Translation Test (L2TT)

The L2TT was designed and developed based on the translation task by Laufer and Goldstein (2004) and Webb (2005, 2009). Direct tests of the form-meaning link were tests in which the learners were required to demonstrate their understanding of the target words or produce the target form for a given meaning (e.g., Laufer & Nation, 1999; Meara & Buxton, 1987; Schmitt, Schmitt, & Claphan, 2001). Laufer and Goldstein (2004) indicated that passive (receptive) knowledge was the ability to perceive the form of the word and retrieve its meaning or meanings, and active (productive) knowledge was the ability to retrieve the appropriate spoken or written word form of the meaning that required to express. Nation (2001: 2013) also argued that productive knowledge could be checked using a recall task in which the target word had to be recalled, as in translating a word from L1 into L2 or using a recognition task in which the target word had to be recognized and selected from

among several options. Therefore, the L2 to L1 translation test could measure learners' receptive knowledge of form-meaning links.

The test was presented as a receptive measure and formatted as an L2-to-L1 translation. The translation task was recommended to measure meaning comprehension and form recognition (Schmitt, 2010, 2014), and the L2-to-L1 translation required the ability to recognize English words (Laufer & Goldstein, 2004). Therefore, this test was used to measure receptive knowledge of form-meaning links. Participants were given the English words with the contextual sentences and required to translate the highlighted word in bold into the correct definition in Thai. The instructions encouraged participants to recognize the form with the attached meaning of the word in the context. The target word with a sentence was given to provide the word's context to avoid misunderstanding the target meaning. The test included 30 lines, with one line for each prompt word. A correct word definition was awarded one point, and no points were given for no answer or an incorrect answer, such as an incorrect form-meaning match definition. An example of this test is shown below.

Instructions: Please translate the underline word in bold from English to Thai.	Answer	Point
1. He smiles happily .	อย่างมีความสุข	1
	ความสุข	0.5
	ความทุกข์	0

3.4.6 The L1 Translation Test (L1TT)

The L1TT was developed based on the translation task by Laufer and Goldstein (2004) and Webb (2005, 2009). Productive knowledge could be checked using a recall task in which the target word had to be recalled, as in translating a word from L1 into L2 (Laufer & Goldstein, 2004; Nation, 2013). Moreover, Nontasee and Sukying (2021) validated the L1 translation test by reaching a reliability of 0.76 on

Cronbach's Alpha, indicating acceptable reliability. Therefore, L1 to L2 translation test measured learners' productive form-meaning link knowledge.

This test was presented as a productive measure and formatted as an L1-to-L2 translation. According to Schmitt (2010, 2014), the translation task could assess form-meaning link knowledge, and L1-to-L2 translation requires the ability to recall English words (Laufer & Goldstein, 2004). Therefore, this test primarily measured productive knowledge of form-meaning links. The test consisted of 30 lines, with one line for each prompt word. The instructions encouraged the participants to recall the form with the attached meaning of the word in the context. Participants were given the Thai words with the contextual sentences. They must translate the highlighted word in bold and supply the correct definition in English by following a given initial letter. A correct word definition was awarded one point, and no points were given for no answer or an incorrect answer. An example of this test is shown as follows.

Instructions: Please translate the underlined given word in bold from Thai to English by following the two initial letters.	Answer	Point
1. เธอ <u>ยิ้ม</u> อย่างมีความสุข	H appily	1
	H appy	0.5
	H appen	0

3.4.7 The Association Recognition Test (ART)

The ART developed based on the Word Associates Test (WAT) validated version by Read (1998) aimed to measure receptive knowledge of word associations. The WAT validation produced high reliability of 0.93 (Read, 1998), and the association version proposed by Zhong (2014) also had a reliability of 0.86. Therefore, this type of test was regarded to measure learners' receptive knowledge of word associations.

The test required participants to choose one out of four words appropriately associated with the target word. There were four words in each item, including one associate synonym and three distracters. This test encouraged participants to recognize the semantic association of the word (synonym). To avoid providing any suggestions on

the association of the word category, all of the words in each set of the vocabulary battery were presented in the same part of speech. One point was awarded for each correct synonym response, and no points were given for no answer or an incorrect answer. An example of this test is shown below.

Instructions: Please select a word which has a similar meaning (synonym) to the target word.

1. beautiful

gorgeous	talkative	cheerful	generous
1 point	0 point	0 point	0 point

2. success

direction	communication	information	achievement
0 point	0 point	0 point	1 point

3.4.8 The Association Production Test (APT)

The APT developed based on the active recall task by Laufer and Goldstein (2004) was used to measure productive knowledge of word associations. The active recall task was to supply the L2 target words. The test format was used to supply the understanding of the meaning of the L2 word. A test of associations, whether alone or in conjunction with other areas of knowledge, also measured the meaning of the target word (Laufer & Goldstein, 2004; Laufer & Nation, 1995). Associations tended to be related to concepts rather than forms (Schmitt & Meara, 1997); therefore, asking the learner to recall or supply the related words to the target words could encourage their productive knowledge of word associations (Webb, 2005). This test was designed as an independent measure to capture learners' productive knowledge of associations. The test required participants to produce the synonym word to associate with the target word. This test encouraged participants' ability to recall the semantic association of the word (synonym). A correct word association (synonym) was awarded one point, and no points were given for no answer or an incorrect answer. An example of this test is shown as follows.

Instructions: Please write a word which has a similar meaning (synonym) to the target word.

Target word	Answer	Point
1. society	community	1
2. comprehension	conversation	0

3.4.9 The Collocation Recognition Test (CRT)

The CRT was designed and developed based on the validated version of the Word Association Test (WAT) by Read (1995, 1998). Initially, the WAT captured the knowledge of both semantic association and collocation aspects. The WAT version by Read (1998) had reached high reliability of 0.93. In a specific version of the collocation measure, the validation of the collocation test produced a reliability of 0.80 (Zhong, 2014) and 0.73 (Nontasee & Sukying, 2021). Therefore, the test format was regarded as appropriate for measuring learners' receptive knowledge of collocations. The test was presented as a receptive measure and is used to measure only receptive knowledge of collocation, with a specific focus on the collocations of adjective + noun. Adjective-noun collocations were frequently used in the literature (Nizonkiza, 2016; Nizonkiza & Van de Poel, 2014; Skory & Eskenazi, 2010). This type of collocation was more common for learners in basic instruction. It encouraged participants' ability to collocation recognition. The test required participants to choose one out of four words that were appropriately collocated with the given word. The test included 30 items. No points were awarded for a blank or an incorrect answer. One point was awarded for each correct response. An example of this test is shown below.

พหุ ประโยค ชั่ว

Instructions: Please select the word (adjective) which collocates with the target word (noun) properly.

1. _____ coffee

long	speedy	strong	slow
0 point	0 point	1 point	0 point

2. _____ injury

serious	loveable	helpful	beautiful
1 point	0 point	0 point	0 point

3.4.10 The Collocation Production Test (CPT)

The CPT was constructed and developed based on the productive version of the Vocabulary Levels Test (PVLТ) (Laufer & Nation, 1999). The validation of the PVLТ reached high reliability of 0.91 (Laufer & Nation, 1999) and provided reliable ranges from 0.87 to 0.90 (Zhong & Hirsh, 2009). The productive vocabulary test developed based on the PVLТ proposed by Zhong (2014) had made high reliability of 0.90. Nontasee and Sukying (2021) designed the CPT based on the PVLТ format and scored 0.77 on Cronbach's Alpha. Therefore, the test measured learners' productive knowledge of collocations.

This test was presented as a productive measure and formatted as a gap-filling. The test primarily measured productive knowledge of collocation, particularly the collocations of adjective + noun. Participants were required to produce predetermined target words by supplying a sentence context. This test encouraged the participants' collocation knowledgeability in production. Only one correct answer was allowed. The beginning letters of the target collocations were provided to avoid non-target words that might fit in the allocated sentence. This was done to prevent guessing and ensure that the participants selected only the target word. The test included 30 collocational items. The correct answer was awarded one point, and no points were given for incorrect or blank answers. An example of this test is shown as follows.

Instructions: Please complete the missing adjective to match the following noun in **Point** the sentence properly by following the three initial letters.

- | | |
|--|---|
| 1. If you have any <i>spe</i> <u>cific</u> requirements, you can directly inform my manager in the office. | 1 |
| 2. This car was a <i>for</i> _____ register under my name. | 0 |
-

3.4.11 The Grammatical Recognition Test (GRT)

The GRT, developed based on the Vocabulary Size Test (VST) designed by Nation and Beglar (2007) and validated by Beglar (2010) and, also modified based on the receptive grammatical functions test by Webb (2005), was presented as a multiple-choice format and was used to measure receptive knowledge of grammatical functions. The multiple-choice vocabulary test worked efficiently at lower levels of language proficiency, but the format became unreliable when the examinees' vocabulary size grew. However, the multiple-choice format test was a choice to best measure grammatical accuracy. Indeed, each choice contained a sentence that was likely to be relatively complex and needed grammatical knowledge strategies. Furthermore, the test independently measured learners' receptive knowledge of grammatical functions; therefore, the test was considered to be proper to test the accusation of the grammatical functions.

The test was presented with three sentences containing each target word and required participants to select the correct one from three alternatives. This test encouraged participants to recognize the grammatical accuracy of the word in the context. One point was awarded for each correct response, and no points were given for no answer or an incorrect answer. An example is shown below.

พหุ ประโยค ชั่ว

Instructions: Please select the sentence which is grammatically correct.	Point
1. a. The test is a changed	0
b. The test has been changed	1
c. The test does not changed	0
2. a. She is beautiful	1
b. She is beaultifully	0
c. She beautifuls	0

3.4.12 The Grammatical Production Test (GPT)

The GPT, developed based on Webb's (2005) productive grammatical functions test, was used to measure productive knowledge of grammatical functions. The test was formatted as a sentence writing task but captured only grammatical accuracy by letting learners produce a grammatically correct sentence with the given word. A sentence writing task has proven to have high internal reliability (Cronbach's Alpha > 0.91) (Zhong, 2014). Indeed, the sentence writing task encouraged learners' ability to understand and use a word because writing reflected learners' vocabulary use and mastery of the word (Coxhead, 2007). Therefore, the sentence writing task was adapted to measure learners' productive knowledge of grammatical functions.

The test was presented with the given word and required participants to write a sentence using the given word with grammatical accuracy. The given word was provided in derivative form. Participants needed to use the given form to produce a sentence. This test encouraged participants to produce the word with the correct grammar in the context sentence. One point was awarded for each correct grammatical function of the given word in the produced sentence, and no points were given for no answer or an incorrect grammatical function of the given word in the produced sentence. An example is shown below.

Instructions: Please write a sentence with grammatical accuracy by using the given word.		Point
1. understandable	Your idea is understandable.	1
2. studying	I studying English.	0

Table 2. A Summary of Vocabulary Tests

Measuring vocabulary aspects		Vocabulary tests
Form	Receptive written form knowledge	Word Recognition Test (WRT)
	Productive written form knowledge	Recall Word Test (RWT)
	Receptive word part knowledge	Form Recognition Test (FRT)
	Productive word part knowledge	Recall Form Test (FPT)
Meaning	Receptive form-meaning link knowledge	L2 Translation Test (L2TT)
	Productive form-meaning link knowledge	L1 Translation Test (L1TT)
	Receptive association knowledge	Association Recognition Test (ART)
	Productive association knowledge	Association Production Test (APT)
Use	Receptive collocation knowledge	Collocation Recognition Test (CRT)
	Productive collocation knowledge	Collocation Production Test (CPT)
	Receptive grammatical function knowledge	Grammatical Recognition Test (GRT)
	Productive grammatical function knowledge	Grammatical Production Test (GPT)

3.5 Data Collection Procedures

After permission from the high school was obtained, the research was presented to the participants as part of their normal classwork and conducted for approximately three weeks during different class sessions. Twelve different vocabulary tests [FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, CRT, CPT, GRT, and GPT] were given to all participants. Before the tests were administered, the instructions and a few test examples were illustrated to participants in their native Thai language. Participants were not allowed to use any tools to assist their responses and could not ask questions or observe other participants' responses. Notably, participants were required to

complete all tests. Any participant did not complete all twelve tests or engage in the tests by giving the patterned answers to multiple choices. Handing-in-the-blank tests or over 50% of missing data were excluded from the analysis.

The productive tests were conducted before the receptive tests to avoid the cross-effect tests (Webb, 2005). The tests of word use aspect (collocations and grammatical functions knowledge) were first examined, followed by the tests of word meaning aspect (form-meaning links and word associations knowledge) and, finally, the tests of word form aspect (word parts and written forms knowledge). Based on Webb (2005) and Laufer and Goldstein (2004), form knowledge could be transferred to any other aspect, and the property of use knowledge was the last aspect that learners acquired (González-Fernández & Schmitt, 2020; Nation, 2013; Nontasee & Sukying, 2021; Schmitt, 2010). The administration of a battery test was separated into three days. The CPT, CRT, GPT, and GRT were conducted first, followed by the L1TT, L2TT, APT, and ART on the second day, and the FPT, FRT, RWT, and WRT on the third day. To be noted, the FRT and FPT as the spelling knowledge tests were conducted before the WRT and RWT as the word class knowledge tests to avoid the cross-effect tests. The L2TT and L1TT, the translation tests, were provided before the ART and APT, the semantic association tests, to prevent guessing the definitions of the words in translation.

Furthermore, the present study used the three-day test administration arrangement to avoid test fatigue. The opportunity for cross-test effect was minimized by not conveying any knowledge to the participants that the tests of the same target words were to take place the next few days. Therefore, participants might have known there were three days of tests, but they might not have expected that the tests would be conducted on three consecutive days and, more importantly, they would not have expected the same words to be tested again on the next days. Finally, the participants were not allowed to resolve any answers in previous tests when they had already finished any tests, or the duration of test administration in each had already been completed.

Data collection procedures	
Day 1	Time
1. Productive test of collocation (CPT)	20
2. Receptive test of collocation (CRT)	15
3. Productive test of grammatical function (GPT)	20
4. Receptive test of grammatical function (GRT)	15
Day 2	
5. Productive test of form-meaning link (L1TT)	20
6. Receptive test of form-meaning link (L2TT)	15
7. Productive test of association (APT)	20
8. Receptive test of association (ART)	15
Day 3	
9. Productive test of word part (FPT)	20
10. Receptive test of word part (FRT)	15
11. Productive test of written form (RWT)	20
12. Receptive test of written form (WRT)	15

Figure 3. Summary of the Data Collection Procedures

3.6 Data Analysis

The purpose of the present study was to investigate the general nature of vocabulary knowledge construct under a multi-dimensional framework by examining the acquisition order and relationships among various vocabulary aspects, both receptively and productively. As follows the assumption framework, vocabulary knowledge was a multidimensional continuum and, alternatively, an incremental process. Multiple word aspects were not acquired simultaneously. The receptive and productive dimensions were separate constructs. The distinction between receptive and productive knowledge was fundamental to the conceptualization of the development of vocabulary knowledge (Nation, 2013; Schmitt, 2000).

The receptive and productive test scores were analyzed using descriptive statistics and inferential statistics to answer the research questions. Before data analysis, the total

number of raw scores in each test was adjusted to have the same average scale of the total number in scoring. Then, statistical analyses were used to determine the significant differences and correlations in test scores of different vocabulary tests. Finally, the probability coefficient (p) ranged from 0 to =1, and the significance level was set at 0.05 to reject the null hypothesis (Dörnyei, 2007).

3.6.1 Descriptive Statistics

Descriptive statistics, including mean, standard deviation (SD), skewness, and kurtosis, were conducted to describe participants' test performance on different vocabulary tests. Mean referred to the average scores, while the standard deviation (SD) showed how scores were spread around the mean (Mackey & Gass, 2005). Skewness and kurtosis described the distribution of the scores (Field, 2009). Positive skewness suggested that more scores cluster at the lower end, whereas negative skewness implied more scores cluster at the higher end. Kurtosis demonstrates the pointiness of the score distribution. The negative kurtosis value indicated a pointed distribution with frequent scores in the tails, whereas the positive value indicated a flatter distribution of the bell curve with thin tails. The normality of the score distribution must be verified (Sawaki, Quinlan, & Lee, 2013).

The mean, skewness, kurtosis, and standard deviation in single variables were used to assess univariate normality. On average, skewness and kurtosis value greater than 2.0 suggests a non-normal distribution (Kunnan, 1998, cited in Hill, 1998). If the univariate distributions are non-normal, the multivariate distribution is non-normal as well. However, no generally acknowledged cut-off number indicates non-normality (Finney & DiStefno, 2006). Researchers also have had differing perspectives on the accepted values. Values higher than 5.0, according to Bentler (2006) and Kim and Bentler (2006), indicate nonnormality in the data. Values greater than 20.0, on the other hand, according to Harrington (2009), imply Maximum likelihood issues. Multivariate normality of all variables was also detected, which should be less than the standard threshold set at ≤ 13.82 (Mahalanobis).

3.6.2 Inferential Statistics

Inference statistics, such as a paired-samples *t*-test, ANOVA, correlation, Implicational Scaling (IS), Structural Equation Modeling (SEM), and effect-size analyses, were conducted to determine the test scores of different vocabulary tests [WRT, RWT, FRT, FPT, L2TT, L1TT, ART, APT, CRT, CPT, GRT, and GPT] to find out the differences and relationships between various vocabulary aspects.

A paired-samples *t*-test was used to compare two means of the same group of participants or the same group of participants before and after a treatment condition (Field, 2009). This study explored the same group of participants and administered the twelve vocabulary knowledge tests with the same group of items. Therefore, this analysis in the present study was used to detect any differences between each of the different vocabulary tests. In addition, an ANOVA analysis was used to compare the significant difference among all vocabulary tests as a whole. These statistical analyses were conducted to compare the means of different vocabulary knowledge tests.

The effect size analysis determined the magnitude of the influence (Aberson, 2010). In other words, the effect size implied a practical relevance that was important in the actual world and the magnitude of the impact when detected in the population (Cohen, 1988; Ellis, 2010). Therefore, Cohen's *d* was used to calculate the effect size of any differences for the paired-sample *t*-test, with an effect size of 0.20 considered small, 0.50 considered medium, and 0.80 thought large (Cohen, 1988). This analysis was used to examine the impact of different vocabulary aspects on one another. Furthermore, the partial eta squared was a way to measure the effect size of different variables in ANOVA models. The value for Partial eta squared ranged from 0 to 1, where values closer to 1 indicated a higher proportion of variance explained by a given variable in the model after accounting for variance explained by other variables in the model. The following rules of thumb were used to interpret values for Partial eta squared (Cohen): 0.01 = small effect size, 0.06 = medium effect size, and 0.14 or higher = large effect size.

In addition, the present study wanted to investigate the nature of the relationships among vocabulary aspects. The literature revealed that these word aspects lay on a continuum. Correlation analysis was calculated to reveal the relationship between different vocabulary tests to trace the nature of the relationship based on Cohen's (1988) guidelines: small, $r = 0.10$ to 0.29 ; medium, $r = 0.30$ to 0.49 ; large, $r = 0.50$ to 1.0 . Correlation results reflected the strengths of these relationships between vocabulary aspects. The estimated level of vocabulary aspects was clearly illustrated in R^2 (Field, 2009; Keith, 2006). The size of the correlation effect R^2 was calculated by squaring the correlation coefficient r , signifying the population of variance from one variable that the other variable might explain in a linear relationship (Cohen, 1988). A small effect of R^2 is 0.01 , a medium effect is 0.09 , and a large effect is 0.25 (Cohen, 1988).

Alternative to correlation, Implicational Scaling (IS) was employed to estimate and analyze the difficulty in acquiring the various vocabulary aspects. IS allowed the establishment of systematic hierarchical relationships between variables (Guttman, 1944) and could be considered a proxy for systematicity in the language (Rickford, 2002). Thus, it could help make predictions about how the various vocabulary aspects were acquired. The goodness-of-fit of the scale was described as follows: the Coefficient of reproducibility (C_{rep}) required to be exceeded the minimum reproducibility value of 0.90 , indicating a valid implicational scale (Guttman, 1944), and the Coefficient of scalability (C_{scal}) needed to be above 0.60 , reflecting the strength of the aspects was unidimensional and scalable (Davidson, 1987).

The present study also used the Structural Equation Modelling (SEM) analysis to determine the hypothesized model of the relationships between various vocabulary aspects. To deal with the analytical limitations, the other statistical analyses made no assumptions about the variance of measurement error for any measured variables (Thompson, 2000), and measuring learners such as actions, attitudes, feelings, and motivations might reflect a high measurement error (Jöreskog & Sörbom, 1993; Thompson, 1994). However, the SEM analysis incorporated score reliability directly into the model fitting process (Jöreskog & Sörbom, 1989; Stevens, 1996). As

demonstrated, all measures included non-random error, and the analysis incorporated the error into models in a way that did not directly influence parameter estimates (Purpura, 1999). More specifically, the SEM analytical model represented reality because observed variables were not always measured with perfect reliability, which means all scores were dependable in estimating parameters. This analysis was used differently, such as to test substantive theory (hypothesis testing); to organize concepts about data analysis into scientific models; to provide tools for the estimation of the mathematical components of models; to provide means for the evaluation of statistical features of these models; to include flexible provisions for models with unobserved or latent variables; to permit a flexible approach for dealing with incomplete data patterns; to determine direct or indirect (mediation) of one variable to another; and to compare group differences and longitudinal differences (e.g., MacCallum & Austin, 2000; Marcoulides & Schumacker, 1996; McArdle & Bell, 2000; Thompson, 2000).

The SEM analysis started with the development of measurement models to identify latent variables and continued establishing the links between the latent variables. A hypothesized model might be statistically estimated in a simultaneous examination of the entire system of variables to assess its coherence with the data (Byrne, 1994, 2010). If the quality of the model fit was ample, it might hypothesize plausible relations between variables. Then, the plausibility of the sample data, including all observed variables in the model, was verified, and the level of fit between the hypothesized model and the sample data was identified. Thus, the model-fitting process could be understood [Data = Model + Residual (Data was score measurements related to the observed variables; Model was the hypothesized structure that linked the observed variables to the latent variables or that linked particular latent variables to one another; Residual was the discrepancy between the hypothesized model and the observed data)]. Bollen and Long (1993) indicated the five key cyclical steps to the development of substantive SEM applications: (1) Model specification was the process by which the researcher formulated an initial theoretical model based on the literature review; (2) Model identification was the statistical procedure for determining whether unique values for the parameters to be estimated in the

theoretical model could be found; (3) Model estimation was the statistical knowledge of estimation techniques to the properties of the variables employed in the model; (4) Model testing was the statistical process for assessing the model fit; and (5) Model respecification and modification were the decision-making procedures of removing, adding, or altering model pathways and then re-running the analysis; respecification occurred when the model fit indices indicated a deprived fit. These steps were essential for establishing the validity of the hypothesized model. That is, these steps must verify the statistical validity of the model.

The present study used SEM analysis to explain the relationships between vocabulary aspects and inferential power. The SEM procedures included (1) creating measurement models to define latent variables and then (2) setting up relationships among the latent variables. SEM was a set of theory-driven statistical techniques that used a confirmatory approach to test the validity of a previously hypothesized model of the relationship between variables (Byrne, 2016). SEM was chosen because it had advantages over other types of analysis. SEM allowed for the specification and analysis of latent, unobservable constructs through means of multiple observed indicators. These latent constructs were more reliable than individual indicators and were less sensitive to the effects of the tasks performed (Kieffer & Lesaux, 2012).

On the other hand, SEM allowed for the specification of theoretical models that constructed multiple relationships among several variables and simultaneously examined the complete set of relationships among these variables. Alternatively, SEM measured the strength of the relationship between each path while considering all of the other pathways in the model. Finally, SEM generated a set of model fit indices, demonstrating how well the data fit the model (Kline, 2016). Therefore, SEM was used to examine the general nature of the vocabulary knowledge construct and model the conceptualization. Nation's (2013) framework that involved knowing a word was the most widely accepted conceptualization of vocabulary knowledge. Within this framework, vocabulary knowledge included multiple word knowledge aspects, each of which comprised receptive and productive knowledge. This hypothesized model represented vocabulary as a general, underlying latent construct that provided for sub-

knowledge constructs (i.e., word part, written form, form-meaning link, association, collocation, and grammatical function), represented by their receptive and productive knowledge aspects. It intended to examine this conceptualization by using SEM empirically.

The interpretation of the SEM model needed a thorough description of the modeling process and the problems that caused the process (Byrne, 1994, 2010). The report often included descriptive statistics such as skewness and kurtosis to prove the data could meet univariate assumptions and be calculated the measurement reliability to build the SEM model. The multivariate sample statistics did not deviate from the sample normality, and the residual value distribution should be symmetrical and centered around zero (Phakiti, 2007). The interpretation of the structural relationships between variables in the model alternatively included factor loadings, regression coefficient estimates (β), squared multiple correlations (R^2), and decomposition of parameter total effects (direct and indirect effects). Alternatively, the effect size of f^2 was considered a global effect size, and the independent variable accounted for a proportion of unexplained variance in the dependent variable (Cohen, 1992). Cohen also suggested that 0.02 was considered small, 0.15 medium, and 0.35 large for effect size.

A good model fit was generally described by following the commonly used fit indexes and guidelines conventions (Brown, 2015; Jöreskog & Sörbom, 1993; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Phakiti, 2007). First, the chi-square (X^2) and degrees of freedom (df) were nonsignificant ($p > 0.05$) (Barrett, 2007). Second, the standardized root mean square residual (SRMR) and root mean square error of approximation (RMSEA) were below 0.05 for good fit and 0.08 for acceptable fit. Third, the goodness-of-fit statistic (GFI) and adjusted goodness-of-fit statistic (AGFI) were recommended to be higher at 0.90 for acceptable or 0.95 for more appropriately acceptable (Miles & Shevlin, 1998). Fourth, the normed fit index (NFI) and comparative fit index (CFI) were ≥ 0.90 for a good fit (Hu & Bentler, 1999). Finally, the regression coefficients (β) suggested the discriminant validity and affected the significance of the construct paths (Kline, 2016).

The hypothesized model in the present study was developed based on González-Fernández and Schmitt's (2020) model of vocabulary knowledge. They 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 vocabulary knowledge as a multi-aspect, particularly in a Thai EFL context. The hypothesized model included six-word aspects [written form, word part, form-meaning link, association, grammatical function, and collocation (both in receptive and productive knowledge)] and measured whether the accepted fit model in the research context. The hypothesized model in the present study is illustrated below in Figure 4.

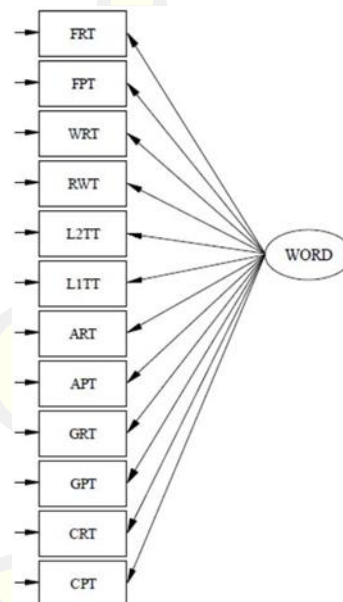


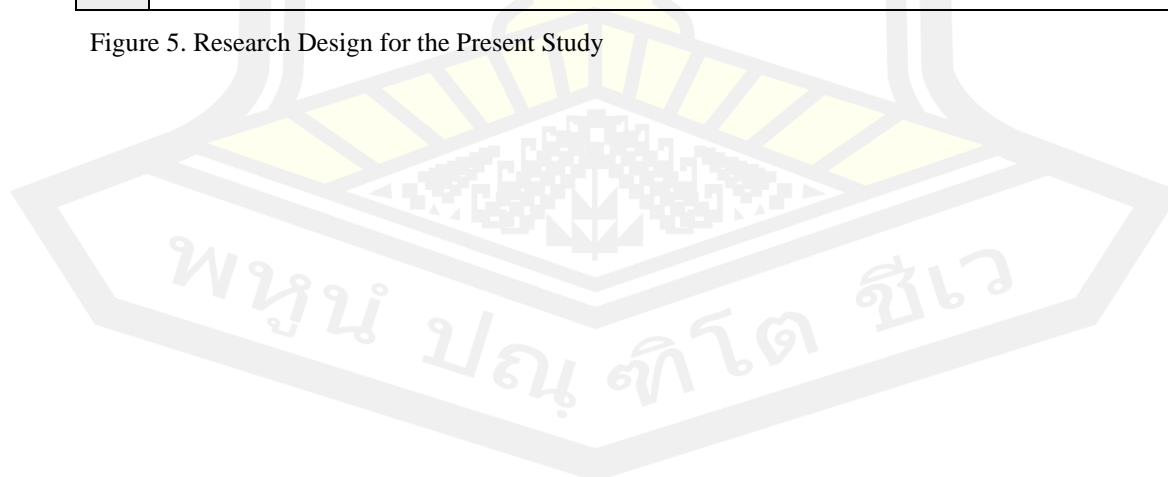
Figure 4. The Hypothesized Model of Relationships between Vocabulary Aspects

3.7 Summary of the Chapter

This chapter outlined the methodology of the present study, including the research design and approach, participants and setting, ethical considerations, measurement instruments, data collection procedures, and data analysis. A summary of the research design procedures for the present study is shown in Figure 5. The next chapter presents the results of the pilot study.

Pilot study	<p>Target words: NGSL</p> <p> AWL</p> <p> CEFR Checklist</p> <p> Meaning Comprehension Test [87 senior high school learners]</p> <p>Tests: 12 tests [WRT, RWT, FRT, FPT, L2TT, L1TT, ART, APT, CRT, CPT, GRT, GPT]</p> <p>Content validity: Five experts [At least ten years of English education]</p> <p>Test reliability: 150 senior high school learners</p>
Main study	<p>Participants: 500 senior high school learners</p> <p>Data collocation 12 tests [WRT, RWT, FRT, FPT, L2TT, L1TT, ART, APT, CRT, CPT, GRT, GPT]</p> <p>Data analysis: Descriptive statistics</p> <p> Inferential statistics</p> <p> RQ 1 • A paired-samples <i>t</i>-test analysis</p> <p> • An ANOVA analysis</p> <p> • A correlation analysis</p> <p> • An effect-size analysis</p> <p> • An Implicational Scaling (IS) analysis</p> <p> RQ 2 • A Structural Equation Modeling (SEM) analysis</p>

Figure 5. Research Design for the Present Study



CHAPTER IV

PILOT STUDY RESULTS

This chapter presents the results from the reliability and validity tests of the twelve measures of different vocabulary knowledge aspects as well as the pilot study results. The analyses related to the appropriateness of the target words are also presented.

4.1 Results of the Pilot Study

As part of strength testing for the new instruments, a pilot study was conducted to create robust test items for the receptive and productive vocabulary knowledge tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT). The pilot study examined the validity and reliability of these tests. The content validity of the twelve tests was assessed by five experts in the area of English education who had taught English in Thai EFL contexts for more than ten years, including one native speaker, one university teacher, and three high school teachers. All twelve tests were piloted with 150 senior high school learners (tenth, eleventh, and twelfth-grade learners) to determine the reliability of tests. The item difficulty and discrimination were also analyzed to identify the best available items for the final form of the test. However, not all learners completed all twelve tests and left some tests blank, leading to over 50% missing data. Only 126 learners who completed all tests in the pilot study, showing an 84% completion rate, were included in the pilot analysis.

The descriptive statistics in the pilot study included the mean, standard deviation, skewness, and kurtosis (see Table 3). The raw total test scores were then converted into percentages, and percentages were used to compare vocabulary knowledge test scores across tests and levels of education.

Table 3. Descriptive Statistics of the Pilot Results

Aspects	Tests	N	Mean	SD	Skewness	Kurtosis	Total score (%)
Written form	R FRT	126	20.78	10.82	-0.71	-1.35	69.26
	P FPT	126	20.16	10.36	-0.66	-1.23	67.20
Word part	R WRT	126	19.67	8.90	-0.50	-1.43	65.58
	P RWT	126	19.19	9.23	-0.54	-1.39	63.97
Form-meaning	R L2TT	126	20.08	10.32	-0.92	-0.99	66.94
	P L1TT	126	17.01	9.37	-0.54	-1.26	56.69
Association	R ART	126	19.71	10.17	-0.75	-1.23	65.69
	P APT	126	17.20	7.88	-0.94	-0.48	57.34
Grammatical function	R GRT	126	19.98	9.40	-0.49	-1.37	66.59
	P GPT	126	19.33	8.74	-1.02	-0.24	64.43
Collocation	R CRT	126	19.66	9.69	-0.77	-1.12	65.53
	P CPT	126	15.87	7.83	-0.59	-0.97	52.91

Notes: R = Receptive knowledge, P = Productive knowledge

The pilot results revealed that the participants knew over half of the items for each test and that receptive knowledge of an aspect was higher than productive knowledge. The distribution of scores was examined for normality, and Skewness and kurtosis were found to be normal across all vocabulary knowledge tests, with all scores less than 2.0 (Kunnan, 1998, cited in Hill, 1998). As such, there was no violation of the statistical assumption of normal distribution (Larson-Hall, 2016).

An ANOVA analysis was used to examine an overall significant difference in scores on the twelve vocabulary tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT). The effect size was also calculated.

Table 4. Comparison of the Twelve Vocabulary Knowledge Tests from the Pilot Results

Tests	F-test	Effect-size (η^2)
FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, CPT	55.730***	0.29

Notes: *** $p < 0.001$, $N = 126$ (2-tailed)

As shown in Table 4, the ANOVA analysis revealed that there was a significant difference between the twelve different vocabulary tests, with a large effect size ($F(11, 115) = 55.730, p < 0.001, \eta^2 = 0.29$).

A paired-samples *t*-test was used to determine if there was any significant difference in performance on receptive and productive vocabulary tests. Effect sizes (*d*) were also calculated.

Table 5. Comparison between Performance on the Receptive and Productive Vocabulary Tests in the Pilot Study

	Aspects	Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Written form	FRT	3.37**	0.06
P	Written form	FPT		
R	Word part	WRT	2.05*	0.05
P	Word part	RWT		
R	Form-meaning link	L2TT	9.89***	0.31
P	Form-meaning link	L1TT		
R	Association	ART	7.91***	0.28
P	Association	APT		
R	Grammatical function	GRT	1.98*	0.07
P	Grammatical function	GPT		
R	Collocation	CRT	13.13***	0.43
P	Collocation	CPT		

Notes: R = Receptive knowledge, P = Productive knowledge, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $N = 126$ (2-tailed)

As shown in Table 5, the analysis revealed a significant difference between receptive and productive vocabulary tests. The paired-samples *t*-test showed that performance was significantly different on the receptive and productive tests of the written form aspect (FRT versus FPT; $t = 3.37$, $p < 0.005$, $d = 0.06$), the word part aspect (WRT versus RWT; $t = 2.05$, $p < 0.05$, $d = 0.05$), the form-meaning aspect (L2TT versus L1TT; $t = 9.89$, $p < 0.001$, $d = 0.31$), the association aspect (ART versus APT; $t = 7.91$, $p < 0.001$, $d = 0.28$), the grammatical function aspect (GRT versus GPT; $t = 1.98$, $p < 0.05$, $d = 0.07$) and, finally, the collocation aspect (CRT versus CPT; $t = 13.13$, $p < 0.001$, $d = 0.43$).

To summarize, the statistical analyses revealed that performance on the twelve vocabulary tests was significantly different and, more specifically, scores on the receptive tests were higher than scores on the productive tests for all aspects. This suggests that vocabulary knowledge aspects are acquired at different rates, with receptive knowledge of an aspect being acquired before productive knowledge. The effect size analysis indicated different strengths of the effect, from small to large. However, it should be noted that the effect sizes reported here may be smaller due to the restricted sample size of the pilot participants.

Next, a correlation analysis was conducted to examine the relationships between the different vocabulary knowledge tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT) (see Table 6). Effect sizes were also calculated (R^2).

Table 6. Correlation between Scores on the Different Vocabulary Knowledge Tests for the Pilot Study

Tests	FRT	FPT	WRT	RWT	L2TT	L1TT	ART	APT	GRT	GPT	CRT	CPT
FRT	1											
FPT	.95***	1										
WRT	.93***	.94***	1									
RWT	.95***	.96***	.92***	1								
L2TT	.95***	.96***	.92***	.98***	1							
L1TT	.94***	.97***	.96***	.92***	.94***	1						
ART	.95***	.97***	.98***	.95***	.94***	.96***	1					
APT	.94***	.97***	.93***	.95***	.96***	.98***	.95***	1				
GRT	.93***	.94***	.89***	.97***	.96***	.92***	.94***	.96***	1			
GPT	.89***	.93***	.87***	.94***	.93***	.89***	.91***	.93***	.96***	1		
CRT	.93***	.96***	.90***	.96***	.96***	.94***	.95***	.97***	.98***	.96***	1	
CPT	.93***	.97***	.90***	.95***	.96***	.97***	.93***	.99***	.97***	.94***	.98***	1

Notes: *** $p < 0.001$, $r (0.10-0.29)$ = Small, $r (0.30-0.49)$ = Medium, $r (0.50-1)$ = Large, $N = 126$ (2-tailed)

Pearson correlation coefficient showed that the vocabulary tests were largely correlated. Specifically, there was a high correlation between the receptive test of an aspect and its productive test, that is: FRT versus FPT ($r = 0.95$, $R^2 = 0.90$), WRT versus RWT ($r = 0.92$, $R^2 = 0.85$), L2TT versus L1TT ($r = 0.94$, $R^2 = 0.88$), ART versus APT ($r = 0.95$, $R^2 = 0.90$), GRT versus GPT ($r = 0.96$, $R^2 = 0.92$), and CRT versus CPT ($r = 0.98$, $R^2 = 0.96$). All effect sizes were large.

As shown in Table 5, scores on receptive and productive tests of different aspects were also highly correlated. Indeed, all correlations were ≥ 0.87 (all R^2 values ≥ 0.76). In addition, scores on receptive tests were highly correlated (all r values ≥ 0.89 , R^2 values ≥ 0.79), as were scores on the productive tests (all $r \geq 0.89$, R^2 values ≥ 0.79).

Overall, the correlation analysis revealed that performance on all the different vocabulary tests was highly correlated with a large effect size. This suggests that vocabulary knowledge aspects are interrelated and that vocabulary knowledge aspects are significantly and positively correlated in the broader population.

4.2 Content Validation of Vocabulary Knowledge Tests

Content validity examines the extent to which test items measure what they purport to measure (Bachman & Palmer, 2010; Lynn, 1986). In the current pilot study, five raters were selected who each had approximately ten years of experience in teaching English as a foreign language (EFL) in Thailand. The raters were instructed to rate the content validity of test items on a Likert scale ranging from -1 to +1 across the twelve vocabulary tests (Hambleton, Swaminathan, Algina, & Coulson, 1978). The raters were instructed to rate -1 when responses did not clearly measure the targeted vocabulary knowledge aspects, 0 when unsure or unclear, and +1 when responses measured the targeted vocabulary knowledge aspects. Based on the suggestions by the experts, some items required modifications; they were revised for appropriateness for the test-context assessment. After that, the threshold for retaining an item was set at > 0.5 (Lynn, 1986). As shown in Table 7, the content validity analysis indicated that all means were > 0.5 .

Table 7. Test Content Validity (Five Raters)

Aspects	Tests	Mean	Test items	Total of items
R	Written form	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	29
		0.80-0.89	10	1
P	Written form	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26,	25
		0.80-0.89	12, 27, 28, 29, 30	5
R	Word part	0.90-1.00	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29	28
		0.80-0.89	1, 30	2
P	Word part	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 20, 22, 24, 25, 28, 29, 30	23
		0.80-0.89	9, 18, 19, 21, 23, 26, 27	7
R	Form-meaning	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 25, 26, 28, 29	26
		0.80-0.89	20, 24, 27, 30	4
P	Form-meaning	0.90-1.00	1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 16, 19, 20, 21, 22, 23, 25, 26, 29, 30	21
		0.80-0.89	6, 9, 14, 15, 17, 18, 24, 27, 28	9
R	Association	0.90-1.00	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	27
		0.80-0.89	2, 13, 14	3
P	Association	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	30
R	Grammatical function	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29	25
		0.80-0.89	13, 16, 17, 25, 30	5
P	Grammatical function	0.90-1.00	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	30
R	Collocation	0.90-1.00	1, 2, 4, 5, 8, 10, 11, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29	19
		0.80-0.89	3, 6, 7, 9, 12, 13, 15, 16, 24, 27, 30	11
P	Collocation	0.90-1.00	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30	28
		0.80-0.89	3, 25	2

Notes: R = Receptive knowledge, P = Productive knowledge

4.3 Examining the Reliability of Vocabulary Knowledge Tests

Reliability is the consistency of a test, or a score, involving Cronbach's Alpha measures of internal consistency and reliability (Mackey & Gass, 2005). According to the vocabulary measures by previous studies, they use the Cronbach's Alpha coefficient to indicate the overall reliability of the measure (e.g., Beglar, 2010; Jeensuk & Sukying, 2021a, 2021b; Laufer & Goldstein, 2004; Laufer & Nation, 1999; Lin, 2015a; Ishii, 2005; Ishii & Schmitt, 2009; Nation & Beglar, 2007; Nontasee & Sukying, 2020, 2021; Read, 1995, 1998; Sukying & Nontasee, 2022; Webb, 2005, 2009; Zhong, 2012, 2014, 2018; Zhong & Hirsh, 2009). Cronbach's alpha was therefore performed overall on the items of vocabulary knowledge tests. Based on DeVellis (2003), Cronbach's Alpha coefficient of a scale should be above 0.70, and internal consistency indicators for a well-developed test should approach 0.80 (Dörnyei, 2007). As shown in Table 8, the pilot results indicated the acceptance of the internal consistency reliability estimates for the twelve test formats of different vocabulary knowledge aspects (all Cronbach's α values ≥ 0.8).

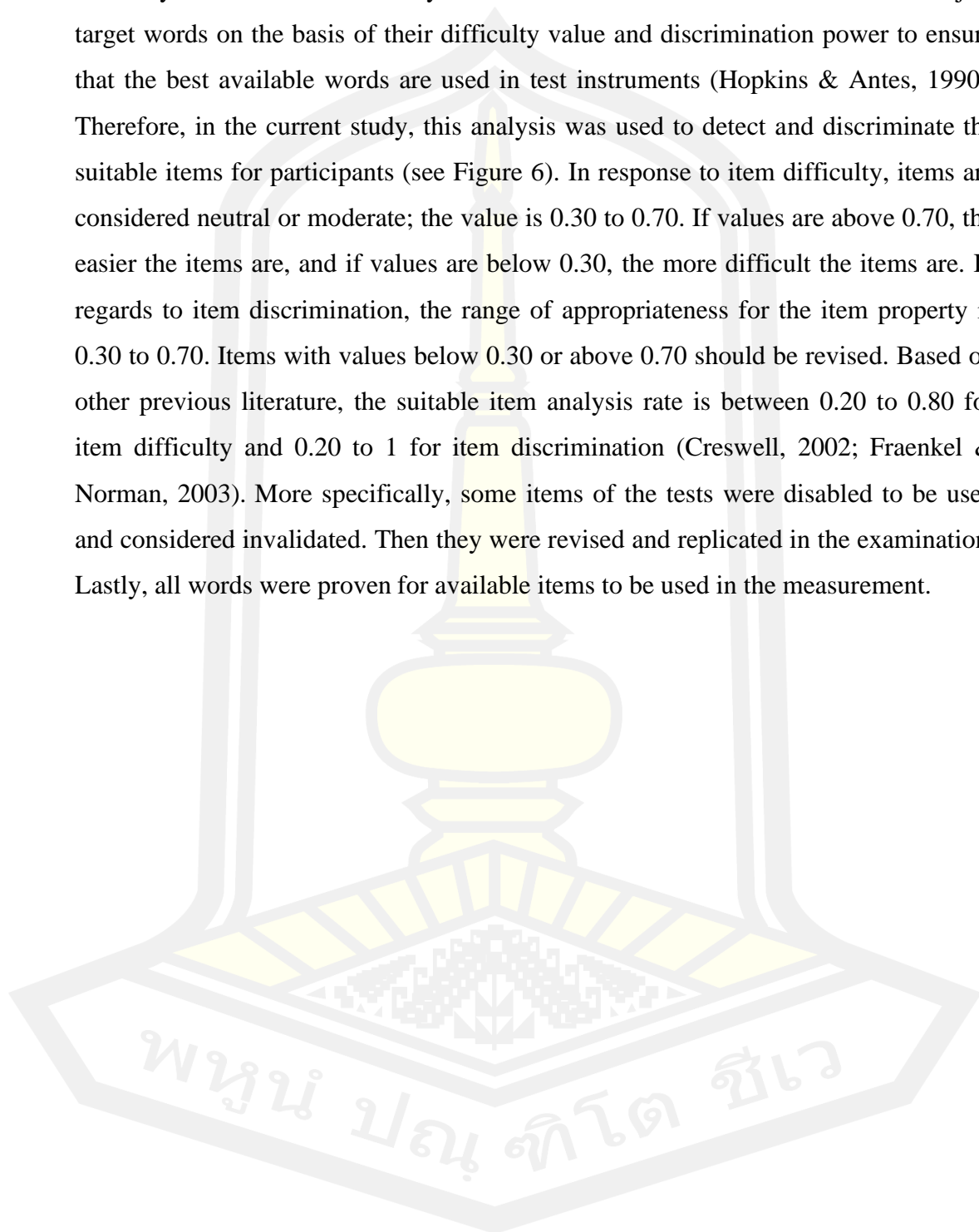
Table 8. Test Reliability

Aspects	Tests	N	Cronbach's α
Written form	R FRT	126	0.85
	P FPT	126	0.91
Word part	R WRT	126	0.93
	P RWT	126	0.90
Form-meaning link	R L2TT	126	0.80
	P L1TT	126	0.92
Association	R ART	126	0.87
	P APT	126	0.91
Grammatical function	R GRT	126	0.93
	P GPT	126	0.90
Collocation	R CRT	126	0.85
	P CPT	126	0.85

Notes: R = Receptive knowledge, P = Productive knowledge

4.4 Test Item Analysis

An analysis of test item difficulty and discrimination can be used to select and reject target words on the basis of their difficulty value and discrimination power to ensure that the best available words are used in test instruments (Hopkins & Antes, 1990). Therefore, in the current study, this analysis was used to detect and discriminate the suitable items for participants (see Figure 6). In response to item difficulty, items are considered neutral or moderate; the value is 0.30 to 0.70. If values are above 0.70, the easier the items are, and if values are below 0.30, the more difficult the items are. In regards to item discrimination, the range of appropriateness for the item property is 0.30 to 0.70. Items with values below 0.30 or above 0.70 should be revised. Based on other previous literature, the suitable item analysis rate is between 0.20 to 0.80 for item difficulty and 0.20 to 1 for item discrimination (Creswell, 2002; Fraenkel & Norman, 2003). More specifically, some items of the tests were disabled to be used and considered invalidated. Then they were revised and replicated in the examination. Lastly, all words were proven for available items to be used in the measurement.



Items		FRT	FPT	WRT	RWT	L2TT	L1TT	ART	APT	GRT	GPT	CRT	CPT
1	Difficulty	0.67	0.70	0.67	0.69	0.69	0.30	0.70	0.47	0.70	0.70	0.48	0.67
	Discrimination	0.57	0.60	0.30	0.56	0.52	0.48	0.51	0.30	0.57	0.49	0.48	0.33
2	Difficulty	0.69	0.67	0.64	0.68	0.67	0.70	0.70	0.46	0.70	0.70	0.68	0.58
	Discrimination	0.62	0.65	0.65	0.54	0.30	0.35	0.41	0.35	0.32	0.40	0.38	0.30
3	Difficulty	0.69	0.70	0.67	0.70	0.67	0.45	0.69	0.68	0.65	0.67	0.69	0.36
	Discrimination	0.59	0.60	0.56	0.51	0.30	0.59	0.62	0.44	0.67	0.32	0.49	0.33
4	Difficulty	0.68	0.68	0.50	0.70	0.69	0.52	0.70	0.68	0.70	0.63	0.68	0.40
	Discrimination	0.44	0.54	0.41	0.60	0.62	0.67	0.44	0.35	0.54	0.36	0.60	0.49
5	Difficulty	0.70	0.70	0.70	0.69	0.69	0.70	0.69	0.70	0.70	0.69	0.68	0.63
	Discrimination	0.60	0.60	0.60	0.62	0.33	0.57	0.46	0.54	0.62	0.52	0.63	0.41
6	Difficulty	0.70	0.67	0.67	0.40	0.69	0.56	0.69	0.45	0.63	0.69	0.69	0.69
	Discrimination	0.60	0.65	0.62	0.35	0.60	0.59	0.62	0.37	0.40	0.40	0.37	0.56
7	Difficulty	0.70	0.65	0.54	0.70	0.69	0.70	0.69	0.69	0.69	0.54	0.46	0.33
	Discrimination	0.48	0.70	0.50	0.41	0.62	0.54	0.62	0.52	0.62	0.33	0.35	0.32
8	Difficulty	0.70	0.69	0.70	0.70	0.70	0.70	0.69	0.67	0.70	0.63	0.58	0.68
	Discrimination	0.51	0.30	0.60	0.60	0.51	0.54	0.59	0.39	0.60	0.33	0.33	0.51
9	Difficulty	0.70	0.68	0.70	0.70	0.69	0.43	0.68	0.49	0.70	0.63	0.68	0.47
	Discrimination	0.60	0.57	0.57	0.51	0.61	0.63	0.51	0.30	0.60	0.33	0.41	0.33
10	Difficulty	0.70	0.65	0.63	0.67	0.69	0.68	0.58	0.64	0.70	0.55	0.70	0.32
	Discrimination	0.60	0.54	0.48	0.56	0.58	0.48	0.40	0.53	0.60	0.31	0.41	0.48
11	Difficulty	0.70	0.69	0.66	0.70	0.60	0.35	0.69	0.46	0.70	0.69	0.70	0.64
	Discrimination	0.54	0.59	0.33	0.60	0.34	0.57	0.49	0.40	0.60	0.60	0.44	0.33
12	Difficulty	0.70	0.69	0.63	0.37	0.70	0.59	0.56	0.55	0.68	0.70	0.68	0.52
	Discrimination	0.60	0.49	0.57	0.40	0.57	0.32	0.46	0.51	0.57	0.41	0.63	0.32
13	Difficulty	0.70	0.68	0.68	0.67	0.70	0.68	0.68	0.53	0.36	0.63	0.70	0.67
	Discrimination	0.62	0.54	0.48	0.57	0.46	0.57	0.54	0.30	0.30	0.36	0.44	0.60
14	Difficulty	0.70	0.51	0.67	0.57	0.67	0.68	0.70	0.46	0.70	0.58	0.69	0.35
	Discrimination	0.54	0.35	0.63	0.57	0.30	0.54	0.60	0.31	0.60	0.31	0.52	0.38
15	Difficulty	0.70	0.70	0.70	0.69	0.68	0.69	0.68	0.60	0.69	0.69	0.67	0.36
	Discrimination	0.44	0.57	0.57	0.59	0.52	0.56	0.60	0.50	0.59	0.60	0.59	0.52
16	Difficulty	0.68	0.69	0.68	0.70	0.68	0.68	0.69	0.59	0.61	0.70	0.69	0.36
	Discrimination	0.54	0.52	0.32	0.41	0.32	0.38	0.56	0.35	0.30	0.54	0.43	0.40
17	Difficulty	0.58	0.70	0.70	0.33	0.69	0.63	0.70	0.65	0.70	0.46	0.38	0.67
	Discrimination	0.30	0.54	0.50	0.44	0.57	0.30	0.60	0.52	0.60	0.34	0.32	0.48
18	Difficulty	0.70	0.67	0.68	0.63	0.65	0.47	0.70	0.69	0.60	0.60	0.67	0.70
	Discrimination	0.57	0.62	0.41	0.30	0.64	0.30	0.57	0.31	0.67	0.30	0.65	0.38
19	Difficulty	0.70	0.70	0.70	0.34	0.69	0.67	0.54	0.48	0.70	0.69	0.68	0.35
	Discrimination	0.60	0.54	0.35	0.40	0.38	0.62	0.48	0.30	0.57	0.59	0.32	0.51
20	Difficulty	0.70	0.70	0.47	0.67	0.67	0.39	0.70	0.62	0.70	0.70	0.69	0.69
	Discrimination	0.60	0.57	0.49	0.52	0.53	0.52	0.54	0.55	0.60	0.54	0.59	0.59
21	Difficulty	0.70	0.70	0.52	0.67	0.70	0.33	0.70	0.55	0.52	0.69	0.69	0.67
	Discrimination	0.60	0.60	0.57	0.65	0.54	0.57	0.60	0.48	0.35	0.39	0.52	0.59
22	Difficulty	0.70	0.70	0.69	0.65	0.70	0.48	0.70	0.69	0.68	0.55	0.70	0.68
	Discrimination	0.57	0.57	0.59	0.41	0.54	0.65	0.60	0.31	0.63	0.30	0.60	0.38
23	Difficulty	0.69	0.70	0.69	0.70	0.70	0.65	0.69	0.49	0.70	0.70	0.69	0.34
	Discrimination	0.59	0.60	0.56	0.38	0.33	0.63	0.30	0.33	0.60	0.41	0.59	0.52
24	Difficulty	0.70	0.68	0.70	0.70	0.69	0.57	0.70	0.59	0.70	0.70	0.58	0.39
	Discrimination	0.60	0.63	0.57	0.57	0.62	0.70	0.60	0.38	0.51	0.48	0.30	0.30
25	Difficulty	0.69	0.70	0.70	0.70	0.68	0.70	0.52	0.44	0.70	0.55	0.69	0.41
	Discrimination	0.59	0.60	0.60	0.60	0.60	0.48	0.40	0.32	0.60	0.30	0.59	0.38
26	Difficulty	0.70	0.70	0.67	0.70	0.67	0.56	0.70	0.45	0.70	0.70	0.66	0.65
	Discrimination	0.60	0.60	0.57	0.60	0.52	0.70	0.60	0.48	0.57	0.60	0.37	0.44
27	Difficulty	0.70	0.70	0.70	0.70	0.66	0.66	0.48	0.53	0.62	0.70	0.70	0.50
	Discrimination	0.60	0.41	0.57	0.60	0.49	0.56	0.43	0.30	0.70	0.48	0.60	0.37
28	Difficulty	0.70	0.70	0.70	0.70	0.48	0.37	0.70	0.65	0.68	0.52	0.68	0.69
	Discrimination	0.57	0.60	0.48	0.60	0.35	0.68	0.51	0.30	0.60	0.36	0.57	0.33
29	Difficulty	0.69	0.70	0.37	0.68	0.52	0.43	0.37	0.64	0.69	0.66	0.68	0.70
	Discrimination	0.62	0.57	0.45	0.60	0.43	0.54	0.30	0.37	0.52	0.33	0.63	0.35
30	Difficulty	0.70	0.36	0.70	0.70	0.70	0.67	0.69	0.62	0.70	0.70	0.70	0.39
	Discrimination	0.60	0.65	0.48	0.57	0.44	0.62	0.62	0.42	0.54	0.41	0.57	0.56

Figure 6. Results of Item Difficulty and Discrimination

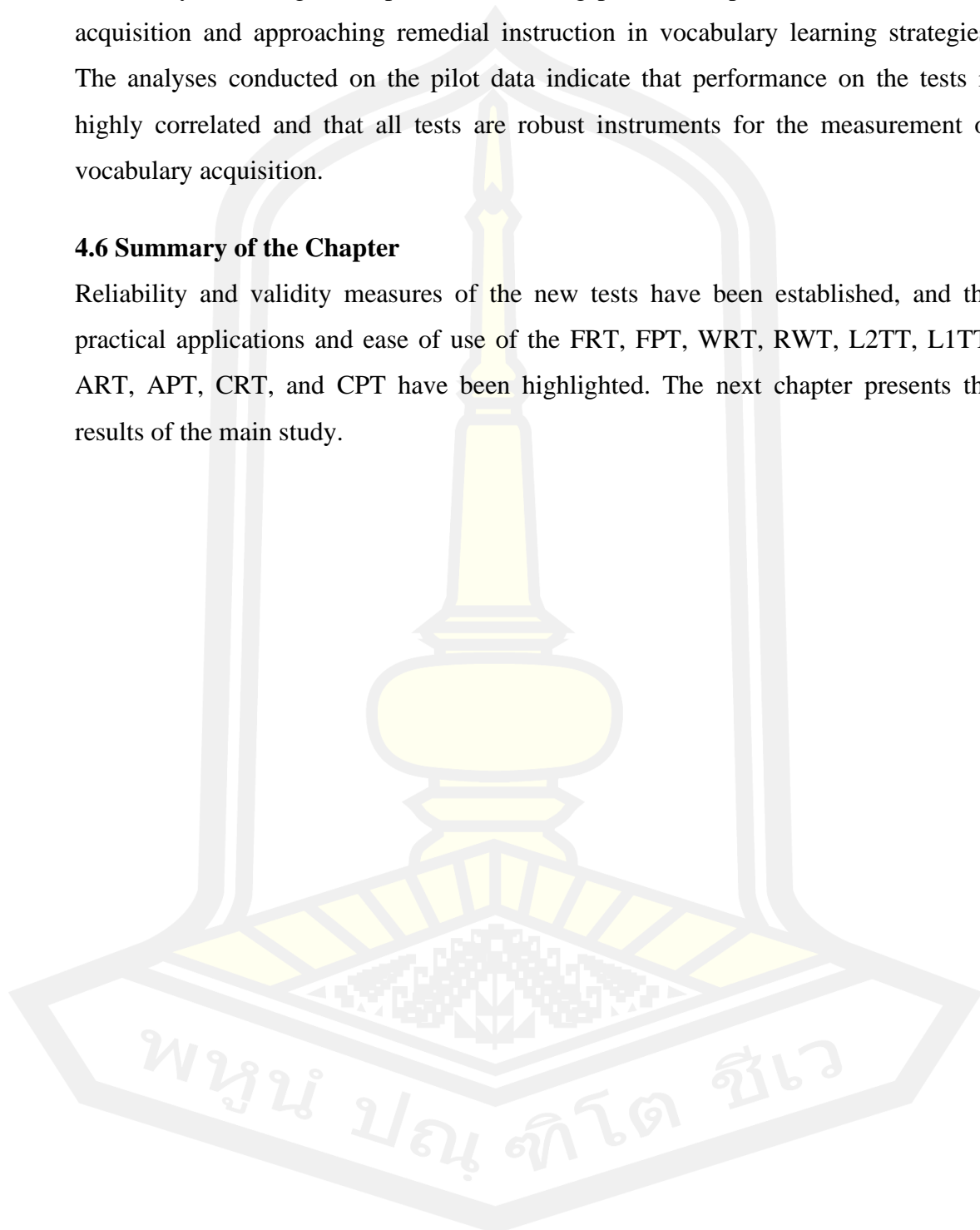
4.5 Conclusions

The measures of receptive and productive vocabulary knowledge (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, CRT, and CPT) were designed and developed based on the conceptualization of word knowledge (Nation, 2013; Read, 2000). These innovative measures of vocabulary knowledge aspects capture the progress of vocabulary acquisition, starting with the recognition of a word and ending with the

full understanding of a word in production. Thus, measuring receptive and productive vocabulary knowledge is important for finding potential impediments to vocabulary acquisition and approaching remedial instruction in vocabulary learning strategies. The analyses conducted on the pilot data indicate that performance on the tests is highly correlated and that all tests are robust instruments for the measurement of vocabulary acquisition.

4.6 Summary of the Chapter

Reliability and validity measures of the new tests have been established, and the practical applications and ease of use of the FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, CRT, and CPT have been highlighted. The next chapter presents the results of the main study.



CHAPTER V

RESULTS OF THE PRESENT STUDY

This chapter presents the quantitative results from learners' participation in the main study and describes the statistical analyses used to address the research questions. The chapter consists of three main sections. First, the descriptive statistics present the participants' test performance for receptive and productive vocabulary knowledge in a Thai EFL context. Second, the results of the inferential statistics and related methods are used to indicate the acquisition order of vocabulary aspects (the hierarchical difficulty of the vocabulary aspects in acquisition). Finally, the conceptualized model of the relationships between various vocabulary aspects is reported.

5.1 Vocabulary Knowledge in Thai EFL Senior High School Learners

5.1.1 Results of Descriptive Statistics

This section summarizes the scores of the senior high school (tenth-, eleventh-, and twelfth-grade) learners on the receptive and productive vocabulary knowledge tests. The descriptive statistics are reported, including mean, standard deviation, minimum and maximum scores, skewness, and kurtosis. The raw total test scores were then converted into percentages for ease of comparison among participants' performance on the tests. The percentage of the total score was calculated by dividing the total score of each test by its mean.

Summarizing descriptive statistics for the senior high school participants' performance on the twelve vocabulary knowledge tests, i.e., FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT, is presented in Table 9.

Table 9. Descriptive Statistics for all Vocabulary Tests ($N = 500$)

Aspects	Tests	Mean	SD	Skewness	Kurtosis	Total (%)
Written form	R FRT	23.16	6.81	-1.33	1.71	77.21
	P FPT	21.21	7.92	-0.97	0.40	70.71
Word part	R WRT	21.48	6.02	-1.25	1.77	71.61
	P RWT	17.86	7.79	-0.66	-0.48	59.53
Form-meaning link	R L2TT	21.35	4.85	-0.44	-0.50	71.15
	P L1TT	14.75	6.26	-0.27	-0.63	49.17
Association	R ART	21.31	6.72	-1.12	1.06	71.02
	P APT	14.76	6.19	-0.62	-0.22	49.19
Grammatical function	R GRT	17.97	8.42	-0.55	-0.78	59.91
	P GPT	16.76	7.08	-0.49	-0.30	55.87
Collocation	R CRT	21.20	6.65	-1.05	0.61	70.67
	P CPT	13.46	6.45	-0.52	-0.52	44.87
Vocabulary knowledge		18.77	6.76	-0.77	0.17	62.58

Notes: R = Receptive knowledge, P = Productive knowledge

The descriptive statistics indicate that the participants knew over half (62.58%) of the items for each test and that scores on the receptive test of an aspect were higher than scores on the productive test. The senior high school participants achieved a higher percentage on the receptive written form test (FRT) at 77.21%, followed by 71.61% on the receptive word part test (WRT), 71.15% on the receptive form-meaning test (L2TT), 71.02% on the receptive association test (ART), 70.67% on the receptive collocation test (CRT), 70.71% on the productive written form test (FPT), 59.91% on the receptive grammatical function test (GRT), 59.53% on the productive word part test (RWT), 55.87% on the productive grammatical function test (GPT), 49.19% on the productive association test (APT), 49.17% on the productive form-meaning test (L1TT) and, finally, 44.87% on the productive collocation test (CPT). Only the L1TT, APT, and CPT were less than 50% of the total score. To put it briefly, the Thai EFL senior high school participants have different degrees of vocabulary knowledge. Specifically, the portion of receptive knowledge known is higher than productive knowledge.

Further examination of the normal distribution of all tests, the skewness and kurtosis values for all vocabulary tests were at the conservative range of ± 1 ($\text{all} \leq 2$) and were proved to be normal on the performance across different vocabulary knowledge tests (Bentler, 2006; Kim & Bentler, 2006; Kunnan, 1998, cited in Hill, 1998; Peat & Barton, 2005). Multivariate normality was also verified (Mahalanobis values ≤ 10.44), which was less than the standard threshold set at ≤ 13.82 . Thus, it appears that the parametric assumption of normality had not been violated (Larson-Hall, 2016).

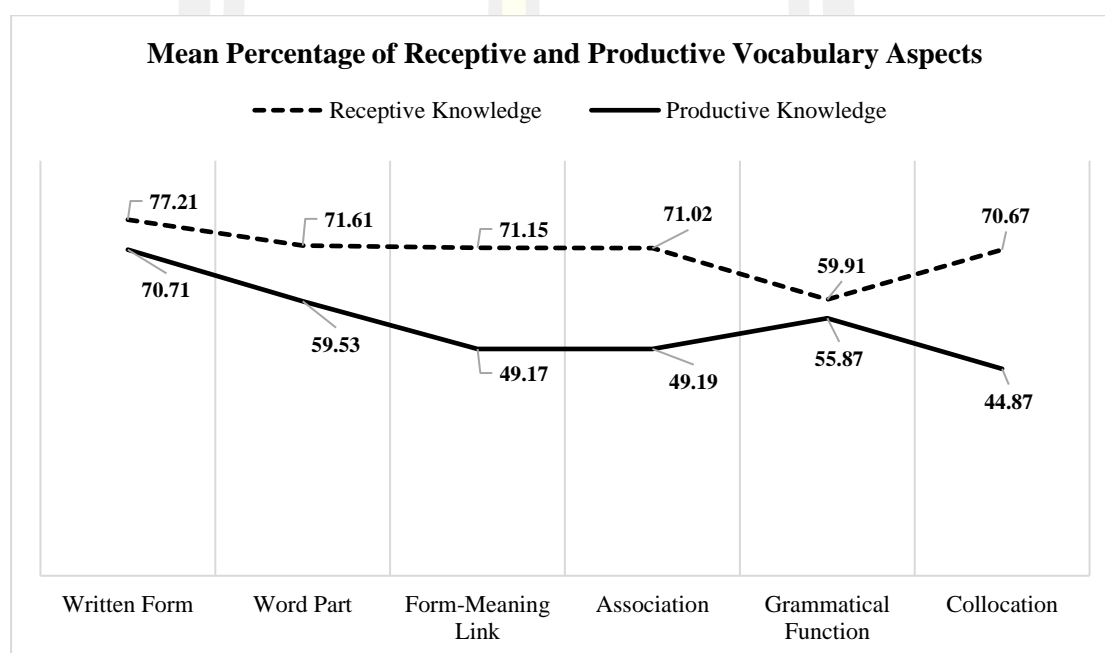


Figure 7. Mean Percentage of Receptive and Productive Vocabulary Knowledge Aspects

5.1.2 Results of Inferential Statistics

The analysis of ANOVA first showed the overall significant difference on all vocabulary knowledge tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT). The comparison results of all receptive and productive vocabulary aspects showed that the twelve vocabulary knowledge tests were statistically different and revealed medium to large effect sizes: all receptive tests ($F = 51.55$, $p < 0.001$, $\eta^2 = 0.09$), all productive tests ($F = 137.01$, $p < 0.001$, $\eta^2 = 0.22$) and, overall, all tests ($F = 191.13$, $p < 0.001$, $\eta^2 = 0.28$) (see Table 10).

Table 10. The Comparison among all Receptive and Productive Tests of Vocabulary Aspects

Aspects	Tests	F-test	η^2
R	FRT, WRT, L2TT, ART, GRT, CRT	51.55***	0.09
P	FPT, RWT, L1TT, APT, GPT, CPT	137.01***	0.22
Overall	FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, CPT	191.13***	0.28

Notes: R =Receptive knowledge, P = Productive knowledge, η^2 = Effect size, *** $p < 0.001$, $N = 500$ (2-tailed)

As shown in Table 11, a paired-samples *t*-test analysis revealed that there was a statistically significant difference between the receptive and productive tests of the same knowledge aspect, revealing small to large effect size: the receptive and productive tests of written form (FRT versus FPT; $t = 5.23$, $p < 0.001$, $d = 0.26$), the receptive and productive tests of word part (WRT versus RWT; $t = 9.97$, $p < 0.001$, $d = 0.52$), the receptive and productive tests of form-meaning (L2TT versus L1TT; $t = 30.26$, $p < 0.001$, $d = 1.18$), the receptive and productive tests of association (ART versus APT; $t = 20.78$, $p < 0.001$, $d = 1.01$), the receptive and productive tests of grammatical function (GRT versus GPT; $t = 2.92$, $p < 0.005$, $d = 0.16$), and the receptive and productive tests of collocation (CRT versus CPT; $t = 24.57$, $p < 0.001$, $d = 1.18$). The GRT-GPT comparison was less than a small level for the effect size.

Table 11. The Comparison of the Receptive and Productive Tests of the Same Knowledge Aspect

	Aspects	Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Written form	FRT	5.23***	0.26
P	Written form	FPT		
R	Word part	WRT	9.97***	0.52
P	Word part	RWT		
R	Form-meaning	L2TT	30.26***	1.18
P	Form-meaning	L1TT		
R	Association	ART	20.78***	1.01
P	Association	APT		
R	Grammatical function	GRT	2.92**	0.16
P	Grammatical function	GPT		
R	Collocation	CRT	24.57***	1.18
P	Collocation	CPT		

Notes: R = Receptive knowledge, P = Productive knowledge, *** $p < 0.001$, ** $p < 0.01$, $N = 500$ (2-tailed)

Further, the receptive and productive tests of different knowledge aspects were significantly different ($p < 0.001$), revealing small to large effect sizes (see Table 12). Five comparisons of the receptive and productive tests of different aspects resulted in no significantly significant difference: the receptive test of word part and the productive test of written form (WRT versus FPT), the receptive test of form-meaning

and the productive test of written form (L2TT versus FPT), the receptive test of association and the productive test of written form (ART versus FPT), the receptive test of grammatical function and the productive test of word part (GRT versus RWT), and the receptive test of collocation and the productive test of written form (CRT versus FPT). The effect size values for these five comparisons were a smaller effect size level.

Table 12. The Comparison between the Receptive and Productive Tests of Different Aspects

Aspects		Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Written form	FRT	15.49***	0.72
P	Word part	RWT		
R	Written form	FRT	27.66***	1.29
P	Form-meaning	LITT		
R	Written form	FRT	25.70***	1.29
P	Association	APT		
R	Written form	FRT	17.67***	0.92
P	Grammatical function	GPT		
R	Written form	FRT	31.44***	1.46
P	Collocation	CPT		
R	Word part	WRT	0.76	0.04
P	Written form	FPT		
R	Word part	WRT	21.64***	1.10
P	Form-meaning	LITT		
R	Word part	WRT	20.52***	1.10
P	Association	APT		
R	Word part	WRT	13.57***	0.72
P	Grammatical function	GPT		
R	Word part	WRT	24.78***	1.29
P	Collocation	CPT		
R	Form-meaning	L2TT	0.43	0.02
P	Written form	FPT		
R	Form-meaning	L2TT	11.85***	0.54
P	Word part	RWT		
R	Form-meaning	L2TT	27.56***	1.19
P	Association	APT		
R	Form-meaning	L2TT	17.63***	0.76
P	Grammatical function	GPT		
R	Form-meaning	L2TT	33.90***	1.38
P	Collocation	CPT		
R	Association	ART	0.27	0.01
P	Written form	FPT		
R	Association	ART	9.40***	0.47
P	Word part	RWT		
R	Association	ART	21.32***	1.01
P	Form-meaning	LITT		
R	Association	ART	12.63***	0.66
P	Grammatical function	GPT		
R	Association	ART	26.18***	1.19
P	Collocation	CPT		
R	Grammatical function	GRT	7.97***	0.40
P	Written form	FPT		
R	Grammatical function	GRT	0.29	0.01
P	Word part	RWT		
R	Grammatical function	GRT	8.75***	0.43
P	Form-meaning	LITT		

	Aspects	Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Grammatical function	GRT	8.27***	0.43
P	Association	APT		
R	Grammatical function	GRT	12.55***	0.60
P	Collocation	CPT		
R	Collocation	CRT	0.03	0.00
P	Written form	FPT		
R	Collocation	CRT	9.98***	0.46
P	Word part	RWT		
R	Collocation	CRT	23.09***	1.00
P	Form-meaning	L1TT		
R	Collocation	CRT	20.60***	1.00
P	Association	APT		
R	Collocation	CRT	12.84***	0.65
P	Grammatical function	GPT		

Notes: R = Receptive knowledge, P = Productive knowledge, *** $p < 0.001$, $N = 500$ (2-tailed)

Next, there was a statistically significant difference between the receptive tests of different aspects ($p < 0.001$), indicating small to medium effect sizes (see Table 13). There was no statistical difference between the receptive tests of word part (WRT) and form-meaning (L2TT), the receptive tests of word part (WRT) and association (ART), the receptive tests of word part (WRT) and collocation (CRT), the receptive test of form-meaning (L2TT) and association (ART), the receptive test of form-meaning (L2TT) and collocation (CRT), and the receptive test of association (ART) and collocation (CRT). The effect size values were smaller than Cohen's *d* range.

Table 13. The Comparison between the Receptive Tests of Different Aspects

	Aspects	Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Written form	FRT	4.84***	0.26
R	Word part	WRT		
R	Written form	FRT	6.85***	0.31
R	Form-meaning	L2TT		
R	Written form	FRT	5.55***	0.27
R	Association	ART		
R	Written form	FRT	13.43***	0.68
R	Grammatical function	GRT		
R	Written form	FRT	6.01***	0.29
R	Collocation	CRT		
R	Word part	WRT	0.50	0.02
R	Form-meaning	L2TT		
R	Word part	WRT	0.54	0.03
R	Association	ART		
R	Word part	WRT	8.87***	0.48
R	Grammatical function	GRT		
R	Word part	WRT	0.82	0.04
R	Collocation	CRT		
R	Form-meaning	L2TT	0.15	0.01
R	Association	ART		
R	Form-meaning	L2TT	10.16***	0.49
R	Grammatical function	GRT		
R	Form-meaning	L2TT	0.59	0.03
R	Collocation	CRT		

Aspects		Tests	<i>t</i> -value	Effect-size (<i>d</i>)
R	Association	ART	8.48***	0.44
R	Grammatical function	GRT		
R	Association	ART	0.32	0.02
R	Collocation	CRT		
R	Grammatical function	GRT	8.63***	0.43
R	Collocation	CRT		

Notes: R = Receptive knowledge, P = Productive knowledge, *** $p < 0.001$, $N = 500$ (2-tailed)

At last, the productive tests of different knowledge aspects showed a statistically significant difference, with different effect sizes, indicating small to large (see Table 14). The productive tests of word part and grammatical function were significantly different (RWT versus GPT; $t = 2.91$, $p < 0.005$), but the effect size value was a smaller level ($d = 0.15$). Only the comparison between the productive tests of form-meaning and association was not a statistically significant difference and had no effect size.

Table 14. The Comparison between the Productive Tests of Different Aspects

Aspects		Tests	<i>t</i> -value	Effect-size (<i>d</i>)
P	Written form	FPT	9.02***	0.43
P	Word part	RWT		
P	Written form	FPT	19.28***	0.90
P	Form-meaning	L1TT		
P	Written form	FPT	18.31***	0.91
P	Association	APT		
P	Written form	FPT	11.12***	0.59
P	Grammatical function	GPT		
P	Written form	FPT	22.88***	1.07
P	Collocation	CPT		
P	Word part	RWT	9.31***	0.44
P	Form-meaning	L1TT		
P	Word part	RWT	8.92***	0.44
P	Association	APT		
P	Word part	RWT	2.91**	0.15
P	Grammatical function	GPT		
P	Word part	RWT	13.03***	0.62
P	Collocation	CPT		
P	Form-meaning	L1TT	0.021	0.00
P	Association	APT		
P	Form-meaning	L1TT	6.22***	0.30
P	Grammatical function	GPT		
P	Form-meaning	L1TT	4.67***	0.20
P	Collocation	CPT		
P	Association	APT	5.68***	0.30
P	Grammatical function	GPT		
P	Association	APT	4.23***	0.21
P	Collocation	CPT		
P	Grammatical function	GPT	10.06***	0.49
P	Collocation	CPT		

Notes: R = Receptive knowledge, P = Productive knowledge, *** $p < 0.001$, ** $p < 0.01$, $N = 500$ (2-tailed)

While a paired-samples *t*-test result indicated that some comparisons were not significant differences, an ANOVA result illustrated overall that there was a statistically significant difference in all vocabulary knowledge tests, both receptively and productively, and also indicated the strength of the effect size. Therefore, these findings may imply that all vocabulary aspects are acquired at significantly different rates.

To sum up, the results showed that the receptive and productive tests of vocabulary aspects were significantly different, specifically, receptive and productive knowledge of an aspect. This suggests that receptive knowledge of an aspect is first known before its productive knowledge, and receptive knowledge of some aspects may first be acquired before or after productive knowledge of some aspects. The implications of the results are that some aspects of vocabulary knowledge are learned in a parallel manner. Thus, the aspect is not required to master before advancing to others; that is, the learners do not need to master all receptive knowledge of a word before moving on to the productive level.

5.2 Relationships in Vocabulary Aspects

Scores on vocabulary aspects, both receptively and productively, were correlated (small to large), and different effect sizes (small to large) (all *r* values ≥ 0.27 ; R^2 values ≥ 0.07) (see Table 15).

Table 15. The Correlation in all Tests of Vocabulary Aspects

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: *** $p < 0.001$, $r (0.10-0.29)$ = Small, $r (0.30-0.49)$ = Medium, $r (0.50-1)$ = Large, $N = 500$ (2-tailed)

There were statistically significant correlations between vocabulary aspects ($p < 0.001$). Specifically, the L2TT and L1TT showed the highest correlated score ($r = 0.64$, $R^2 = 0.41$), and the lowest correlated score was the FRT and WRT ($r = 0.27$, $R^2 = 0.07$).

The results indicate that vocabulary aspects are interrelated and that the aspects are significantly and positively correlated in the broader population.

5.3 The Acquisition Order of Vocabulary Aspects

The Implicational Scaling (IS) analysis was used to estimate the difficulty of the various vocabulary tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT) and form a systematic hierarchical relationship of the acquisition of vocabulary knowledge aspects. The observation of the implicational scale of the vocabulary aspects in the participants was prescribed horizontally in a matrix and hierarchized from most known to least known (left to right) as follows:

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 Coefficient of reproducibility (C_{rep}) was set at ≥ 0.90 , and the Coefficient of scalability (C_{scal}) was set at ≥ 0.60 (Guttman, 1944). The IS results 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). That is, based on the C_{rep} , if the participants can recall one aspect, it is assumed around 93% 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 revealed differently 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} represents the strength of the aspects on an implicational scale, indicating whether the aspects are unidimensional and, thereby, scalable. If the C_{scal} is > 0.60 , the data is considered scalable, reflecting a more valid implicational scale. The scalability coefficient indicates that the scalability pattern is quite active and that the measured aspects are one-dimensional (González-Fernández & Schmitt, 2020).

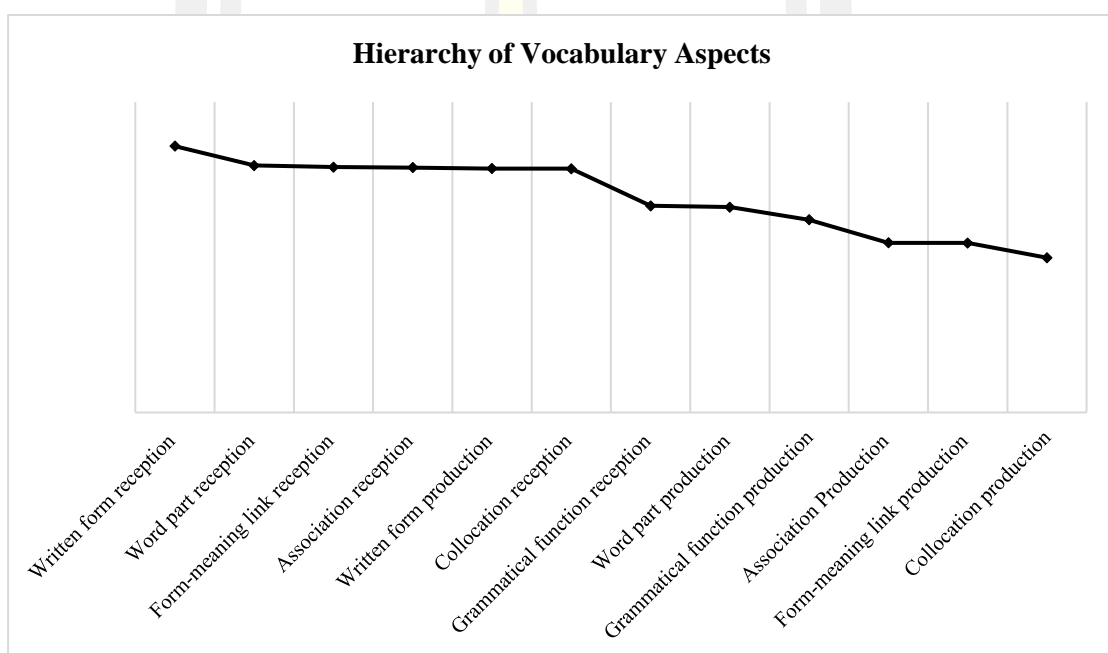


Figure 8. The Hierarchical Difficulty of Vocabulary Knowledge Aspects

5.4 The Relationship Model of Various Vocabulary Aspects

The hypothesized model of vocabulary knowledge illustrated in Figure 9 was examined in the conceptualized model of the relationships between various aspects. The Structural Equation Modelling (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).

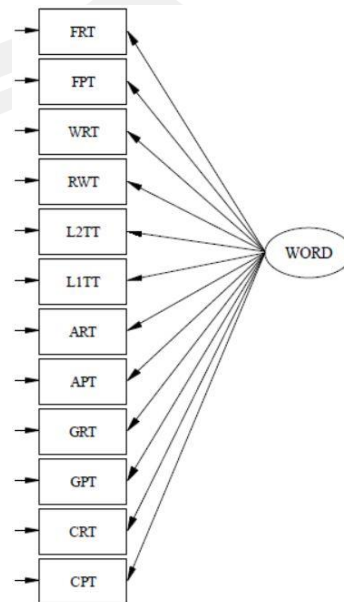


Figure 9. Hypothesized Model of Relationships between Vocabulary Aspects

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 significantly differed. Furthermore, based on the high correlation results, the receptive and productive knowledge of the same aspect were interrelated. This model is illustrated in Figure 10.

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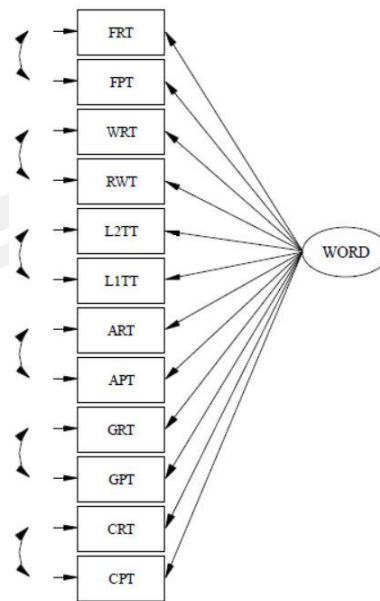


Figure 10. Model of Vocabulary Knowledge that Receptive and Productive Knowledge as Independent Aspects

Table 16. Model Fit Indexes

	χ^2	<i>df</i>	<i>p</i> -value	RMSEA	GFT	AGFT	SRMR	NFI	CFI
Acceptable fit			> 0.05	< 0.05	> 0.95	> 0.95	< 0.05	> 0.95	> 0.95
Model	53.84	46	0.20	0.02	0.98	0.97	0.02	0.99	1.00

As shown in Table 16, the results of the model of vocabulary knowledge demonstrated a good fit model. The insignificant χ^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 suitability of the model and, consequently, the validity of the construct. The analysis further indicated the prediction values of vocabulary knowledge aspects to influence vocabulary knowledge, as shown in Table 17.

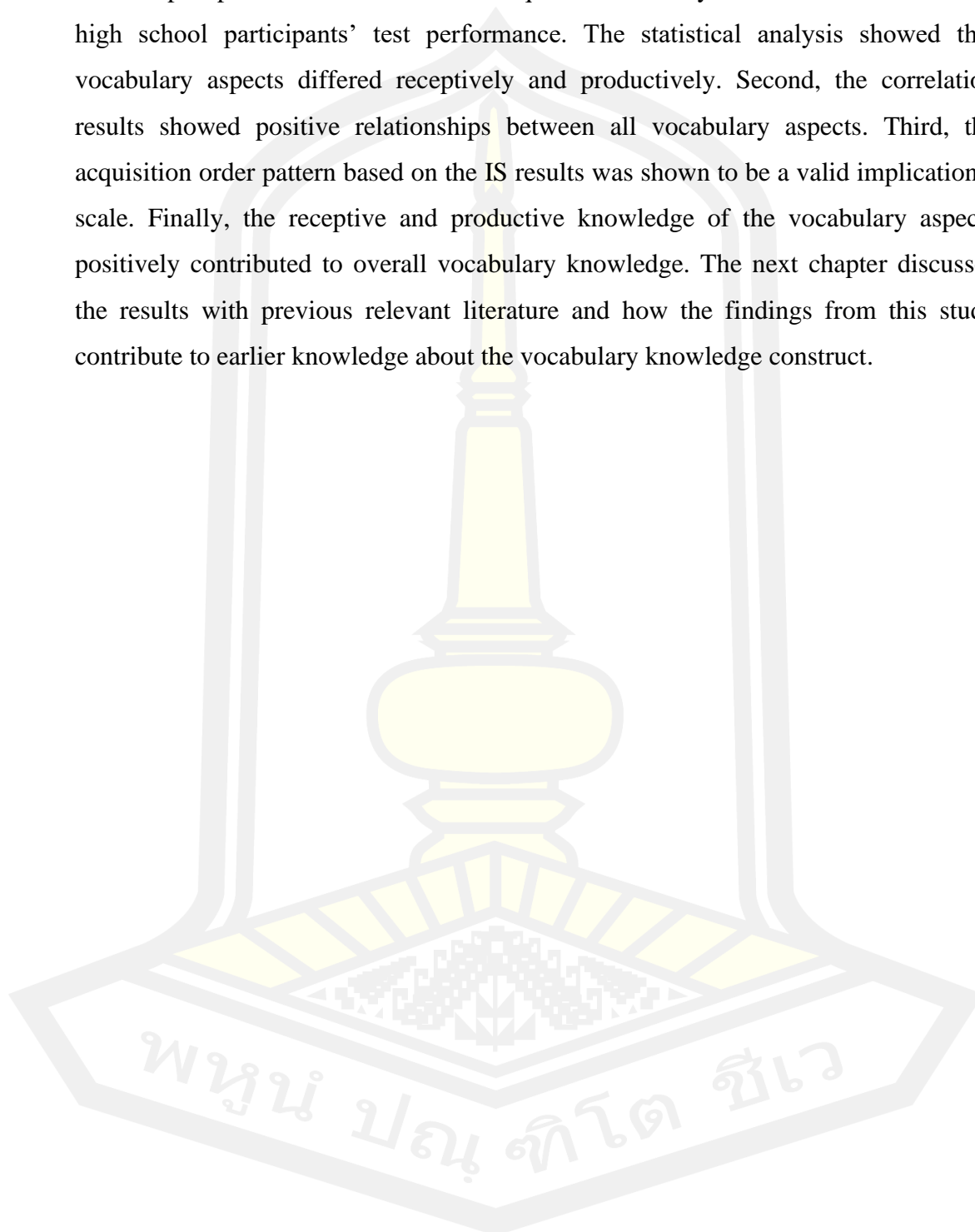
Table 17. Predictions of Vocabulary Aspects to Vocabulary Knowledge (SEM Result)

Vocabulary aspects	β
Predicting vocabulary 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 (i.e., paths between vocabulary knowledge and these twelve aspects) were interrelated, and they can be understood as a single construct. The growth of vocabulary knowledge averaged an overall 64.50% contribution and was specifically predicted by FRT at 63%, FPT at 66%, WRT at 47%, RWT at 65%, L2TT at 85%, L1TT at 74%, ART at 60%, APT at 61%, GRT at 58%, GPT at 55%, CRT at 69%, and CPT at 71%, based on the β values. This illustrates, based on various β coefficients of predictions, that these aspects were different sub-constructs of vocabulary knowledge which indicates varying degrees of a path to vocabulary growth (Kline, 2016). Thus, based on the data, this model seems to be a good representative of vocabulary knowledge. The model suggests that all vocabulary aspects positively contribute to the acquisition of vocabulary knowledge and further description of vocabulary knowledge construct, demonstrating that they are all crucial aspects of knowing a word.

5.5 Summary of the Chapter

This chapter presented the results of the quantitative analysis of the Thai EFL senior high school participants' test performance. The statistical analysis showed that vocabulary aspects differed receptively and productively. Second, the correlation results showed positive relationships between all vocabulary aspects. Third, the acquisition order pattern based on the IS results was shown to be a valid implicational scale. Finally, the receptive and productive knowledge of the vocabulary aspects positively contributed to overall vocabulary knowledge. The next chapter discusses the results with previous relevant literature and how the findings from this study contribute to earlier knowledge about the vocabulary knowledge construct.



CHAPTER VI

DISCUSSION AND CONCLUSION

The previous chapter presented a detailed analysis of the results and furnished a preliminary explanation of these results about the research questions regarding the acquisition order of different vocabulary knowledge aspects and their relationship model. This chapter will discuss the results in the context of the current literature, the construct of vocabulary knowledge, and the relationships of its aspects. Notably, it will be argued that the findings of the present study increase the comprehension of the natural acquisition of vocabulary knowledge and how it interrelates with the vocabulary development process in Thai EFL senior high school learners.

6.1 Discussion

There is no consensus on the relative conceptualization of the vocabulary knowledge construct. The nature of vocabulary knowledge, including various related aspects, is an incrementally developmental continuum (Henriksen, 1999; Laufer & Goldstein, 2004; Nation, 2013; Schmitt, 2008). The aspects of vocabulary knowledge are prior knowledge of vocabulary growth. Understanding the roles of vocabulary knowledge aspects affords a vibrant picture of vocabulary knowledge acquisition about the ease or difficulty of learning a word. Therefore, the present study sought to explore the nature of the vocabulary knowledge construct as a multi-aspect by examining the acquisition order of various vocabulary aspects and their relationships to convey the conceptualization of the vocabulary knowledge aspects in Thai EFL senior high school learners. The overall results largely support previous assumptions about vocabulary knowledge acquisition. The results showed that word aspects were interrelated but not learned simultaneously, suggesting that vocabulary knowledge is a developmental learning process.

Two research questions were formulated for the present study. Research Question 1 examined the direction of vocabulary knowledge aspects [written form, word part, form-meaning link, association, grammatical function, and collocation (both receptive and productive knowledge)] hierarchically acquired in Thai EFL senior high school

learners. Research Question 2 examined the conceptualized model of the relationship among the aspects in Thai EFL senior high school learners. The extensive multi-aspect test battery assessed these different vocabulary knowledge aspects with a large number of participants ($N = 500$).

This chapter will discuss the findings within Nation' (2013) vocabulary knowledge framework, which suggests multi-dimensional aspects. Indeed, the present study investigated the overall nature of vocabulary knowledge as a multi-aspect construct. The findings, in some cases, confirm common earlier assumptions but, in other cases, lead to unanticipated results, which differ from general understandings of vocabulary knowledge. The new insight into this conceptualization is also revealed in the present study.

6.1.1 Vocabulary Knowledge Aspects

The descriptive statistics indicated that the participants knew almost two-thirds (62.58%) of the items for each test. All tests (FRT, FPT, WRT, RWT, L2TT, L1TT, ART, APT, GRT, GPT, CRT, and CPT) were scored with statistically significant differences. The results of the present study demonstrated that the aspects of vocabulary knowledge are likely learned at different rates.

The findings support the supposition of a multi-aspect investigation that some aspects of vocabulary knowledge are acquired before others (e.g., Henriksen, 1999; Laufer & Goldstein, 2004; Nation, 2013; Schmitt, 2000; Schmitt & Zimmerman, 2002; Zimmerman, 2009). González-Fernández and Schmitt (2020) investigated multiple aspects [form–meaning link, derivative, multiple-meaning, and collocation (reception and production)] and found that multiple aspects of vocabulary knowledge were different levels to be acquired. Nontasee and Sukying (2021) argued the implications of different acquisition levels of various aspects. They explored the learnability of multiple aspects [word part, form-meaning link, and collocation (reception and production)] and found that multiple aspects of vocabulary knowledge were unknown simultaneously. Sukying and Nontasee (2022) further argued that various acquisition levels existed in different vocabulary knowledge aspects.

It was also 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, 2021a, 2021b; Laufer & Goldstein, 2004; Nontasee & Sukying, 2020, 2021; Zhong, 2014, 2018). The production of vocabulary knowledge was likely more difficult than the reception of vocabulary knowledge. 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, 2018a, 2018b, 2020; Webb, 2005).

To demonstrate, Zhong (2014, 2018) also proposed that receptive knowledge of any vocabulary aspects (form recognition, meaning comprehension, word class knowledge, association, and collocation) was initially known and likely transferred to and contributed to productive knowledge of the vocabulary use aspect. Schmitt (2019) alternatively indicated that receptive knowledge mastery of a lexical item is the ability to understand it while listening or reading. Its productive knowledge mastery is the ability to use it while speaking and writing. According to prior research, acquiring most words to receptive knowledge mastery is relatively uncomplicated, but the actual problem is to convert such knowledge to productive knowledge mastery (Jeensuk & Sukying, 2021a, 2021b; Masrai, Milton, El-Dakhs, & Elmenhawy, 2021; Nizonkiza, 2016; Tang & Nesi, 2003). The intervals (i.e., learning burden) between no knowledge to receptive knowledge and receptive knowledge to productive knowledge are roughly similar for most words. It is also possible to suppose that major learning happens at the initial instance of acquiring the word to receptive knowledge mastery and that productive knowledge mastery comes without too much difficulty.

The interface between these receptive and productive aspects of vocabulary knowledge may appear challenging to describe how they relate to one another (Lin, 2015; Zhong, 2014, 2018). Melka (1997) clarified that identifying how familiarity reaches the point where knowledge is no longer receptive knowledge but productive knowledge is critical and sought to divide the gap between receptive and productive knowledge aspects into four stages: imitation or reproduction without assimilation,

comprehension, reproduction with assimilation, and production. The pattern from receptive to productive knowledge is not clear and well-ordered, and in a few cases, the production of vocabulary knowledge begins before the complete reception of vocabulary knowledge. This signifies that they are not watertight compartments that overlap and interact with one another. The assumption is that the gap between the reception and production of vocabulary knowledge may therefore be decreased by increasing the range of the reception of vocabulary knowledge. The assumption is that increasing the range of the reception of vocabulary knowledge may reduce the gap between the reception and production of vocabulary knowledge.

The correlational results showed that all vocabulary knowledge aspects at both the receptive and productive knowledge were related to one another. Specifically, the results showed that receptive and productive tests in the same aspect were largely correlated. In addition, various aspects of vocabulary knowledge were also interrelated, indicating that knowledge of one aspect could enhance the other aspect of learning. These findings align with previous studies (e.g., Laufer & Goldstein, 2004; Lin, 2015; Nontasee & Sukying, 2021; Schmitt & Meara, 1997; Zhong, 2018). As illustrated, Laufer and Goldstein (2004) studied vocabulary knowledge testing. The study focused on word form and meaning knowledge to test four aspects: passive recognition, active recognition, passive recall, and active recall. It was also shown that the four different aspects of knowledge were closely related and indicated a hierarchical relationship between receptive and productive knowledge of form and meaning. Lin (2015) also revealed a significant relationship between multiple features of a lexical item and their influence on L2 word acquisition, specifically focusing on the written form of a word, including morphology, orthography, and word length, and suggested that multiple related vocabulary features facilitate L2 receptive and productive word acquisition. However, it must be noted that this study was limited to the written form of a word. Furthermore, Zhong (2014, 2018) found positive relationships in all measured knowledge aspects and between receptive knowledge of different vocabulary aspects (meaning, form, morphology, collocation, and association) and productive knowledge of vocabulary use and the individual contribution of the five receptive vocabulary aspects to productive vocabulary use. It

was also found that the influence of receptive knowledge on productive knowledge changed significantly over time, and the extent to which receptive knowledge enables productive knowledge varies depending on the learner's level of vocabulary knowledge.

Overall, receptive vocabulary knowledge could build up productive vocabulary knowledge. Plus, any aspects of vocabulary knowledge imply others, inferring that all aspects of vocabulary knowledge could contribute to knowing one another. This suggests that the multiple aspects interact to benefit vocabulary acquisition and development (e.g., González-Fernández & Schmitt, 2019; Lin, 2015; Nation, 2013; Schmitt & Meara, 1997; Webb, 2005; Zhong, 2018).

In conclusion, the current findings indicate that the multiple aspects of word knowledge are related but 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).

6.1.2 Acquisition Order Relationship of Vocabulary Knowledge Aspects

The IS results in this research provided empirical evidence about the acquisition order of vocabulary knowledge in Thai EFL senior high school learners 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 appears to be known at the early stage (Laufer & Goldstein, 2004; Nontasee & Sukying, 2020; Sukying, 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

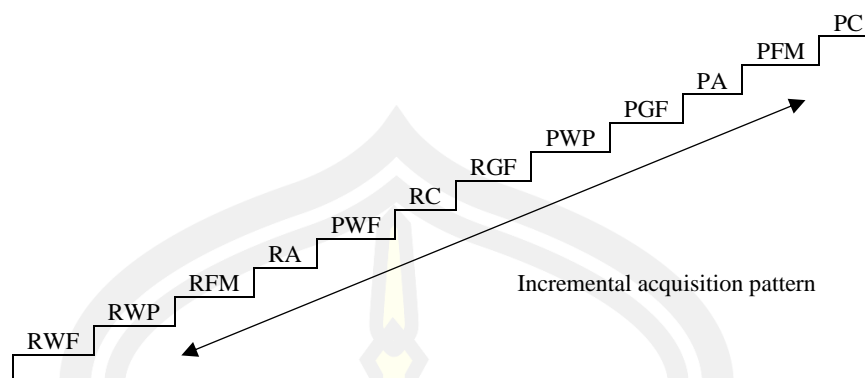
inconsistencies in acquisition order patterns of the written form (form knowledge) and form-meaning link (meaning knowledge) among learners with different language backgrounds. Form-meaning link was proved to be well-known (González-Fernández & Schmitt, 2020). However, the unmeasured knowledge aspects, 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 reception (or word use knowledge) are the most difficult to be learned and are mastered last (Nontasee & Sukying, 2020, 2021; Sukying & Nontasee, 2022; Webb, 2005; Zhong, 2018). The acquisition of vocabulary knowledge relies on exposure to the language (Sukying & Nontasee, 2022), as well as the learning environment (Nation, 2013) and learners' 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 receptive knowledge aspects were learned before word productions, this research, based on the IS results, showed that word part production was recalled before the two receptive knowledge 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, while 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 were asked to freely spell the word without any indicators or were 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. That is, the word part, known as a syntactic category, typically indicates the grammatical function of a lexical item. 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 form concurrently. In contrast, APT required them to recall only one synonym. It has also been shown that association is difficult for learners and is likely known after other aspects. Indeed, acquiring word association hinges on the natural setting and presents an obstacle for Thai EFL senior high school learners.

Finally, collocation production was the most difficult aspect to be learned 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. 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 errors, which might indicate that it was particularly complicated or challenging. An Implicational Scaling (IS) analysis posits an acquisition order pattern of all aspects, as shown in Figure 11.



Notes: RWF = Receptive written form; RWP = Receptive word part; RFM = Receptive form-meaning link; RA = Receptive association; PWF = Productive written form; RC = Receptive collocation; RGF = Receptive grammatical function; PWP = Productive word part; PGF = Productive grammatical function; PA = Productive association; PFM = Productive form-meaning link; PC = Productive collocation

Figure 11. Acquisition Order Pattern of Measured Variables (Vocabulary Aspects)

It is possible to argue that vocabulary knowledge is not an all-or-nothing relationship but rather a systematic approach in which various types of knowledge are acquired until all aspects of knowledge for an item are known. Obtaining a full comprehension of a word necessitates significant efforts in all nine aspects of knowledge, both receptively and productively. Accordingly, a large number of words, particularly the less common ones, may only be partially mastered. It also appears that some aspects of knowledge are likely to be gained before others. Schmitt and McCarthy (1997) and Schmitt (1998) argue that knowledge of form and meaning can be acquired before the other aspects, such as knowledge of collocation and register.

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 learners. Still, Sukying and Nontasee (2022) reported that the implicational patterns of word aspects in different grade learners differed. Remarkably, these studies affirm the exact stage of the reception and production of vocabulary knowledge, indicating that receptive knowledge is early known and followed by productive knowledge.

The interface between vocabulary 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.

6.1.3 Model of Multiple Related Vocabulary Knowledge Aspects

This study was built on Nation's (2013) framework to determine to what extent different vocabulary knowledge aspects relate to one another and examine the relationships among the vocabulary aspects using latent variables. These variables indicated various level estimations (i.e., related paths between vocabulary knowledge and these twelve aspects). This demonstrates that these aspects were distinct sub-constructs of vocabulary knowledge that could be interpreted as a single construct (Kline, 2016). The results illustrated that the various vocabulary aspects were found to influence the acquisition of vocabulary knowledge. Specifically, the construct of vocabulary knowledge emphasizes the process of multiple related aspects. The reception and production of the vocabulary knowledge aspects were the primary mechanisms for acquiring vocabulary knowledge. However, all aspects of both reception and production behaved differently from each other. No vocabulary 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 vocabulary knowledge is implied by multiple-related-aspect contributions, indicating that knowing multiple aspects helps learners develop their vocabulary knowledge more successfully.

Still, based on previous literature, there are limitations to the studies in the domain of vocabulary acquisition that cope with the entirety of vocabulary knowledge as a multi-aspect construct, particularly the examination of the concept of multiple vocabulary knowledge aspects and the generalization of the relationship of multiple vocabulary knowledge aspects as a model. Therefore, it hardly explicates the whole concept of vocabulary knowledge.

The implication of vocabulary growth through knowing multiple vocabulary knowledge aspects relates consistently to all previous literature on the exploration of the multi-aspect construct of vocabulary knowledge (e.g., González-Fernández, 2022; González-Fernández & Schmitt, 2020; Hayashi & Murphy, 2011; Luafer & Goldstein, 2004; Lin, 2015; Nontasee & Sukying, 2020, 2021; Schmitt, 2019; Sukying, 2017, 2018a, 2018b; Zhong, 2014, 2018). As suggested, the vocabulary knowledge construct includes multiple vocabulary knowledge aspects; that is, learners with numerous aspects of vocabulary knowledge can learn and acquire vocabulary knowledge more effectively. In other words, the more learners know various vocabulary knowledge aspects, the more they improve their vocabulary knowledge more successfully.

As previous models of the relationships of vocabulary knowledge aspects, González-Fernández and Schmitt (2020) studied the nature of the vocabulary knowledge construct within the various aspects [form–meaning link, derivative, multiple-meaning, and collocation (reception and production)] and demonstrated the model of the relationships of vocabulary aspects. They also clarified that the reception and production of vocabulary knowledge are individual aspects, and a process of receptive-productive knowledge is essential to build on the conceptualization of vocabulary development. In a follow-up study, González-Fernández (2022) further investigated the nature of L2 vocabulary knowledge by examining the hypothesis of how various vocabulary 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 vocabulary knowledge, highlighting the need for further refinement of the

conceptualization of the construct. Therefore, this study extends the conceptualization of multiple vocabulary knowledge aspects as a model in a particular Thai EFL context and can be supportive evidence in the area of the nature of the acquisition of the vocabulary knowledge construct.

Although this research yields some new insight into the nature of vocabulary knowledge construct in the acquisition process, which is the conceptualization of multiple vocabulary aspects in a Thai EFL context, i.e., the implicational scale of the acquisition order of vocabulary aspects and their model of relationships, there is still a necessity to straightly investigate the acquisition order of vocabulary knowledge aspects as a multi-framework to obtain more empirical evidence on the hierarchical structure of vocabulary knowledge (González-Fernández, 2022). This research reveals that the implicational scale (the vocabulary acquisition pattern) and the conceptualized model of vocabulary knowledge may be crucial resources in this field. 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 vocabulary 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 the acquisition order of vocabulary knowledge aspects. This may be valuable, known as the learnability of a word in EFL learners, for naturally teaching and learning vocabulary knowledge. The findings also imply that any aspects of vocabulary 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.

6.2 Conclusion of the Present Study

The study investigated the nature of vocabulary knowledge construct in an EFL context, examining the acquisition order of vocabulary knowledge aspects and their relationship model.

The results showed that vocabulary knowledge aspects were interrelated and were acquired at different rates, indicating that they were varying degrees of acquisition, which lie along a developmental process. Specifically, it was shown that the Thai EFL senior high school participants had significantly higher receptive score tests of the same knowledge aspect than their productive score tests, which implied that receptive knowledge of an aspect is easier to be known before its productive knowledge. A correlation analysis illustrated a positive interrelatedness of various vocabulary knowledge aspects. Additionally, the hierarchical pattern of the IS results indicated an implicational acquisition in the difficulty and ease of vocabulary knowledge aspects. All aspects of reception did not need to be mastered before knowing the aspects of production. Furthermore, the SEM results indicated the benefit of the various vocabulary aspects to acquiring vocabulary knowledge and found that the receptive-productive process was fundamental to conceptualizing vocabulary knowledge.

The present findings together establish the interrelatedness of vocabulary knowledge aspects and reinforce previous claims that the various vocabulary knowledge aspects are acquired according to an incremental continuum (e.g., González-Fernández & Schmitt, 2019; Hayashi & Murphy, 2011; Henriksen, 1999; Laufer & Goldstein, 2004; Nation, 2013; Nontasee & Sukying, 2021; Schmitt & Meara, 1997; Sukying & Nontasee, 2022; Sukying, 2022; Zhong, 2014, 2018). The present study further implies a new insight into vocabulary knowledge acquisition of Thai EFL senior high school learners by suggesting the acquisition order of vocabulary knowledge aspects and the model of the relationships between the various vocabulary knowledge aspects as well as the vocabulary learning direction in the pedagogy as the primary vocabulary acquisition pattern in English as a foreign language (EFL) learners in Thailand.

6.3 Contributions of the Present Study

6.3.1 Theoretical Contributions

Theoretically, the present study provides empirical evidence for the concept of vocabulary knowledge, which contains various sub-knowledge aspects. This study extended prior research on vocabulary knowledge under Nation's (2001: 2013) full vocabulary construct via the investigation of the nature of vocabulary knowledge by analyzing the acquisition order of vocabulary aspects and their relationships.

The present study quantitatively validates the L2 Vocabulary Learnability Hypothesis and a better picture of overall vocabulary acquisition. An ANOVA analysis first revealed that significantly different levels of understanding existed for vocabulary knowledge aspects, specifically receptive knowledge being learned before productive knowledge across all aspects. A correlative analysis also showed a positive interconnectedness of various vocabulary knowledge aspects. An Implicational Scaling (IS) analysis further illustrated an acquisition order pattern of all aspects. A Structural Equation Modeling (SEM) analysis demonstrated that all aspects, both receptively and productively, contribute considerably to the global vocabulary construct. Plus, SEM advised that receptive and productive knowledge of any single lexical knowledge ought to be seen as independent structures.

Various vocabulary knowledge aspects seem not to be acquired simultaneously by learners but are interrelated. The findings suggest that the multiple related vocabulary aspects contribute to developing vocabulary knowledge and that vocabulary learning occurs in a system with related aspects called a developmental continuum. Based on relating to one another, EFL learners require more profound vocabulary knowledge across several learning modes rather than any particular one alone (perceiving some knowledge aspects could help to understand and also recall others). The findings may imply that as vocabulary knowledge advances in various lexical aspects, both receptively and productively, greater development of vocabulary knowledge would be anticipated. This shows that knowing various aspects of vocabulary knowledge is essential for vocabulary acquisition and growth.

The results further show that the receptive-productive knowledge process is fundamental to conceptualizing vocabulary knowledge, indicating that receptive and productive vocabulary knowledge is vital for developing vocabulary knowledge. As we know, receptive vocabulary knowledge is built on productive vocabulary knowledge; some productive knowledge aspects may be initially known and help to know other receptive knowledge aspects too. The beneficial acquisition of vocabulary knowledge based on SEM results that independent receptive and productive knowledge is to together know both of them. Therefore, understanding both receptive and productive knowledge together simultaneously of any different aspects can progress the growth of vocabulary knowledge.

6.3.2 Methodological Contributions

The present study sought to create a generally recognized and thorough test battery of receptive and productive vocabulary knowledge across various aspects. Twelve distinct vocabulary knowledge measures were developed to suggest that vocabulary knowledge should be measured using both receptive and productive measures and that each type of vocabulary knowledge aspect requires a different measure to obtain effective data (Schmitt, 2010; Nation, 2013).

All vocabulary instruments in this study were applied based on the vocabulary testing theory (Read, 2000), which is different tests used to measure different lexical knowledge. The findings imply that the extent of construct evoked by the vocabulary measures may differ from the instrument developers' initial anticipation at the design stage. This study serves as a cue to future vocabulary researchers and test designers that the design of a vocabulary instrument requires not only theoretical-based analysis but also empirical analysis to develop a concise and trustworthy interpretation of research findings drawn from test performance. The selected instruments, however, may grasp more than one knowledge component, and the instruments to be documented should be thoroughly and extensively defined for a specific purpose.

The measures were piloted and found to be reliable and valid. The present study is an indication of testing and assessing vocabulary knowledge and highlights the impact of instruments on understanding learners' vocabulary knowledge. It offers practitioners,

test developers, and academics a novel methodology. A pioneering battery of vocabulary knowledge tests was designed to account for the aspects of written forms, word parts, form-meaning links, associations, collocations, and grammatical functions at both reception and production testing. Each measure in the research was created to collect a distinct type of direct knowledge. Given that the battery was shown to be reliable and valid, researchers and test developers should examine how to expand its possible research applications.

The measures used here were formulated for the precise research purposes of this study; therefore, further research should ensure that the content of the measures and the measures themselves are adjusted to the particular research setting.

6.3.3 Pedagogical Contributions

The empirical evidence of the multi-aspect construct of vocabulary knowledge in this study suggests that the contributions of multiple vocabulary knowledge aspects are fundamental knowledge to one another. The findings also indicate the significance of various vocabulary knowledge aspects in acquiring a word, such as written forms, word parts, form-meaning links, associations, collocations, and grammatical functions. These aspects clarify a significant amount of variance in vocabulary acquisition and development, indicating that all aspects statistically enhance the increase of vocabulary knowledge. EFL learners who concentrate on multiple aspects of a word in learning a new word may be able to receptively know the word and later productively use it. The findings also suggest that any aspects of vocabulary 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. The present study offers a conceptualized model of vocabulary knowledge for L2 classroom practice and practitioners, e.g., teachers, learners, researchers, curriculum designers and developers, materials developers, and test developers. Therefore, the findings of the present study point to an empirical vocabulary teaching and learning principle and may help to develop policy in English instruction; for example, the additional input in English classrooms by instructional

methods that integrate the aspects of vocabulary knowledge may benefit learners of English.

Vocabulary knowledge, known as the cornerstone of English language acquisition, can positively impact other sub-skills of the English language because knowing a word is particularly beneficial in expanding learners' vocabulary and supporting efficient English language achievement. Indeed, L2 vocabulary learning is one of the most effective alternatives for boosting Thai EFL senior high school learners' vocabulary acquisition skills. It would be preferable if there was vocabulary teaching and learning among Thai EFL senior high school learners, such as developing a vocabulary course in the English curriculum. Truly, understanding the roles of vocabulary knowledge will aid the input and output of vocabulary knowledge.

To strengthen the depth and breadth of vocabulary knowledge, the teaching should clearly convey the full concept of vocabulary knowledge. As the related knowledge of different vocabulary aspects, a multiple-aspect learning concept of vocabulary knowledge should be input to facilitate learners' vocabulary acquisition because all knowledge aspects can be transferred to others and develop their vocabulary knowledge. Thus, it will be beneficial in enhancing vocabulary knowledge in all multiple aspects. Plus, the concept of vocabulary teaching and learning necessitates linking with the nature of vocabulary acquisition and development, as the study indicated the acquisition order of vocabulary knowledge aspects. This may be valuable, known as the learnability of a word in EFL learners, for naturally teaching and learning vocabulary knowledge. The conceptualization of receptive and productive vocabulary knowledge is a fundamental process of vocabulary growth. Increasing learners' receptive knowledge is important to advance their productive knowledge. Indeed, receptive and productive knowledge is independent-related skills. Therefore, vocabulary teaching should concurrently improve learners' receptive and productive skills. It is not only inputting receptive skills but also teaching the output of productive skills, which is helping to improve the ability to recognize and understand a word and recall and use it in context. Knowing both receptive and

productive knowledge of a word together helps to acquire and develop vocabulary knowledge effectively.

6.4 Limitations of the Present Study

6.4.1 Test Administration

One of the drawbacks of the cross-sectional study design is the possibility of data conflation due to irrelevant factors. For instance, the present study used a three-day test administration arrangement, which, although avoiding test fatigue, may have given learners the time to look up the target words in the dictionary, thereby impacting test performance on subsequent days. The possibility of a cross-test effect was reduced by not informing participants that they would be tested on the same target words in the following days. Participants may have been aware that there would be three days of testing, but they may not have anticipated that the tests would be given on three consecutive days. More significantly, they would not have anticipated being tested on the same vocabulary the other two days. However, the duration of a vocabulary knowledge test battery was three days; hence, the findings might be influenced by external variables such as motivation, exhaustion, exam stress, and particularly some uncontrol cross-knowledge effects.

6.4.2 Target Vocabulary

The study chose 30 target words to measure. The words were picked with different word lists in consideration [the Academic Word List (AWL) (Coxhead, 2000) and the New General Service List (NGSL) (Browne, Culligan, & Phillips, 2013)]. The frequency of the target words was cross-checked with high-frequency lists in the British National Corpus (BNC) and the Common European Framework of Reference for Languages (CEFR) to an international standard for describing language proficiency. The Meaning Comprehension Test was used to assess the familiarity with the target words in the context of the investigation. The number of target words was under-represented in comparison to the frequency principle (Nation, 2013), the estimated vocabulary size of 2,000-word families for ESL and EFL learners (Nation & Waring, 1997), and the implications of vocabulary need for language learners: 86 percent for high-frequency words and 10% for academic words (Hayashi & Murphy,

2011; Sukying, 2017). As a result, the target words were chosen to fit the research context. The issue may be common to all language research that requires a balance between the study aim's intensity and the data collection's practicality and feasibility. In the present study, 30 target words were deemed appropriate for a Thai context and, more particularly, for Thai EFL senior high school learners.

However, the desired words may not be appropriate in other circumstances. The findings may not be generalizable outside the Thai culture, specifically the present study's learners. Furthermore, the findings cannot be applied to other educational levels because the education level was limited to senior high school.

6.4.3 Vocabulary Measures

The validation analysis of the tests may have been utilized to improve the tests' reliability and content validity. There are, however, no appropriate methods for assessing vocabulary knowledge aspects. Although the measuring tools were thoroughly designed and tested, there are several different methods by which the various vocabulary knowledge aspects may have been assessed. It is feasible that various metrics provide different findings, which should be investigated. More sophisticated analyses, such as Rasch analysis, are still required to validate the vocabulary tests. Most tests in the present study were designed similarly to the multiple-choice test, such as the FRT, ART, CRT, and GRT. One common weakness of the multiple-choice format is inevitable guessing. For the reason that the vocabulary knowledge tests were developed for a specific study context, they cannot be extended to other research designs or settings.

6.5 Recommendations for Further Research

This research provides significant evidence for the multi-construct nature of vocabulary knowledge acquisition in Thai EFL senior high school learners. Notably, the research examined learners of only one L1; therefore, it is unclear whether the results can be generalized to other EFL learners. Second, participants with a wide range of educational levels, such as primary, high school, and university learners, 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, and 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 vocabulary 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). The target words used require a wider vocabulary size in the vocabulary experimentation. 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.

6.6 Concluding Remarks

The present study investigated the multi-aspect nature of vocabulary knowledge by analyzing the acquisition order of (or hierarchical difficulty in acquiring) different vocabulary knowledge aspects and their conceptualized relationship. Concluding remarks posit here for readers what points have been found in this study.

The findings first indicated that the receptive tests scored higher than the productive tests in any knowledge aspect, and it suggests that vocabulary knowledge aspects are acquired at different rates. It is specifically shown that receptive knowledge of an aspect is easier to be known before its productive knowledge. It also suggests that receptive vocabulary knowledge is built on productive vocabulary knowledge.

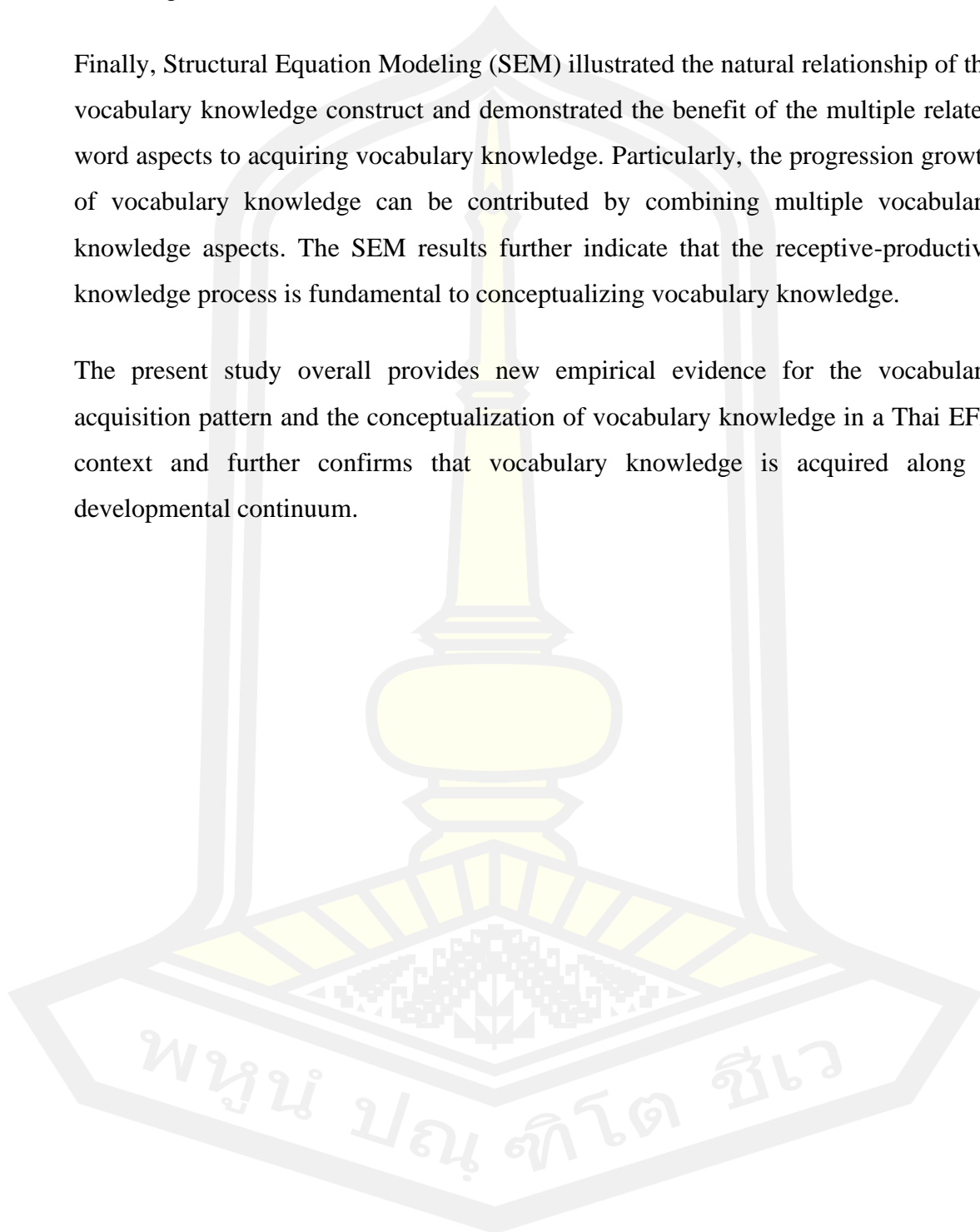
There was also a positive correlation between knowledge of the different aspects. This suggests that various vocabulary knowledge aspects are related to one another in acquiring a word, and multiple related aspects together facilitate acquiring a word more successfully.

An Implicational Scaling (IS) analysis further illustrated a valid implicational acquisition pattern of vocabulary knowledge aspects and found that productive

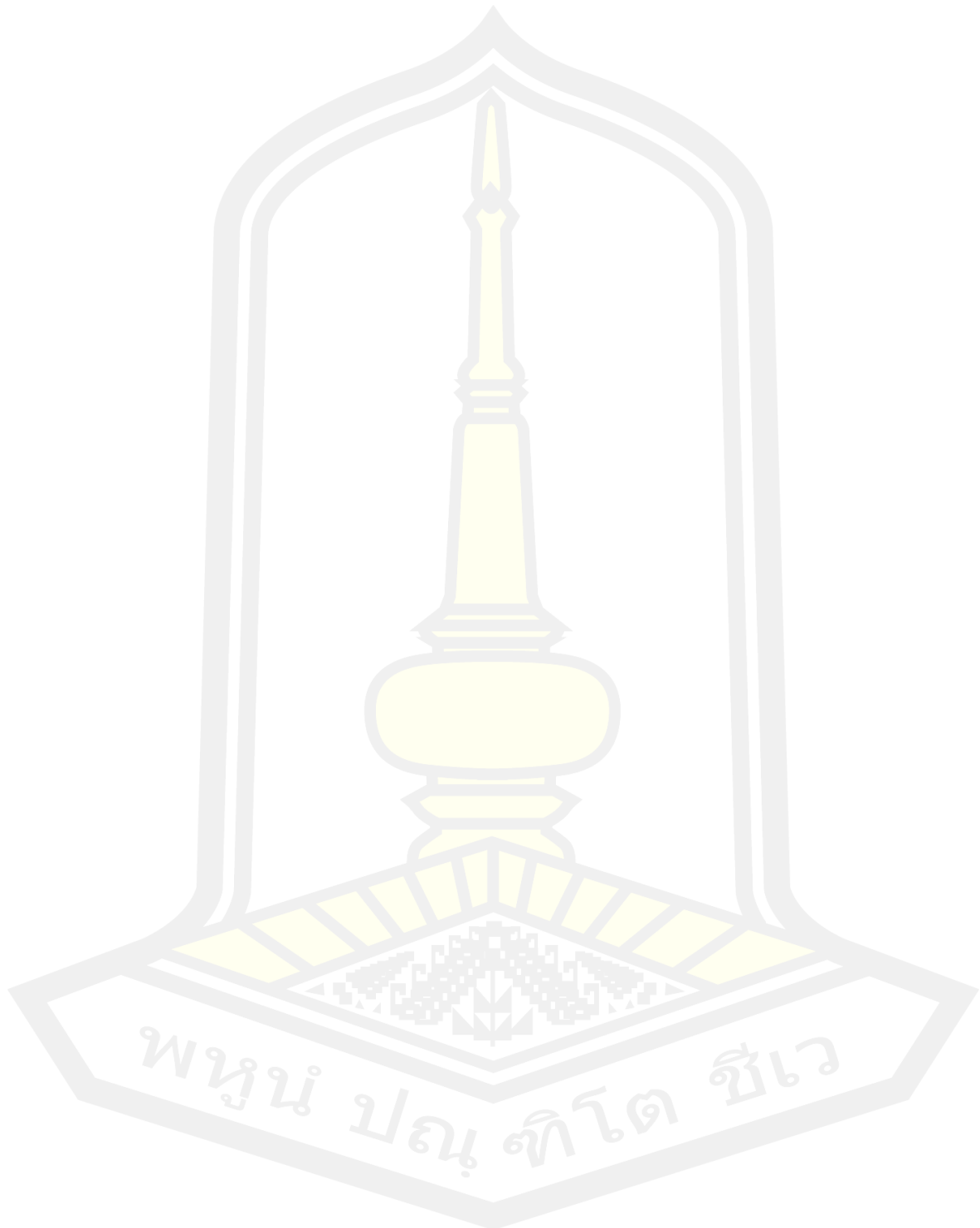
knowledge could be known without complete mastery of all aspects of receptive knowledge.

Finally, Structural Equation Modeling (SEM) illustrated the natural relationship of the vocabulary knowledge construct and demonstrated the benefit of the multiple related word aspects to acquiring vocabulary knowledge. Particularly, the progression growth of vocabulary knowledge can be contributed by combining multiple vocabulary knowledge aspects. The SEM results further indicate that the receptive-productive knowledge process is fundamental to conceptualizing vocabulary knowledge.

The present study overall provides new empirical evidence for the vocabulary acquisition pattern and the conceptualization of vocabulary knowledge in a Thai EFL context and further confirms that vocabulary knowledge is acquired along a developmental continuum.



REFERENCES



References

- Aberson, C. L. (2010). *Applied power analysis for the behavioral Sciences*. Taylor and Francis Group, LLC.
- Aitchison, J. (2012). *Words in the mind: An introduction to the mental lexicon* (4th ed.). Wiley-Blackwell.
- Alqahtani, M. (2015). The importance of vocabulary in language learning and how to be taught. *International Journal of Teaching and Education*, 3(3), 21-34.
- Anderson, R. C., & Freebody, P. (1981). Comprehension and teaching. In J. Guthrie (Ed.), *Vocabulary knowledge* (pp. 77-117). IRA.
- Andrich, D. (1985). An elaboration of Guttman scaling with Rasch models for measurement. In N. Brandon-Tuma (Ed.), *Sociological Methodology* (pp. 33-80). CA: Jossey-Bass.
- Astika, G. (1993). Analytical assessment of foreign students writing. *RELC Journal*, 24(1), 61-72.
- Bachman, L. F. (1990). *Fundamental considerations in language testing*. Oxford: Oxford University Press.
- Bachman, L. F., & Palmer, A. S. (2010). *Language assessment in practice*. Oxford: Oxford University Press.
- Bauer, L., & Nation, I. S. P. (1993). Word families. *International Journal of Lexicography*, 6(4), 253-279.
- Beglar, D. (2010). A rasch-based validation of the vocabulary size test. *Language Testing*, 27(1), 101-118.
- Beglar, D., & Hunt, A. (1999). Revising and validating the 2000 word level and university word level vocabulary tests. *Language Testing*, 16(2), 131-162.
- Bentler, P. M. (2006). *EQS 6, Structural equations program manual*. Multivariate Software Inc.
- Bogaards, P., & Laufer, B. (2004). *Vocabulary in a second language*. John Benjamins.

- Bollen, K. A., & Long, J. S. (1993). *Testing structural equation models*. Sage Publications, Inc.
- Bowers, P. N., & Kirby, J. R. (2010). Effects of morphological instruction on vocabulary acquisition. *Reading and Writing, 23*(5), 515-537.
- Brashi, A. (2009). Collocability as a problem in L2 production. *Reflections on English Language Teaching, 8*(1), 21-34.
- British Council. (2016). CEFR in Thailand. Retrieved July 17, 2021, from <https://www.britishcouncil.or.th/en/teach/our-work/cefr-thailand>
- Brown, D. (2010). What aspects of vocabulary knowledge do textbooks give attention to? *Language Teaching Research, 15*(1), 83-97.
- Brown, R., & McNeill, D. (1966). The "Tip of the Tongue" phenomenon. *Journal of Verbal Learning and Verbal Behaviour, 5*(4), 325-337.
- 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](http://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>
- Bueraheng, N., & Laohawiriyanon, C. (2014). Does learners' degree of exposure to English language influence their collocational knowledge? *Psychology, 4*(3), 1-10.
- Byrne, B. M. (1994). Burnout: Testing for the validity, replication, and invariance of causal structure across elementary, intermediate, and secondary teachers. *American Educational Research Journal, 31*(3), 645-673. <https://doi.org/10.2307/1163231>

- Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). Routledge/Taylor & Francis Group.
- Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (3rd ed.). Routledge.
- Chapelle, C. (1998). Construct definition and validity inquiry in SLA research. In L. F. Bachman & A. D. Cohen (Eds.), *Interface between second language acquisition and language testing research* (p. 32-70).
- Chawwang, N. (2008). An investigation of English reading problems of Thai 12th grade students in Nakhonratchasima educational regions 1, 2, 3 and 7. [Master's dissertation, Srinakharinwirot University].
- 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.
- Clark, E. (1993). *The lexicon in acquisition*. Cambridge University Press.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159.
- Colovic-Markovic, J. (2017). "I used them because I had to . . .": The effects of explicit instruction of topic-induced word combinations on ESL writers. *TESOL International Journal*, 12(1), 32-47.
- Corson, D. J. (1995). *Using English words*. Kluwer Academic Publishers.
- Council of Europe. (2001). Common European Framework of Reference for Languages: Learning, Teaching and Assessment. Retrieved August 7, 2021, from www.coe.int/lang-CEFR

- Cowie, A. P. (1998). Stable and creative aspects of vocabulary. In R. Carter & M. McCarthy (Eds.), *Vocabulary and language teaching* (pp. 126-139). Pearson Education Limited.
- Coxhead, A. (2000). A new academic word list. *TESOL Quarterly*, 34(2), 213-238.
- Coxhead, A. (2007). Factors and aspects of knowledge affecting L2 word use in writing. In P. Davidson, C. Coombe, D. Lloyd, & D. Palfreyman (Eds.), *Teaching and learning vocabulary in another language* (pp. 331-342). TESOL Arabia.
- Coxhead, A. (2012). A new academic word list. *TESOL Quarterly*, 34(2), 213-238.
<https://doi.org/10.2307/3587951>
- Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. New Jersey: Pearson Education.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). CA: Sage.
- Crow, J. T. (1986). Receptive vocabulary acquisition for reading comprehension. *Modern Language Journal*, 70(2), 242-250.
- Davidson, F. (1987). Guttman Scalogram Analysis. Unpublished Manuscript, University of Illinois at Urbana-Champaign.
- DeKeyser, R. M., & Sokalski, K. J. (1996). The differential roles of comprehension and production practice. *Language Learning*, 46(4), 613-642.
- DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Dokchandra, D. (2019). Thai EFL learners' collocational competence and their perceptions of collocational difficulty. *Theory and Practice in Language Studies*, 9(7), 776-784.
- Dörnyei, Z. (2007). *Research methods in applied linguistics*. Oxford: Oxford University Press.

- Elgort, I. (2011). Deliberate learning and vocabulary acquisition in a second language. *Language Learning, 61*(2), 367-413.
- Ellis, N. C. (2002). Frequency effects in language processing: A review with implications for theories of implicit and explicit language acquisition. *Studies in Second Language Acquisition, 24*(2), 143-188.
- Ellis, N. C. (2013). *Second language acquisition*. In G. Trousdale & T. Hoffmann (Eds.), *Oxford handbook of construction grammar* (pp. 365-378). Oxford University Press.
- Ellis, N. C., & Beaton, A. (1993). Psycholinguistic determinants of foreign language vocabulary learning. *Language Learning, 43*, 559-617.
- Ellis, P. D. (2010). *The essential guide to effect sizes*. Cambridge University Press.
- Elman, J. L. (2004). An alternative view of the mental lexicon. *Trends in Cognitive Sciences, 8*(7), 301-306.
- Enayat, M. J., & Amirian, S. M. R. (2020). The relationship between vocabulary size and depth for Iranian EFL learners at different language proficiency levels. *Iranian Journal of Language Teaching Research, 8*(2), 97-114.
- Enayat, M. J., Amirian, S. M. R., Zareian, G., & Ghaniabadi, S. (2018). Reliable measure of written receptive vocabulary size: Using the L2 depth of vocabulary knowledge as a Yardstick. *SAGE Open, 8*(1), 1-15.
- Faerch, C., Haastrup, K., & Phillipson, R. (1984). *Learner language and language learning*. Multilingual Matters.
- Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). Sage.
- Finney, S. J., & DiStefano, C. (2006). Non-normal and categorical data in structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (pp. 269-314). Connecticut: Information Age Publishing.
- Fitzpatrick, T. (2007). Word association patterns: Unpacking the assumptions. *International Journal of Applied Linguistics, 17*(3), 319-331.

- Fitzpatrick, T. (2012). Tracking the changes: Vocabulary acquisition in the study abroad context. *The Language Learning Journal*, 40(1), 81-98.
- Fitzpatrick, T., & Clenton, J. (2010). The challenge of validation: Assessing the performance of a test of productive ability. *Language Testing*, 27(4), 538-555.
- Fraenkel, J. R., & Norman, E. W. (2003). *How to design and evaluate research in education* (5th ed.). New York: Mc Graw Hill.
- Francis, W. N., & Kučera, H. (1982). *Frequency analysis of English usage*. Houghton Mifflin.
- Gairns, R., & Redman, S. (1986). *Working with words: A guide to teaching and learning vocabulary*. Cambridge University Press.
- González-Fernández, B., & Schmitt, N. (2019). 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>
- Griffin, G., & Harley, T. A. (1996). List learning of second language vocabulary. *Applied Psycholinguistics*, 17(4), 433-460.
- Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *The sage handbook of qualitative research* (3rd ed.) (pp. 191-215). CA: Sage.
- Guoyi, X., & Nation, I. S. (1984). A university word list. *Language Learning and Communication*, 3, 215-229.
- Guttman, L. (1944). A basis for scaling qualitative data. *American Sociological Review*, 9, 139-150. <http://dx.doi.org/10.2307/2086306>
- Gyllstad, H., Vilkaitė, L., & Schmitt, N. (2015). Assessing vocabulary size through multiple-choice formats: Issues with guessing and sampling rates. *ITL International Journal of Applied Linguistics*, 166(2), 278-306.
- Haastруп, K., & Henriksen, B. (2000). Vocabulary acquisition: Acquiring depth of knowledge through network building. *International Journal of Applied Linguistics*, 10(2), 221-240.

- Hambleton, R. K., Swaminathan, H., Algina, J., & Coulson, D. B. (1978). Criterion-referenced testing and measurement: A review of technical issues and developments. *Review of Educational Research*, 48(1), 1-47. <https://doi.org/10.2307/1169908>
- Harrington, D. (2009). *Confirmatory factor analysis*. Oxford University Press.
- Harrington, M., & Carey, M. (2009). The on-line yes/no test as a placement tool. *System*, 37(4), 614-626.
- Hatch, E., & Brown, C. (1995). *Vocabulary, semantics, and language education*. Cambridge University Press.
- 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>
- Henderson, L. (1982). *Orthography and word recognition in reading*. Academic Press.
- Henriksen, B. (1999). Three dimensions of vocabulary development. *Studies in Second Language Acquisition*, 21(2), 303-317. <https://doi.org/10.1017/S0272263199002089>
- Henriksen, B. (2013). Researching L2 learners' collocational competence and development - a progress report. *EROSLA*, 27(2), 29-56.
- Henriksen, B., & Haastrup, K. (2000). Describing foreign language learners' productive vocabulary use and development. In I. Plag & K. P. Schneider (Eds.), *Language use, language acquisition and language history: (Mostly) Empirical studies in honour of Rüdiger Zimmermann* (pp. 150-157). WVT Wissenschaftlicher Verlag Trier.
- 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.
- Hilton, H. (2008). The link between vocabulary knowledge and spoken L2 fluency. *Language Learning Journal*, 36(2), 153-166.

- Hirsh, D., & Nation, P. (1992). What vocabulary size is needed to read unsimplified texts for pleasure? *Reading in a Foreign Language*, 8(2), 689-696.
- Hopkins, C. D., & Antes, R. L. (1990). *Classroom measurement and evaluation* (3rd ed.). F. E. Peacock Publishers. <https://doi.org/10.3102/0013189X011008020>
- Hsu, J. Y. T., & Chiu, C. Y. (2008). Lexical collocations and their relation to speaking proficiency of college EFL learners in Taiwan. *The Asian EFL Journal*, 10(1), 181-204.
- 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>
- Hu, M., & Nation, P. (2000). Unknown vocabulary density and reading comprehension. *Reading in a Foreign Language*, 13(1), 403-430.
- Hulstijn, J. H. (2001). Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 258-286). Cambridge: University Press.
- 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>
- Jamtawe, T. (2000). Reading a foreign language: Similarities and differences between English and German. *Thammasart Review*, 5(1), 134-146.
- Jeensuk, S., & Sukying, A. (2021a). An investigation of high school EFL learners' knowledge of English collocations. *Journal of Applied Linguistics and Language Research*, 8(1), 90-106.

- Jeensuk, S., & Sukying, A. (2021b). Receptive and productive knowledge of English collocations among Thai EFL high school learners. *Journal of Humanities and Social Sciences (JHUSOC)*, 19(1), 159-180.
- Jiang, N. (2000). Lexical representation and development in a second language. *Applied Linguistics*, 21(1), 47-77.
- Jiang, N. (2002). Form-meaning mapping in vocabulary acquisition in a second language. *Studies in Second Language Acquisition*, 24(4), 617-637.
- Jiang, N. (2004a). Semantic transfer and its implications for vocabulary teaching in a second language. *The Modern Language Journal*, 88(3), 416-432.
- Jiang, N. (2004b). Semantic transfer and development in adult L2 vocabulary acquisition. In P. Bogaards & B. Laufer (Eds.), *Vocabulary in a second language: Selection, acquisition and testing* (pp. 101-126). John Benjamins.
- Joe, A. (1998). What effects do text-based tasks promoting generation have on incidental vocabulary acquisition? *Applied Linguistics*, 19(3), 357-377.
- Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: A guide to the program and applications*. IL: SPSS.
- Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International.
- Keith, T. Z. (2006). *Multiple regression and beyond*. Pearson Education Inc.
- Kieffer, M. J., & Lesaux, N. K. (2012). Knowledge of words, knowledge about words: Dimensions of vocabulary in first and second language learners in sixth grade. *Reading and Writing*, 25, 347-373.
- Kim, K. H., & Bentler, P. M. (2006). Data modeling: Structural equation modeling. In J. L. Green, G. Camilli, & P. B. Elmore (Eds.), *Handbook of complementary methods in education research* (pp. 161-175). Lawrence Erlbaum Associates Publishers.
- Kirby, J., Bowers, P., & Deacon, S. (2009). *Effects of instruction in morphology on reading*. Paper presented at the biannual meeting of the European Association for Research in Learning and Instruction, Amsterdam, the Netherlands.

- Kittigosin, R., & Phoocharoensil, S. (2015). Investigation into learning strategies and delexical verb use by Thai EFL learners. *3L: The Southeast Asian Journal of English Language Studies*, 21(2), 63-72.
- Kline, R. B. (2016). Principles and practice of structural equation modeling (4th ed.). The Guilford Press.
- Kotchana, S., & Tongpoon-Patanasorn, A. (2015). EFL learners' vocabulary size: A case in the northeastern region of Thailand. *ASEAN Journal of Education*, 1(1), 9-26.
- Krashen, S. D. (1989). We acquire vocabulary and spelling by reading: Additional evidence for the input hypothesis. *The Modern Language Journal*, 73, 440-464.
- Kremmel, B., & Schmitt, N. (2016). Interpreting vocabulary test scores: What do various item formats tell us about learners' ability to employ words? *Language Assessment Quarterly*, 13(4), 377-392.
- Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33(2), 149-174.
- Larson-Hall, J. (2016). *A guide to doing statistics in second language research using SPSS* (2nd ed.). London: Routledge.
- Laufer, B. (1990). Ease and difficulty in vocabulary learning: Some teaching implications. *Foreign Language Annals*, 23(2), 147-156.
- Laufer, B. (1991). The development of L2 lexis in the expression of the advanced learner. *The Modern Language Journal*, 75(4), 440-448.
- Laufer, B. (1992). Reading in a foreign language: How does L2 lexical knowledge interact with the reader's general academic ability. *Journal of Research in Reading*, 15(2), 95-103.
- Laufer, B. (1994). The lexical profile of second language writing: Does it change over time? *RELC Journal*, 25(2), 21-32.

- Laufer, B. (1997). What's in a word that makes it hard or easy? Intralexical factors affecting the difficulty of vocabulary acquisition. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 140-155). Cambridge University Press.
- Laufer, B. (1998). The development of passive and active vocabulary: Same or different? *Applied Linguistics*, 19(2), 255-271.
- Laufer, B. (2000). *Task effect on instructed vocabulary learning: The hypothesis of 'involvement'*. Paper presented at the selected papers from AILA '99 Tokyo, Tokyo.
- Laufer, B. (2005a). Focus on form in second language vocabulary learning. *EUROSLA Yearbook*, 5(1), 223-250.
- Laufer, B. (2005b). Lexical frequency profiles: From a Monte Carlo analysis to the real world, a response to Meara 2005. *Applied Linguistics*, 26(4), 582-588.
- 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. (2013). Second language word difficulty. In C. A. Chapelle (Ed.), *The encyclopedia of applied linguistics* (pp. 5151-5156). Wiley-Blackwell.
- 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>
- Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics*, 22(1), 1-26.
- Laufer, B., & Nation, I. S. P. (1995). Vocabulary size and use: Lexical richness in L2 written production. *Applied Linguistics*, 16(3), 307-322.
- Laufer, B., & Nation, I. S. P. (1999). A vocabulary-size test of controlled productive ability. *Language Testing*, 16(1), 33-51.

- Laufer, B., & Paribakht, T. S. (1998). The relationship between passive and active vocabularies: Effects of language learning context. *Language Learning*, 48(3), 365-391.
- Lee, S. L., & Munice, J. (2006). From receptive to productive: Improving ESL learners' use of vocabulary in a post-reading composition task. *TESOL Quarterly*, 40(2), 295-320.
- Li, M., & Kirby, J. R. (2015). The effects of vocabulary breadth and depth on English reading. *Applied Linguistics*, 36, 611-34. <https://doi.org/10.1093/applin/amu007>
- Liangpanit, C. (2014). Vocabulary teaching and learning in Thai EFL contexts: findings and implication. *Songklanakarin Journal of Social Sciences and Humanities*, 15(3), 119-131.
- Lin, C. C. (2012). The nature of word learnability in L2 contexts. In D. Hirsh (Ed.), *Current perspectives in second language vocabulary research* (pp. 57-77). Peter Lang.
- Lin, C. C. (2015a). L2 word learnability: A focus on written form of words. [Doctoral dissertation, University of Sydney].
- Lin, C. C. (2015b). L2 word processing: A review from a word form perspective. *University of Sydney Papers in TESOL*, 10, 129-154.
- Liu, D. (2010). Going beyond patterns: Involving cognitive analysis in the learning of collocations. *TESOL Quarterly*, 44(1), 4-30.
- Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing Research*, 35(6), 382-386.
- MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, 51, 201-226. <https://doi.org/10.1146/annurev.psych.51.1.201>
- Mackey, A., & Gass, S. M. (2005). *Second language research: Methodology and design*. Lawrence Erlbaum.

- Magnussen, E. & Sukying, A. (2021). The impact of songs and TPR on Thai preschoolers' vocabulary acquisition. *THAITESOL Journal*, 34(1), 71-95. Retrieved from <https://so05.tci-thaijo.org/index.php/thaitesoljournal/article/view/252356>
- Mallikamas, P., & Pongpairoj, N. (2005). Thai learners' knowledge of English collocations. *HKBU Papers in Applied Language Studies*, 5, 1-28.
- Marcoulides, G. A., & Schumacker, R. E. (1996). *Advanced structural equation modeling: Issues and techniques*. Lawrence Erlbaum Associates Publishers.
- Masrai, A., Milton, J., El-Dakhs, D. A. S., & Elmenshawy, H. (2021). Measuring the contribution of specialist vocabulary knowledge to academic achievement: Disentangling effects of multiple types of word knowledge. *Asian-Pacific Journal of Second and Foreign Language Education*, 6(8), 1-15.
- McArdle, J. J., & Bell, R. Q. (2000). An introduction to latent growth models for developmental data analysis. In T. D. Little, K. U. Schnabel, & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: Practical issues, applied approaches, and specific examples* (pp. 69-107, 269-281). Lawrence Erlbaum Associates Publishers.
- McLaughlin, B. (1990). Restructuring. *Applied Linguistics*, 11(2), 113-128.
- Meara, P. (1983). *Word associations in a foreign language: A report on the Birkbeck vocabulary project*. Notts Ling.
- Meara, P. (1990) A note on passive vocabulary. *Second Language Research*, 6(2), 150-154.
- Meara, P. (1996). The dimensions of lexical competence. In G. Brown, K. Malmkjaer, & J. Williams (Eds.), *Performance and competence in second language acquisition* (pp. 35-33). Cambridge: Cambridge university press.
- Meara, P. (1996a). The vocabulary knowledge framework. Retrieved July 26, 2021, from <http://www.lognostics.co.uk/vlibrary/meara1996c.pdf>

- Meara, P. (1996b). The dimensions of lexical competence. In G. Brown, K. Malmkjaer, & J. Williams (Eds.), *Performance and competence in second language acquisition* (pp. 35-53). Cambridge University Press.
- Meara, P. (1997). Towards a new approach to modelling vocabulary acquisition. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 109–121). Cambridge University Press.
- Meara, P. (2007). Growing a vocabulary. *EUROSLA Yearbook*, 7(1), 49-65.
- Meara, P. (2009). *Connected words: Word associations and second language vocabulary acquisition*. John Benjamins.
- Meara, P., & Buxton, B. (1987). An alternative to multiple choice vocabulary tests. *Language Testing*, 4(2), 142-154.
- Meara, P., & Fitzpatrick, T. (2000). Lex 30: An improved method of assessing productive vocabulary in an L2. *System*, 28(1), 19-30.
- Meara, P., & Jones, G. (1988). Vocabulary size as a placement indicator. In P. Grunwell (Ed.), *Applied linguistics in society* (pp. 80-87). Centre for Information and Language Teaching and Research.
- Meara, P., & Wolter, B. (2004). V-Links: Beyond vocabulary depth. In D. Albrechtsen, K. Haastrup, & B. Henriksen (Eds.), *Angles on the English-speaking world* (pp. 85-96). Museum Tusulanum/University of Copenhagen Press.
- Melka, F. (1997). Receptive vs. productive aspects of vocabulary. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 84-102). Cambridge University Press.
- Miller, G. A. (1999). On knowing a word. *Annual Review of Psychology*, 50(1), 1-19.
- Miller, G. A., & Fellbaum, C. (1991). Semantic networks in English. *Cognition*, 41, 197-229.
- Milton J. (2009). *Measuring second language vocabulary acquisition*. Cambridge: Multilingual Matters.

- 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>
- Mochida, A., & Harrington, M. (2006). The yes/no test as a measure of receptive vocabulary knowledge. *Language Testing*, 23(1), 73-98.
- Mochizuki, M., & Aizawa, K. (2000). An affix acquisition order for EFL learners: An exploratory study. *System*, 28(2), 291-304.
- Moghadam, S. H., Zainal, Z., & Ghaderpour, M. (2012). A review on the important role of vocabulary knowledge in reading comprehension performance. The 8th International Language for Specific Purposes (LSP) Seminar - Aligning Theoretical Knowledge with Professional Practice. Elsevier Ltd. <https://doi/10.1016/j.sbspro.2012.11.300>
- Mondria, J.-A., & Wiersma, B. (2004). Receptive, productive, and receptive + productive L2 vocabulary learning: What difference does it make? In P. Boggards & B. Laufer (Eds.), *Vocabulary in a second language: Selection, acquisition and testing* (pp. 79-100). John Benjamins.
- Morgan, C. L., & Bonham, D. N. (1944). Difficulty of vocabulary learning as affected by parts of speech. *Journal of Educational Psychology*, 35, 369-377.
- Mungkonwong, P. (2017). An investigation of vocabulary size of Thai freshmen and its relationship to years of English study. *LEARN Journal Language Institute Thammasat University*, 10(2), 1-9.
- Nation, I. S. P. (1983). Testing and teaching vocabulary. *Guidelines*, 5(1), 12-25.
- Nation, I. S. P. (1990). *Teaching and learning vocabulary*. New York: Newbury House.

- Nation, I. S. P. (1998). "Helping learners take control of their vocabulary learning". *GRETA*, 6(1), 9-18.
- Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge University Press.
- Nation, I. S. P. (2006). How large a vocabulary is needed for reading and listening? *The Canadian Modern Language Review*, 63(1), 59-82.
- Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd ed.). Cambridge: Cambridge University Press.
<https://doi.org/10.1017/CBO9781139524759>
- Nation, I. S. P., & Beglar, D. (2007). A vocabulary size test. *The Language Teacher*, 31(7), 9-13. (Publications on Paul Nation's web site for current information on publications)
- Nation, I. S. P., & Waring, R. (1997). Vocabulary size, text coverage and word lists. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 6-19). Cambridge University Press.
- Nizonkiza, D. (2016). First-year university students' receptive and productive use of academic vocabulary. *Stellenbosch Papers in Linguistics*, 45, 169-187.
- Nizonkiza, D., & Van den Berg, K. (2014). Dimensional approach to vocabulary testing: What can we learn from past and present practices? *Stellenbosch Papers in Linguistics Plus*, 43, 1-14.
- 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>
- Noom-ura, S. (2013). *English teaching problems and teachers' needs for professional development*. Paper presented at The 33rd Annual Thailand TESOL International Conference. (25-26 January, 2013).

- Obilisteanu, G. (2009). Improving receptive and productive skills. *Behavioural-Social Sciences and Foreign Languages*, 2(54), 65-70.
- Palmberg, R. (1987). Patterns of vocabulary development in foreign-language learners. *Studies in Second Language Acquisition*, 9(2), 201-220.
- Paribakht, T. S., & Wesche, M. (1996). Enhancing vocabulary acquisition through reading: A hierarchy of text-related exercise types. *The Canadian Modern Language Review*, 52(2), 155-178.
- Peat, J., & Barton, B. (2005). *Medical statistics: A guide to data analysis and critical appraisal*. Oxford: Blackwell Publisher.
- 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/10.125/66652>
- 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. Retrieved from <https://www.peterlang.com/document/1103002>
- Phoocharoensil, S. (2013). Cross-linguistic influence: Its impact on L2 English collocation production. *English Language Teaching*, 6(1), 1-10.
- Phoocharoensil, S. (2014). Exploring learners' developing L2 collocational competence. *Theory and Practice in Language Studies*, 4(12), 2533-2540.
- Porte, G., & McManus, K. (2019). *Doing replication research in applied linguistics*. Routledge.
- Pulido, D. (2003). Modeling the role of second language proficiency and topic familiarity in second language incidental vocabulary acquisition through reading. *Language Learning*, 53, 233-284.
- Purpura, J. E. (1999). *Learner strategy use and performance on language tests: A structural equation modeling approach*. Cambridge University Press.

- Qian, D. D. (1999). Assessing the roles of depth and breadth of vocabulary knowledge in reading comprehension. *The Canadian Modern Language Review*, 56(2), 282-308.
- Qian, D. D. (2002). Investigating the relationship between vocabulary knowledge and academic reading performance: An assessment perspective. *Language Learning*, 52(3), 513-536.
- Read, J. (1988). Measuring the vocabulary knowledge of second language learners. *RELC Journal*, 19(2), 12-25.
- Read, J. (1990). The Word associates tests: A measure of quality of vocabulary knowledge. Unpublished working paper.
- Read, J. (1993). The development of a new measure of L2 vocabulary knowledge. *Language Testing*, 10(3), 355-371.
- Read, J. (1995). Refining the word association format as a measure of depth of vocabulary knowledge. *New Zealand Studies in Applied Linguistics*, 1, 1-17.
- Read, J. (1998). Validating a test to measure depth of vocabulary knowledge. In A. Kunnan (Ed.), *Validation in language assessment* (pp. 41-60). Lawrence Erlbaum.
- Read, J. (2000). *Assessing vocabulary*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511732942>
- Read, J. (2004a). Researching in teaching vocabulary. *Annual Review of Applied Linguistics*, 24, 146-161.
- Read, J. (2004b). Plumbing the depths: How should the construct of vocabulary knowledge be defined? In P. Bogaards & B. Laufer (Eds.), *Vocabulary in a second language: Selection, acquisition and testing* (pp. 209-227). John Benjamins.
- Read, J., & Chapelle, C. A. (2001). A framework for second language vocabulary assessment. *Language Testing*, 18(1), 1-32.
- Richards, J. C. (1976). The role of vocabulary testing. *TESOL Quarterly*, 10(1), 77-89.

- 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.
- Rossiter, M. J., Abbott, M. L., & Kushnir, A. (2016). L2 vocabulary research and instructional practices: Where are the gaps? *Teaching English as a Second or Foreign Language*, 20(1), 1-16.
- Sawaki, Y., Quinlan, T., & Lee, Y. W. (2013). Understanding learner strengths and weaknesses: Assessing performance on an integrated writing task. *Language Assessment Quarterly*, 10(1), 73-95.
- Schmitt, N. (1994). Vocabulary testing: Questions for test development with six examples of tests of vocabulary size and depth. *Thai TESOL Bulletin*, 6(2), 9-16.
- 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. (1998). Tracking the incremental acquisition of second language vocabulary: A longitudinal study. *Language Learning*, 48(2), 281-317.
- Schmitt, N. (2000). *Vocabulary in language teaching*. Cambridge University Press.
- 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. (2019). Understanding vocabulary acquisition, instruction, and assessment: A research agenda. *Language Teaching*, 52(1), 261-274.

- Schmitt, N., & McCarthy, M. (1997). *Vocabulary: Description, acquisition and pedagogy*. Cambridge: Cambridge University Press.
- 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>
- Schmitt, N., Nation, P., & Kremmel, B. (2020). Moving the field of vocabulary assessment forward: The need for more rigorous test development and validation. *Language Teaching*, 53, 109-120.
- Schmitt, N., Schmitt, D., & Clapham, C. (2001). Developing and exploring the behaviour of two new versions of the Vocabulary Levels Test. *Language Testing*, 18(1), 55-88.
- Schneider, V. L., Healy, A. F., & Bourne, L. E. Jr. (2002). What is learned under difficult conditions is hard to forget: Contextual interference effects in foreign vocabulary acquisition, retention, and transfer. *Journal of Memory and Language*, 46(2), 419-440.
- Simpson, M. L. (1987). Alternative formats for evaluating content area vocabulary understanding. *Journal of Reading*, 31(1), 20-27.
- Skory, A., & Eskenazi, M. (2010). *Automatic selection of collocations for instruction*. Carnegie Mellon University.
- Srisawat, C., & Poonpon, K. (2014). *An Investigation of Vocabulary Size of Thai University Student*. Paper presented at the 3rd International Conference "Language, Society, and Culture in Asian Contexts (LSCAC 2014)" on Asian Dynamics: Prospects and Challenge.
- Staeher, L. S. (2008). Vocabulary size and the skills of listening, reading and writing. *Language Learning Journal*, 36(2), 139-152.

- Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). Lawrence Erlbaum Associates Publishers.
- 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). The acquisition of English affix knowledge in L2 learners. *NIDA Journal of Language and Communication*, 23(34), 89-102.
- Sukying, A. (2018b). 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. (2020). Word knowledge through morphological awareness in EFL students. *TESOL International Journal*, 15(1), 74-85. Retrieved from <https://eric.ed.gov/?id=EJ1257212>
- Sukying, A. (2022). A taxonomy of English affix acquisition in EFL students. In D. Hirsh (Ed.), *Research perspectives in language and education* (pp. 49-82). Peter Lang. <https://doi.org/10.3726/b19346>
- Sukying, A., & Matwangsang, R. (2022). Exploring primary school students' morphological awareness in Thailand. *World Journal of English Language*, 12(6), 388-401. <https://doi.org/10.5430/wjel.v12n6p388>
- 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>
- Supa-Siraprapa, S. (2019). The effect of learning environments on Thai speakers' English L2 vocabulary depth. *PASAA*, 57, 101-132.
- Supatranont, P. (2005). *Classroom Concordancing: Increasing Vocabulary Size for Academic Reading*. Paper presented at the 3rd International Conference Language Society and Culture in Asian Contexts.

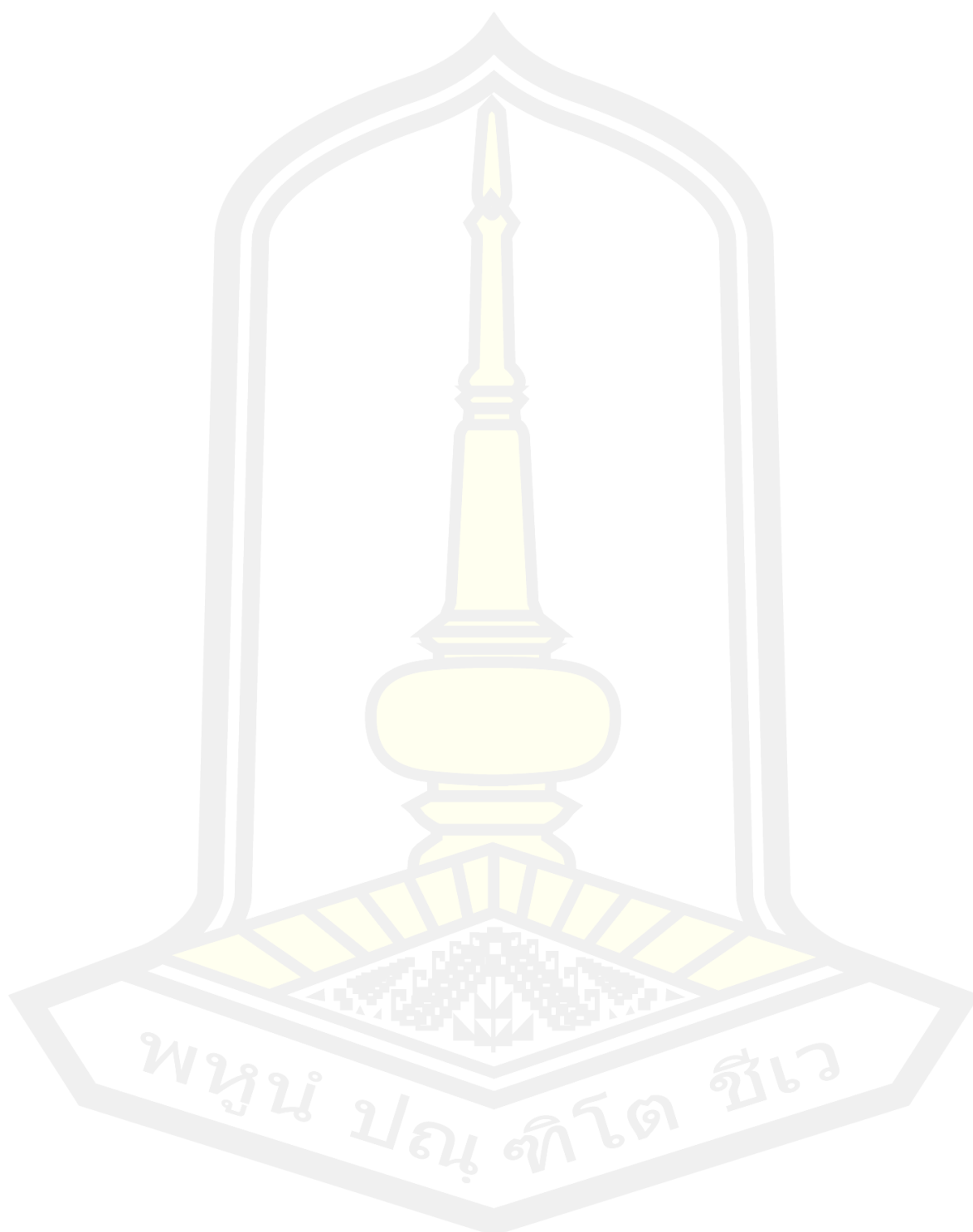
- Suwitchanphan, P., & Phoocharoensil, S. (2014). Adjective + noun collocational competence of L1 Thai learners: A comparative study of a regular program and an English program. *Asian Social Science*, 10(17), 210-221.
- Tang, E., & Nesi, H. (2003). Teaching vocabulary in two Chinese classrooms: Schoolchildren's exposure to English words in Hong Kong and Guangzhou. *Language Teaching Research*, 7(1), 65-97.
- 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
- The Ministry of Education. (2001). *English Curriculum in 2001*. Khurusapha Press. [in Thai].
- The Ministry of Education. (2008). *English Curriculum in 1996*. Khurusapha Press. [in Thai].
- The Ministry of Education. (2014). Policy of English Language Teaching and Learning Reformation. Chamjureeproducts Ltd.
- The Ministry of Education. (2017). Office of the Minister News. Retrieved May 14, 2021, from <http://www.thaigov.go.th/index.php>
- Thompson, B. (1994). Guidelines for authors. *Educational and Psychological Measurement*, 54, 837-847.
- Thompson, B. (2000). Ten commandments of structural equation modeling. In L. G. Grimm & P. R. Yarnold (Eds.), *Reading and understanding more multivariate statistics* (pp. 261-283). American Psychological Association.
- Thornbury, S. (2002). *How to teach vocabulary*. Longman.
- Van Zeeland, H., & Schmitt, N. (2013). Lexical coverage in L1 and L2 listening comprehension: The same or different from reading comprehension? *Applied Linguistics*, 34(4), 457-479.
- Vermeer, A. (2001). Breadth and depth of vocabulary in relation to L1/L2 acquisition and frequency of input. *Applied Psycholinguistics*, 22(2), 217-234.

- Vidal, K. (2003). Academic listening: A source of vocabulary acquisition? *Applied Linguistics*, 24, 56-89.
- Vincy, I. R. (2020). Examining the effect of explicit instruction on vocabulary learning and on receptive-productive gap: An experimental study. *Journal of Language and Linguistic Studies*, 16(4), 2040-2058.
- Walters, J. D. (2012). Aspects of validity of a test of productive vocabulary: Lex30. *Language Assessment Quarterly*, 9(2), 172-185.
- Waring, R. (1997a). A comparison of the receptive and productive vocabulary sizes of some second language learners. *Immaculata (Notre Dame Seishin Univerisy, Okayama)*, 1, 53-68.
- Waring, R. (1997b). A study of receptive and productive vocabulary learning from word cards. *Kiyo, Notre Dame Seishin University: Studies in Foreign Language and Literature*, 21(1), 94-114.
- 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. (2007a). The effects of repetition on vocabulary knowledge. *Applied Linguistics*, 28, 46-65.
- Webb, S. (2007b). Learning word pairs and glossed sentences: The effects of a single context on vocabulary knowledge. *Language Teaching Research*, 11, 63-81.
- Webb, S. (2008a). Receptive and productive vocabulary sizes of L2 learners. *Studies in Second Language Acquisition*, 30(1), 79-95.
- Webb, S. (2008b). The effects of context on incidental vocabulary learning. *Reading in a Foreign Language*, 20(2), 232-245.
- Webb, S. (2009). The effects of receptive and productive learning of word pairs on vocabulary knowledge. *RELC Journal*, 40(3), 360-376.
- Webb, S. (2020). *The routledge handbook of vocabulary studies*. Routledge.

- Webb, S. A. (2013). New directions in vocabulary testing. *RELC Journal*, 44(2), 263-277.
- Webb, S., & Nation, I. S. P. (2017). *How vocabulary is learned*. Oxford University Press.
- Wesche, M., & Paribakht, S. (1999). Incidental L2 vocabulary acquisition: Theory, current research, and instructional implications [Special issue]. *Studies in Second Language Acquisition*, 21(2), 195-224.
- Wesche, M., & Paribakht, T. S. (1996). Assessing second language vocabulary knowledge: Depth versus breadth. *The Canadian Modern Language Review*, 53(1), 13-40.
- West, M. (1953). *A general service list of English words*. Longman.
- Wilkins, D. (1972). *Linguistics in language teaching*. London: Arnold.
- Wilks, C., & Meara, P. (2002). Untangling word webs: Graph theory and the notion of density in second language word association networks. *Second Language Research*, 18(4), 303-324.
- Wolter, B. (2001). Comparing the L1 and L2 mental lexicon: A depth of individual word knowledge model. *Studies in Second Language Acquisition*, 23(1), 41-69.
- 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>
- Yu, G. (2010). Lexical diversity in writing and speaking task performance. *Applied Linguistic*, 31(2), 236-259.
- Yumanee, C., & Phoocharoensil, S. (2013). Analysis of collocational errors of Thai EFL students. *LEARN Journal: Language Education and Acquisition Research Network*, 6(1), 88-98.
- Zareva, A. (2005). Models of lexical knowledge assessment of second language learners of English at higher levels of language proficiency. *System*, 33(4), 547-562.

- Zareva, A., Schwanenflugel, P., & Nikolova, Y. (2005). Relationship between lexical competence and language proficiency: Variable sensitivity. *Studies in Second Language Acquisition*, 27(4), 567-595.
- Zhong, H. (2012a). Multidimensional vocabulary knowledge: Development from receptive to productive use. In D. Hirsh (Ed.), *Current Perspectives in Second Language Vocabulary Research* (pp. 23–55). Peter Lang.
- Zhong, H. (2012b). “I am on my way” - *From unknown to known vocabulary knowledge*. Paper presented at the 2012 joint International Conference of the Australian Association for Research in Education (AARE) and the Asia Pacific Educational Research Association (APERA). Sydney, Australia.
- Zhong, H. F. (2014). The interface between receptive and productive vocabulary knowledge: Vocabulary knowledge as a multi-aspect construct. [Doctoral dissertation, University of Sydney].
- 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>
- Zhong, H., & Hirsh, D. (2009). Vocabulary growth in an English as a foreign language context. *University of Sydney Papers in TESOL*, 4(1), 85-113.
- Zimmerman, C. B. (2009). *Word knowledge: A vocabulary teacher's handbook*. Oxford University Press.

APPENDICES



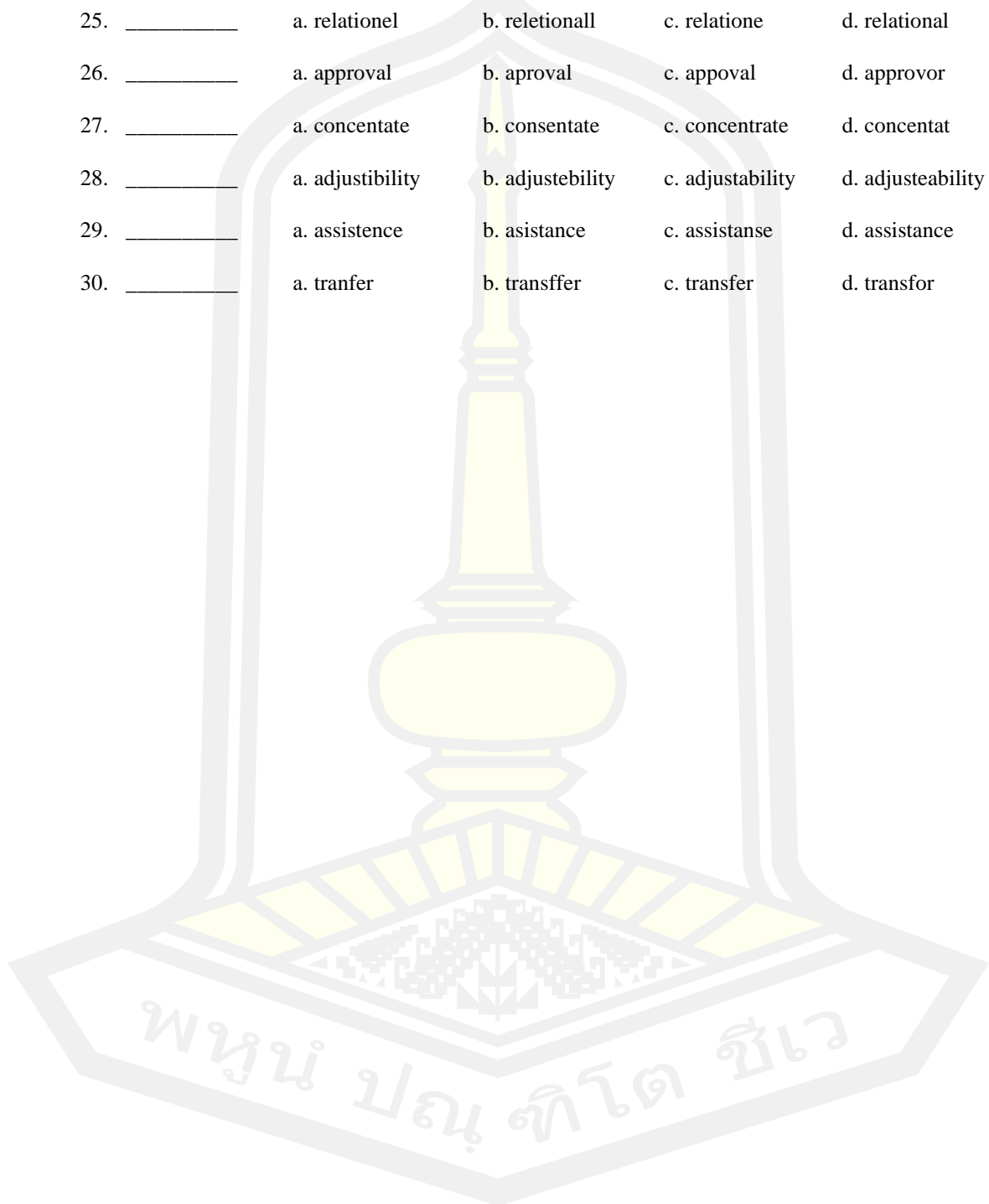
Appendix I-A: The Form Recognition Test (FRT)

Instructions: Please select the word which is spelled correctly.

Examples:

- | | | | | | |
|-----|-----------------|-------------------|------------------|------------------|-------------------|
| 1. | <u> c </u> | a. happyness | b. hapiness | c. happiness | d. happeness |
| 2. | <u> c </u> | a. carefuly | b. cariffuly | c. carefully | d. careffully |
| 1. | <u> </u> | a. adverticement | b. advertisement | c. advertisment | d. advertisament |
| 2. | <u> </u> | a. acuse | b. accusee | c. accuse | d. acusse |
| 3. | <u> </u> | a. dissturb | b. disstrub | c. distrub | d. disturb |
| 4. | <u> </u> | a. admirer | b. admiror | c. admirier | d. admier |
| 5. | <u> </u> | a. dissatisfied | b. disatisfied | c. dissatisfied | d. dissatified |
| 6. | <u> </u> | a. profitable | b. profitible | c. profiteble | d. pofiteble |
| 7. | <u> </u> | a. devide | b. devede | c. divide | d. divid |
| 8. | <u> </u> | a. aimlesness | b. aimlesnes | c. aimlessnes | d. aimlessness |
| 9. | <u> </u> | a. examinition | b. examination | c. examinention | d. examintion |
| 10. | <u> </u> | a. prevant | b. peven | c. prevent | d. pevent |
| 11. | <u> </u> | a. consultant | b. consutent | c. consultant | d. consutant |
| 12. | <u> </u> | a. combination | b. combinention | c. combinition | d. combintion |
| 13. | <u> </u> | a. awareness | b. awariness | c. awariness | d. aweranness |
| 14. | <u> </u> | a. arguement | b. agruement | c. argument | d. agrument |
| 15. | <u> </u> | a. permissiveness | b. permisiveness | c. permitiveness | d. permittiveness |
| 16. | <u> </u> | a. purchaseer | b. purchasor | c. purchasier | d. purchaser |
| 17. | <u> </u> | a. employable | b. employible | c. employeble | d. emploiable |
| 18. | <u> </u> | a. praticipate | b. praticipat | c. participate | d. participat |
| 19. | <u> </u> | a. desiribility | b. desirebility | c. desirability | d. desireability |
| 20. | <u> </u> | a. appropriate | b. apropiate | c. apropiate | d. appropriat |
| 21. | <u> </u> | a. requirement | b. requirement | c. requirment | d. requurment |
| 22. | <u> </u> | a. maesure | b. mesure | c. measure | d. measur |

23. _____ a. occur b. occure c. ocure d. ocur
24. _____ a. increase b. increese c. increse d. increase
25. _____ a. relationel b. reletionall c. relatione d. relational
26. _____ a. approval b. aproval c. appoval d. approvor
27. _____ a. concentate b. consentate c. concentrate d. concentat
28. _____ a. adjustibility b. adjustebility c. adjustability d. adjusteability
29. _____ a. assistence b. asistance c. assistanse d. assistance
30. _____ a. tranfer b. transffer c. transfer d. transfor



Appendix I-B: The Recall Form Test (FPT)

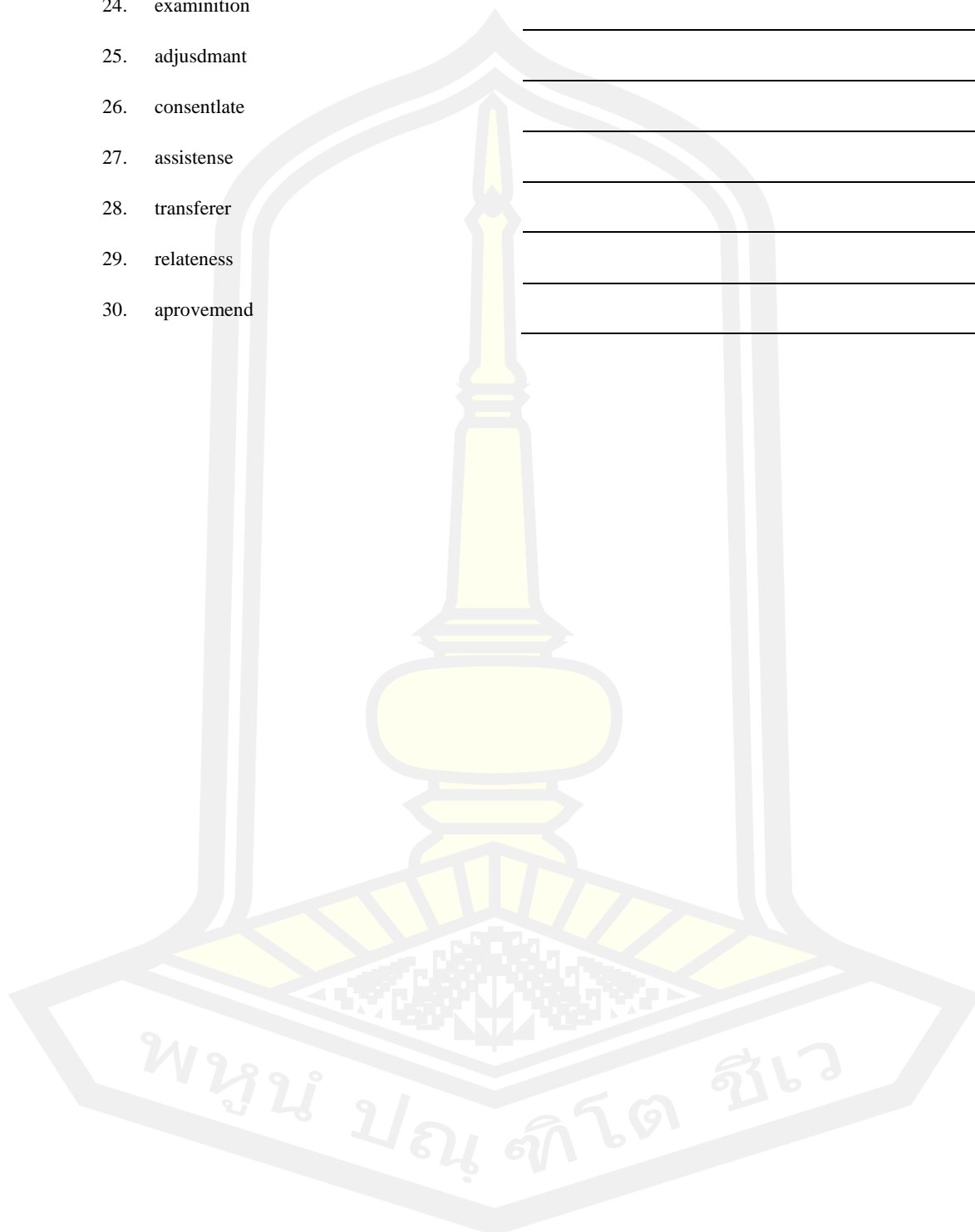
Instructions: Please write the correct form of the given word.

Examples:

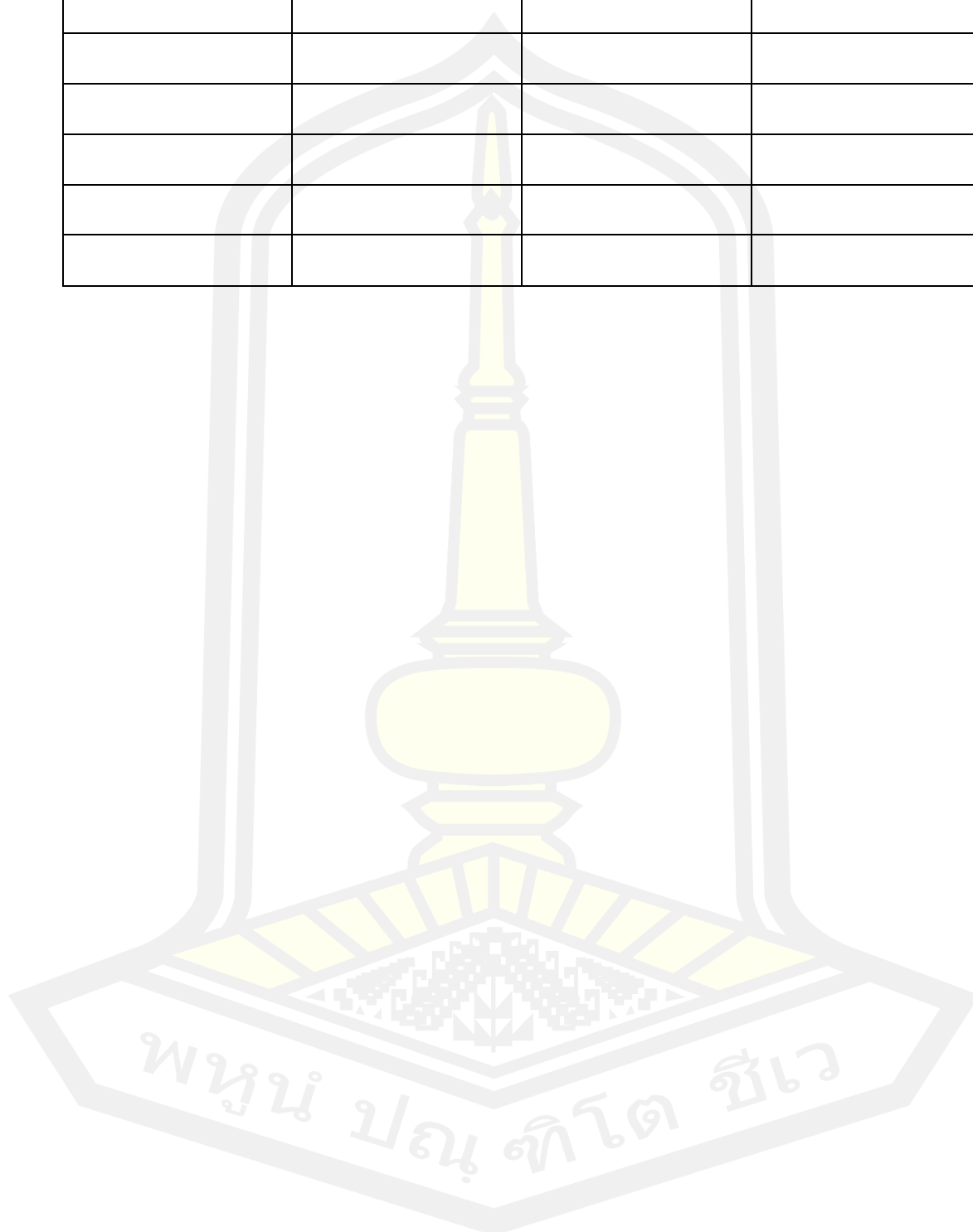
Misspelling form of a word	Correct form of a word
1. strate	start
2. definitoin	definition

Misspelling form of a word	Correct form of a word
1. apropiate	
2. requrement	
3. maesure	
4. occure	
5. increase	
6. advertisment	
7. accusse	
8. disstrubed	
9. permittiveness	
10. purchasier	
11. emploiable	
12. praticipat	
13. desireability	
14. admier	
15. dissatisfied	
16. pofiteble	
17. devede	
18. aimlessness	
19. agruement	
20. awarness	
21. combination	
22. consutent	

23. prevant
24. examination
25. adjusdmant
26. consentlate
27. assistense
28. transferer
29. relateness
30. aprovemend



Noun	Verb	Adjective	Adverb



Appendix I-D: The Recall Word Test (RWT)

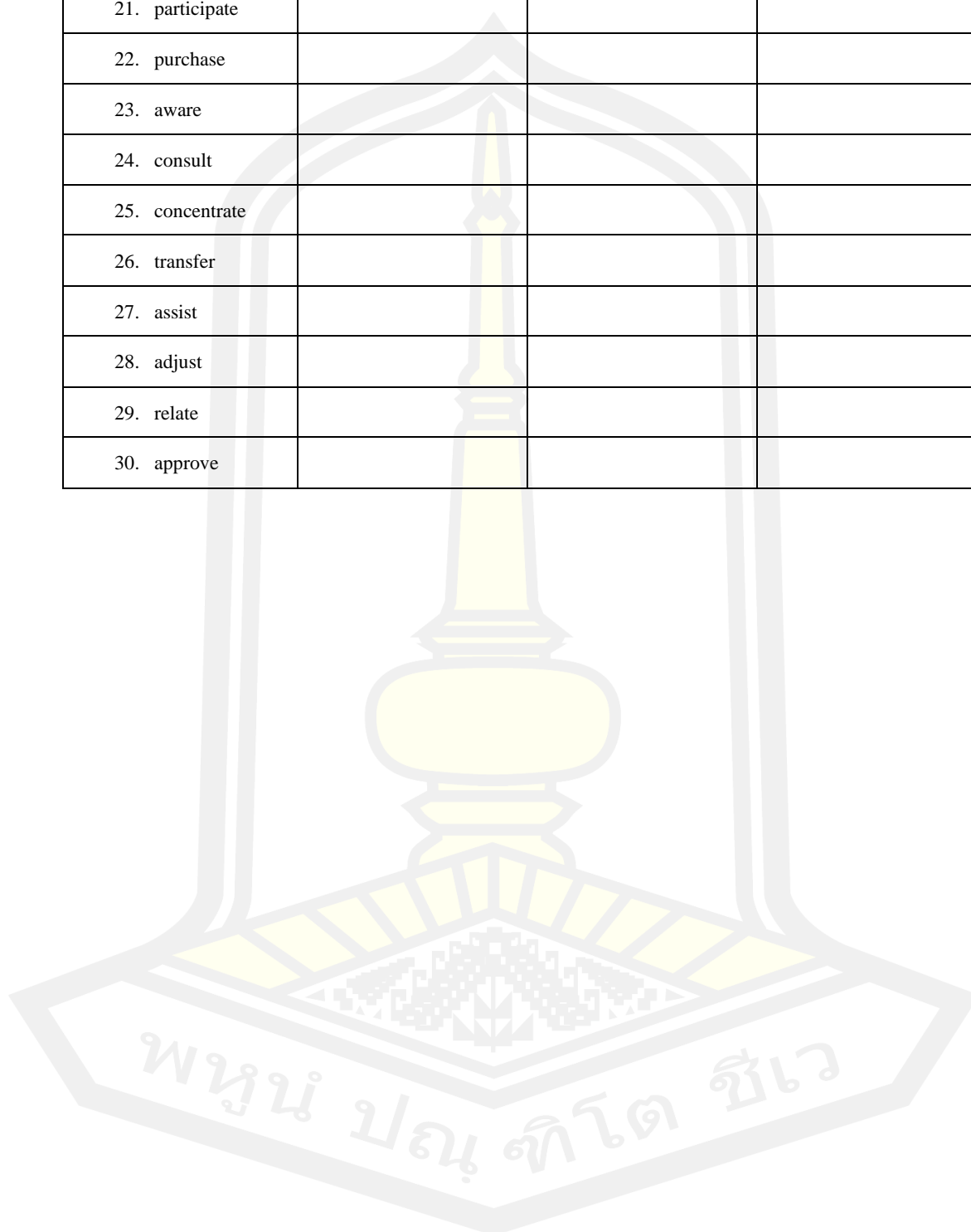
Instructions: Please write the correct derivative form of the given word in each part of speech.

Examples:

Target word	Noun	Verb	Adjective
stimulate	stimulation	stimulating	stimulative
develop	development	develop	developmental

Target words	Noun	Verb	Adjective
1. increase			
2. measure			
3. desire			
4. employ			
5. permit			
6. argue			
7. combine			
8. prevent			
9. examine			
10. aim			
11. divide			
12. profit			
13. advertise			
14. satisfy			
15. admire			
16. disturb			
17. accuse			
18. occur			
19. require			
20. appropriate			

Target words	Noun	Verb	Adjective
21. participate			
22. purchase			
23. aware			
24. consult			
25. concentrate			
26. transfer			
27. assist			
28. adjust			
29. relate			
30. approve			



Appendix I-E: The L2 Translation Test (L2TT)

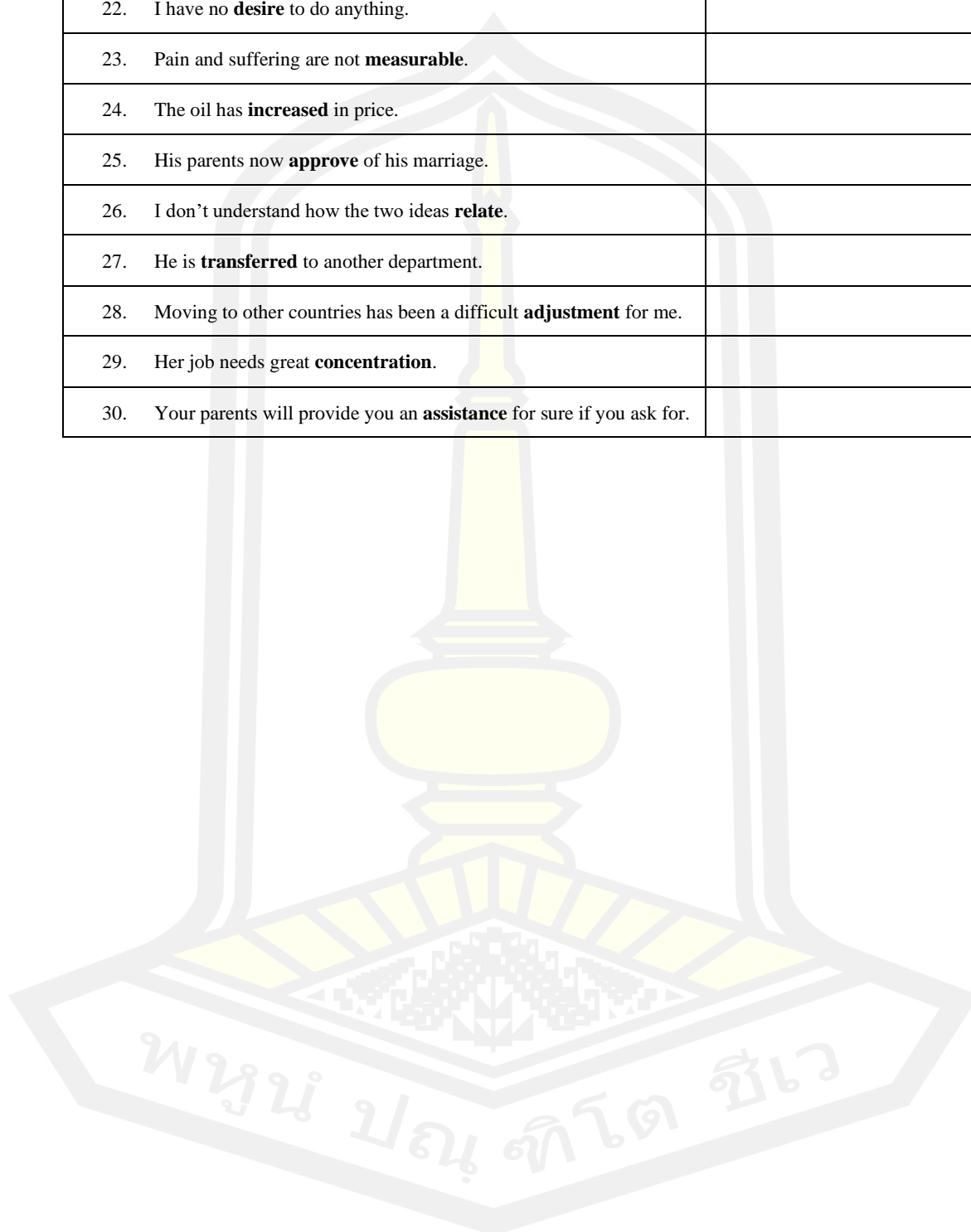
Instructions: Please translate the given word from English to Thai.

Examples:

English	Thai
She smiles happily .	อย่างมีความสุข
I hope she succeeds in winning a game.	ทำให้สำเร็จ

English	Thai
1. I need a financial consultant .	
2. He is unaware that he is being watched.	
3. All goods in this store are purchasable .	
4. Thank you for your participation .	
5. She behaves appropriately .	
6. She requires to see the doctor.	
7. The explosion occurred at 4 am.	
8. How can you accuse me without knowing all the facts?	
9. Sorry to disturb you, but I have an urgent message.	
10. This is an admirable book.	
11. Nothing I did will ever satisfy my father.	
12. Many companies advertise their products on TV.	
13. It is a profitable business.	
14. The group will be divided up into pairs.	
15. Teamwork is required in order to achieve these aims .	
16. She's already taken the entrance examination .	
17. The rules are set to prevent accidents.	
18. I have already combined two things together.	
19. They are arguing about politics.	
20. I have already gotten a permission from my parents.	
21. The company needs to retire some employees by the end of this year.	

English	Thai
22. I have no desire to do anything.	
23. Pain and suffering are not measurable .	
24. The oil has increased in price.	
25. His parents now approve of his marriage.	
26. I don't understand how the two ideas relate .	
27. He is transferred to another department.	
28. Moving to other countries has been a difficult adjustment for me.	
29. Her job needs great concentration .	
30. Your parents will provide you an assistance for sure if you ask for.	



Appendix I-F: The L1 Translation Test (L1TT)

Instructions: Please translate the given word from Thai to English by following the two initial letters.

Examples:

Thai	English
เธอยิ้มอย่างมีความสุข	happily
เธอจัดการกับเวลาได้ดี	manage

Thai	English
1. ฉันถูกถามเกี่ยวกับเหตุการณ์ที่เกิดขึ้นเมื่อวานนี้	oc
2. อาจารย์ต้องการที่จะคุยกับเธอ	re
3. เขาแก้ปัญหาได้อย่างเหมาะสม	ap
4. ฉันต้องการที่จะมีส่วนร่วมกับการงานนี้	pa
5. ฉันซื้อรถคันใหม่	pu
6. เขามีการรับรู้ที่ดี	aw
7. ฉันต้องการที่จะปรึกษาเธอ	co
8. บริษัทได้เพิ่มเงินเดือนให้กับพนักงาน	in
9. ความรู้เป็นสิ่งที่สามารถวัดได้	me
10. แม้มิแต่ความปรารถนาดีให้แก่ลูก	de
11. การจ้างงานลดน้อยลงมากในปี	em
12. ฉันอนุญาตให้คุณทำงานนี้	pe
13. ฉันไม่ต้องการที่จะโต้เถียงใดๆกับคุณ	ar
14. สสารสองประเภทถูกนำมารวมกัน	co
15. ที่นี่มีการป้องกันแน่นหนา	pr
16. เขามีลักษณะของผู้ตรวจสอบที่ดี	ex
17. ฉันขอการท่องเที่ยวแบบไม่มีจุดหมาย	ai

Thai	English
18. สมัยก่อนมีการแบ่งแยกดินแดนกันอย่างชัดเจน	di
19. ปีนี้บริษัททำกำไรได้เยอะกว่าปีที่แล้ว	pr
20. ห้ามโฆษณาสินค้าชิ้นนี้ได้เด็ดขาด	ad
21. เธอทำให้ฉันพอใจมาก	sa
22. เขาได้รับการชื่นชมอย่างล้นหลาม	ad
23. อย่างน่าอัศจรรย์เสีย	di
24. ฉันถูกล่าวาทา	ac
25. ตำแหน่งของฉันได้รับการอนุมัติเมื่อปีที่แล้ว	ap
26. ฉันไม่สามารถจำเครือข่ายติของฉันได้หมดหรอก	re
27. ฉันไม่ชอบการปรับเปลี่ยน	ad
28. การให้ความสนใจเป็นสิ่งที่ดี	co
29. การโยกย้ายตำแหน่งเกิดขึ้นทุกปี	tr
30. เขาเป็นผู้ช่วยคนสำคัญของฉันเอง	as



Appendix I-G: The Association Recognition Test (ART)

Instructions: Please select the word which is the similar meaning (synonym) of the target word.

Examples:

1. beautiful = appealing

appealing	confirming	defining	revising
-----------	------------	----------	----------

2. respect = appreciation

direction	communication	information	appreciation
-----------	---------------	-------------	--------------

1. employ =

see	raise	use	rise
-----	-------	-----	------

2. permit =

except	accept	perform	differ
--------	--------	---------	--------

3. argue

display	disclose	dismiss	disagree
---------	----------	---------	----------

4. combine =

associate	communicate	differentiate	appreciate
-----------	-------------	---------------	------------

5. measure =

ascent	succeed	access	assess
--------	---------	--------	--------

6. desire =

have	do	need	play
------	----	------	------

7. increase =

gain	match	invite	invent
------	-------	--------	--------

8. prevent =

boost	book	block	build
-------	------	-------	-------

9. examine =

exercise	explode	explore	express
----------	---------	---------	---------

10. aim =

produce	propose	purpose	postpone
---------	---------	---------	----------

11. divide =

break	bake	blind	blend
-------	------	-------	-------

12. profit =

presume	assume	allow	earn
---------	--------	-------	------

13. advertise =

announce	explain	pronounce	indicate
----------	---------	-----------	----------

14. satisfy =

fascinate	approximate	eliminate	destroy
-----------	-------------	-----------	---------

15. admire =

permit	admit	adore	submit
--------	-------	-------	--------

16. disturb =

disrupt	dismiss	deserve	divide
---------	---------	---------	--------

17. accuse =

sum	sue	situate	stimulate
-----	-----	---------	-----------

18. consult =

conclude	continue	disclose	confer
----------	----------	----------	--------

19. awareness =

aimlessness	happiness	consciousness	appropriateness
-------------	-----------	---------------	-----------------

20. purchase =

sell	buy	borrow	lent
------	-----	--------	------

21. participate =

cooperate	organize	recognize	interest
-----------	----------	-----------	----------

22. appropriately =

newly	commonly	relatively	properly
-------	----------	------------	----------

23. require =

detect	decrease	desire	determine
--------	----------	--------	-----------

24. occur =

appeal	appear	appreciate	approve
--------	--------	------------	---------

25. relatedness

accordance	synthesis	analysis	abundance
------------	-----------	----------	-----------

26. approve

resist	accept	insult	raise
--------	--------	--------	-------

27. assistive

successful	beneficial	accomplishable	hectic
------------	------------	----------------	--------

28. transfer

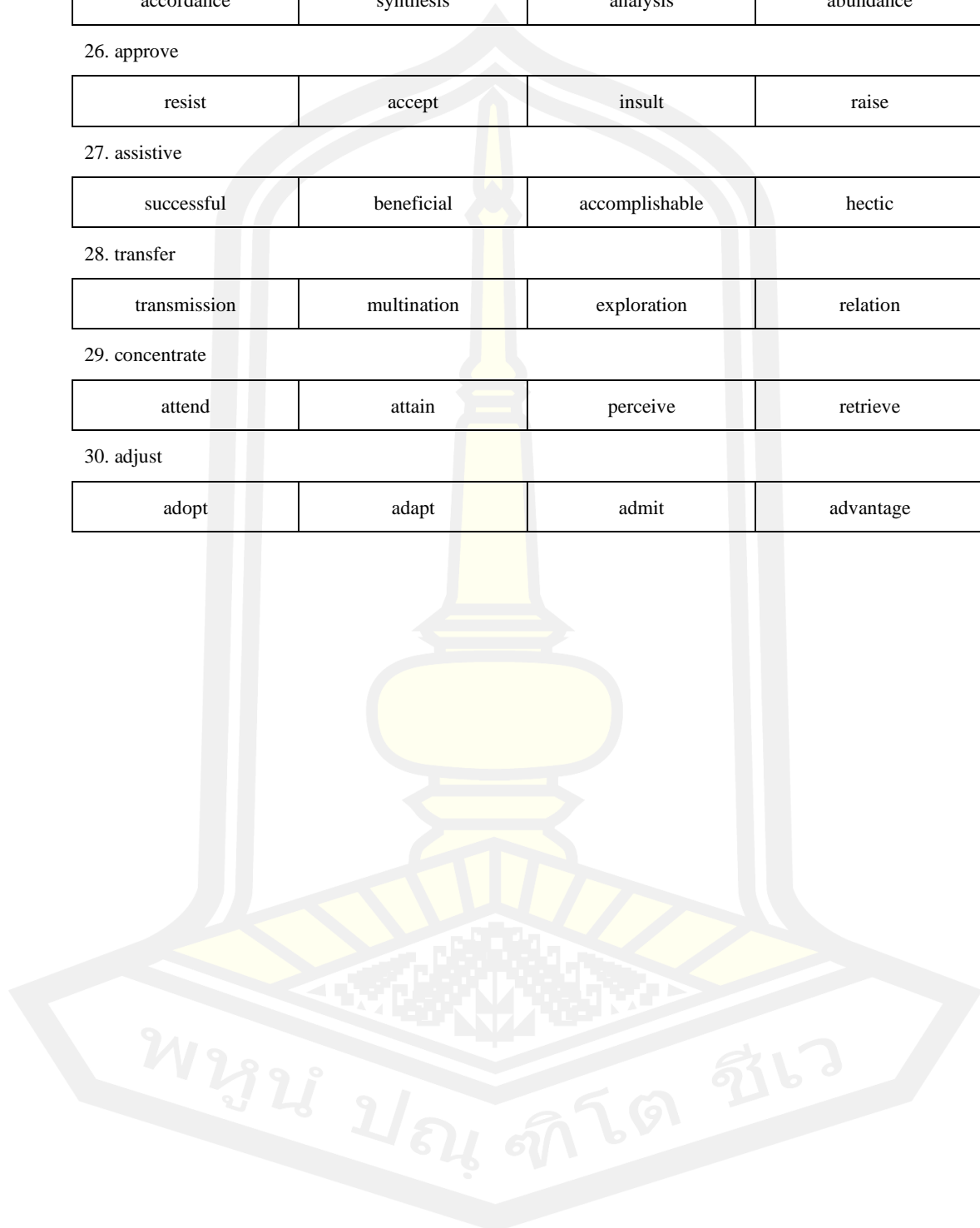
transmission	multination	exploration	relation
--------------	-------------	-------------	----------

29. concentrate

attend	attain	perceive	retrieve
--------	--------	----------	----------

30. adjust

adopt	adapt	admit	advantage
-------	-------	-------	-----------



Appendix I-H: The Association Production Test (APT)

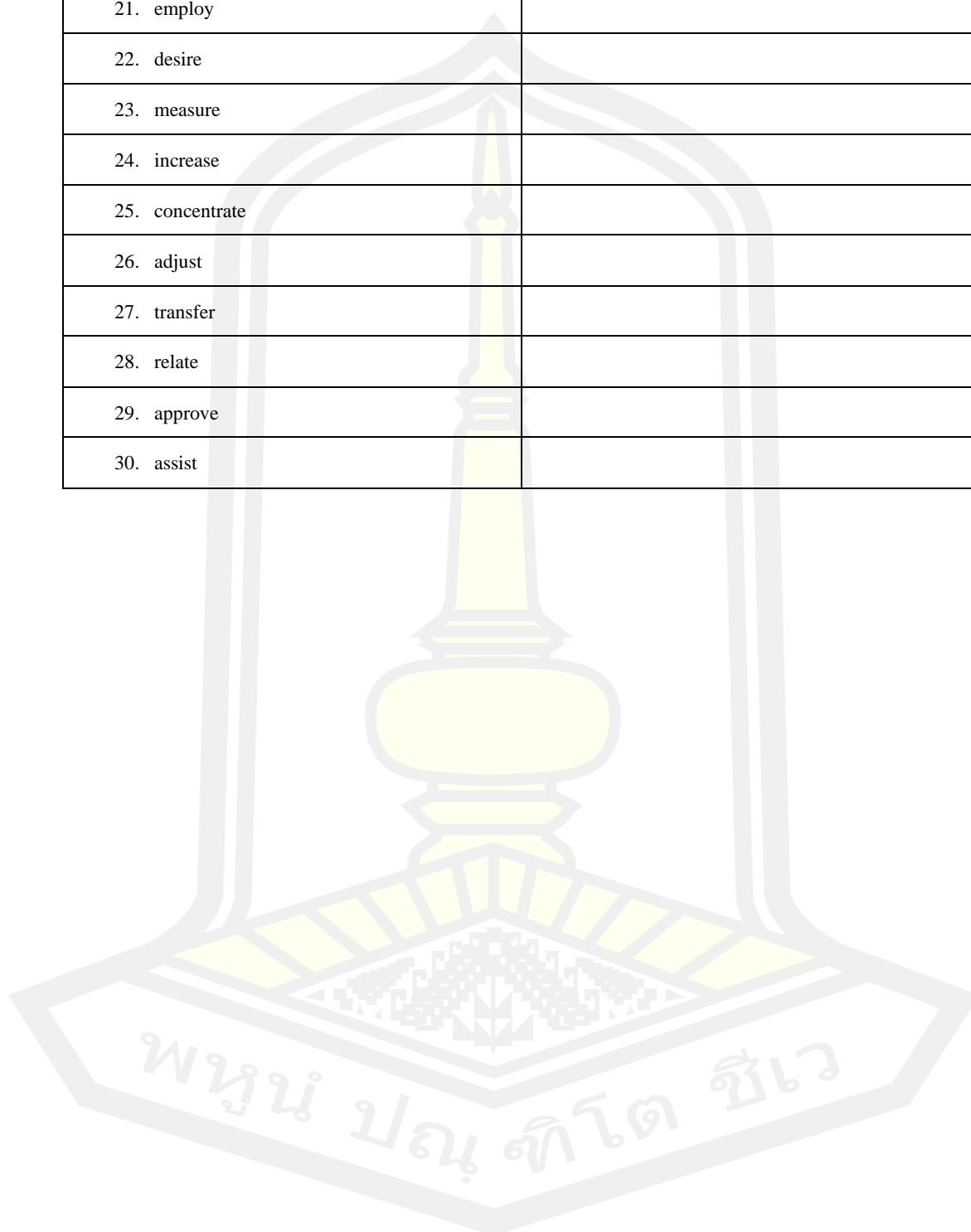
Instructions: Please write the word which is similar meaning (synonym) of the target word.

Examples:

Target words	Synonym
1. society	community
2. comprehension	conversation

Target words	Synonym
1. aware	
2. consult	
3. occur	
4. require	
5. appropriate	
6. participate	
7. purchase	
8. accuse	
9. disturb	
10. admire	
11. satisfy	
12. advertise	
13. profit	
14. divide	
15. aim	
16. examine	
17. prevent	
18. combine	
19. argue	
20. permit	

Target words	Synonym
21. employ	
22. desire	
23. measure	
24. increase	
25. concentrate	
26. adjust	
27. transfer	
28. relate	
29. approve	
30. assist	



Appendix I-I: The Collocation Recognition Test (CRT)

Instructions: Please select the word (adjective) which collocates with the target word (noun) properly.

Examples:

1. strong coffee

long	speedy	strong	slow
------	--------	--------	------

2. serious injury

serious	loveable	helpful	beautiful
---------	----------	---------	-----------

1. _____ increase

annual	tall	far	furious
--------	------	-----	---------

2. _____ measure

well-done	practical	beautiful	relative
-----------	-----------	-----------	----------

3. _____ desire

playful	fast	frequent	strong
---------	------	----------	--------

4. _____ employee

permanent	speedy	little	rough
-----------	--------	--------	-------

5. _____ permit

gradual	work	hard-working	nervous
---------	------	--------------	---------

6. _____ argument

well	generous	angry	lovely
------	----------	-------	--------

7. _____ combination

interested	dirty	quick	perfect
------------	-------	-------	---------

8. _____ prevention

hard-working	flooding	beautiful	sage
--------------	----------	-----------	------

9. _____ examination

final	rapid	poor	tiny
-------	-------	------	------

10. _____ aim

well	main	rapid	handsome
------	------	-------	----------

11. _____ division

sweet	fatty	clear	hungry
-------	-------	-------	--------

12. _____ profit

fatty	sleepless	handy	high
-------	-----------	-------	------

13. _____ advertisement

distinctive	small	good	sticky
-------------	-------	------	--------

14. _____ satisfaction

personal	threatened	terrible	terrified
----------	------------	----------	-----------

15. _____ admiration

sincere	aware	frustrated	false
---------	-------	------------	-------

16. _____ disturbance

angry	serious	conscious	careful
-------	---------	-----------	---------

17. _____ accusation

light	well	unjust	thirsty
-------	------	--------	---------

18. _____ consultant

financial	pure	familiar	similar
-----------	------	----------	---------

19. _____ awareness

neutral	close	cultural	black
---------	-------	----------	-------

20. _____ purchase

proud	grounded	online	bright
-------	----------	--------	--------

21. _____ participant

open	active	founded	blinking
------	--------	---------	----------

22. _____ requirement

blinked	wormy	special	specious
---------	-------	---------	----------

23. _____ occurrence

tall	rare	fine	yummy
------	------	------	-------

24. _____ appropriation

full-time	largo	good	well
-----------	-------	------	------

25. _____ approval

fine	official	active	dark
------	----------	--------	------

26. _____ relation

careful	close	well	well-done
---------	-------	------	-----------

27. _____ transfer

beautiful	successful	well-known	cheerful
-----------	------------	------------	----------

28. _____ concentration

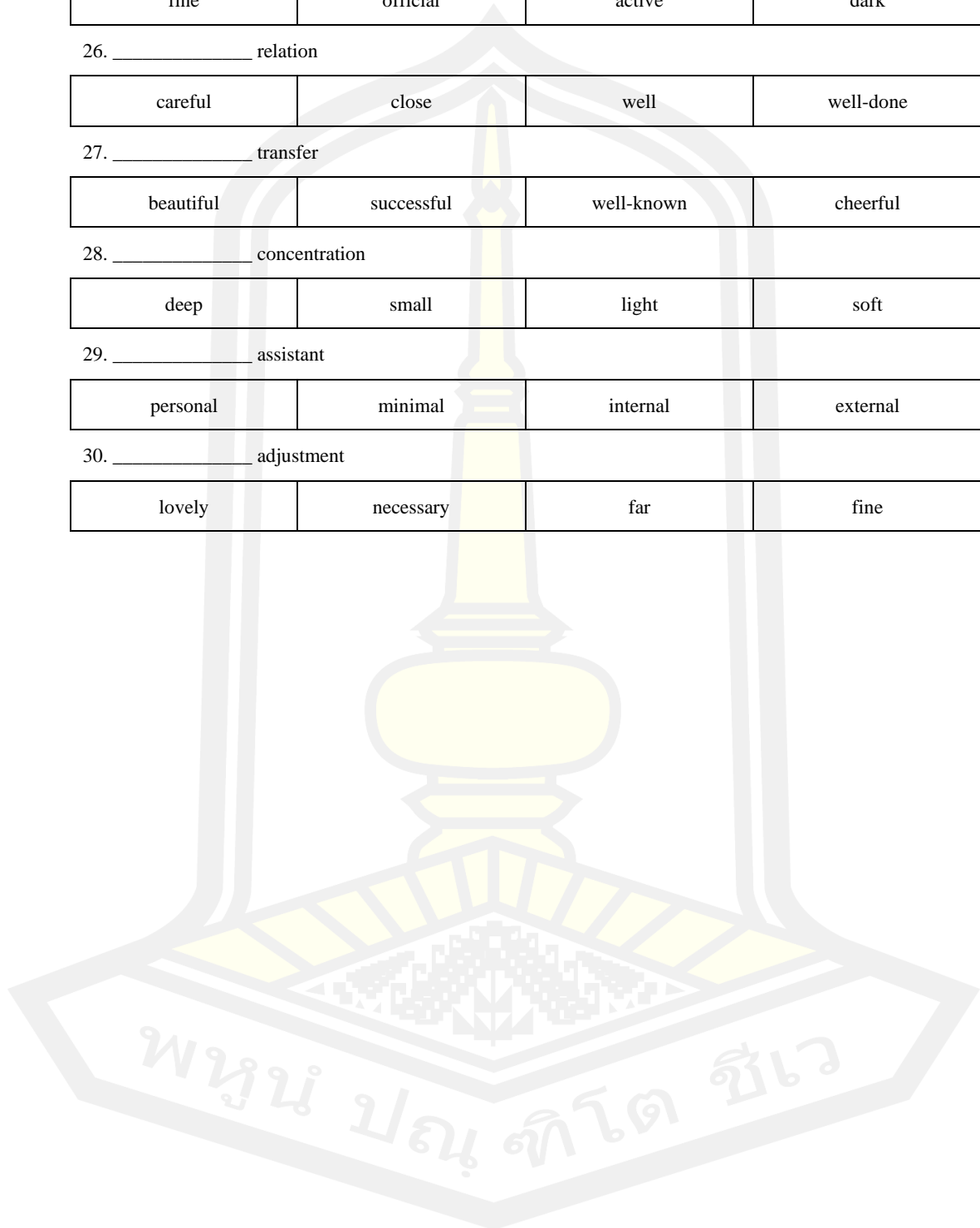
deep	small	light	soft
------	-------	-------	------

29. _____ assistant

personal	minimal	internal	external
----------	---------	----------	----------

30. _____ adjustment

lovely	necessary	far	fine
--------	-----------	-----	------



Appendix I-J: The Collocation Production Test (CPT)

Instructions: Please complete the adjective to suit the following noun in the sentence by following the two initial letters.

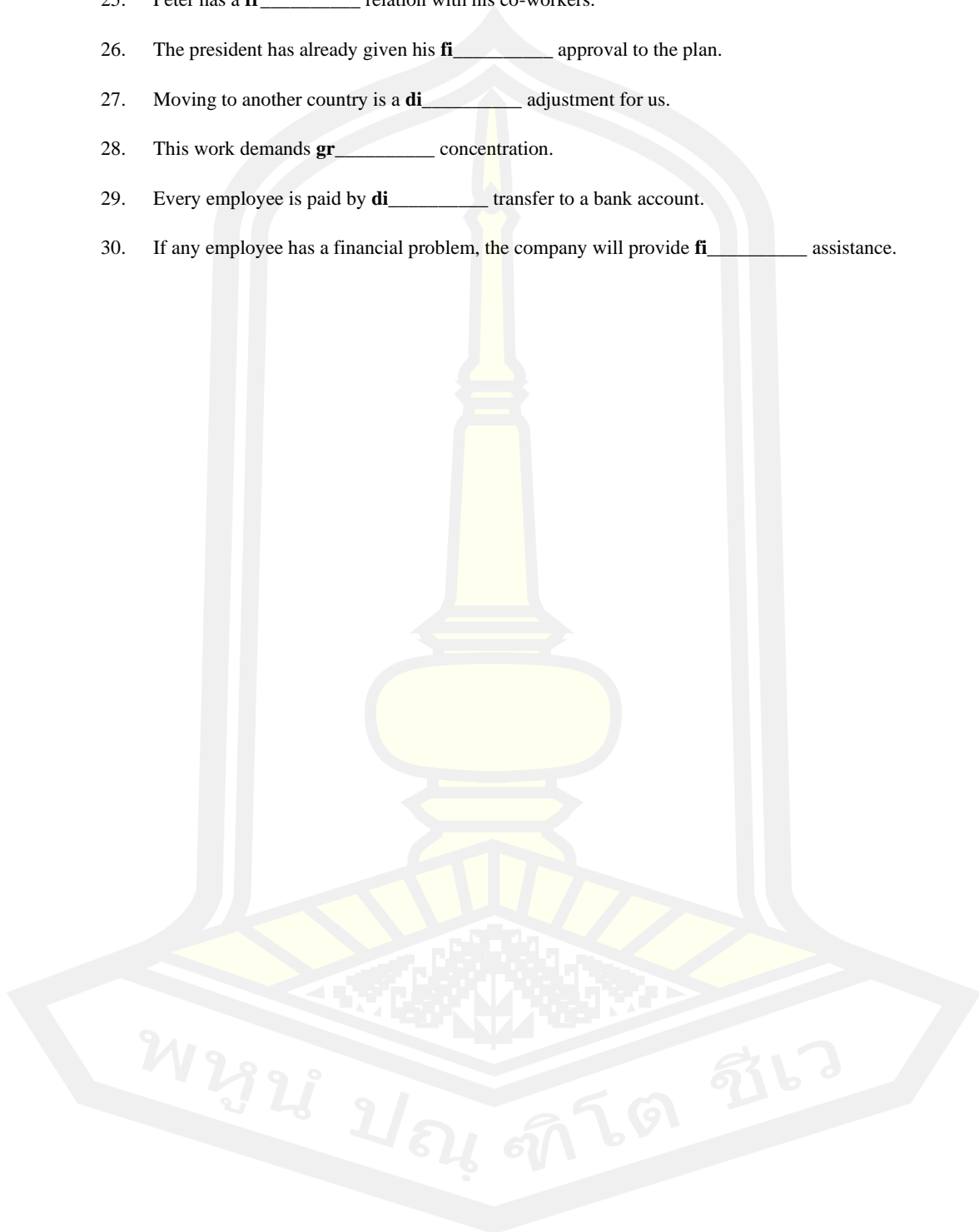
Example:

If you have any **specific** requirements, you can directly inform my manager in the office.

This car was a **formal** register under my name.

1. She has made a lot of **se** _____ accusations but she hasn't got any evidence.
2. Over a hundred people are injured during **vi** _____ disturbances in the city.
3. She is a woman for whom I have the **gr** _____ admiration.
4. The victory give me **re** _____ satisfaction.
5. Are there any **go** _____ advertisements in today newspaper?
6. Car companies make **hu** _____ profits.
7. The **ra** _____ divide between people is deepening.
8. The **ma** _____ aim of the country is to slow inflation.
9. He had failed the college **en** _____ examination twice.
10. A **po** _____ combination of people can fight with great success.
11. There were **ma** _____ argument about whether we should move to a new apartment.
12. I am granted **of** _____ permission to travel to North Korea.
13. The company offers substantial bonuses to all junior and **se** _____ employees.
14. My one **st** _____ desire in life is to own a five-star hotel.
15. Video surveillance cameras are installed as a **se** _____ measure.
16. His temperature chart shows a **gr** _____ increase over the preceding six hours.
17. The park staff said elephants in the camp are a **ra** _____ occurrence.
18. We cannot deny that water is a **ba** _____ requirement of life.
19. In the seminar, the **ac** _____ participants always ask a lot of questions.
20. Most people like to order goods via an **on** _____ purchase.
21. There is a **gr** _____ awareness of the need for vehicles that are safe for elders.
22. He can give you a **cl** _____ consultation to better understand it.
23. He can avoid punishment by **ap** _____ actions.

24. Occupants claim for **fi**_____ prevention after the last serious conflagration.
25. Peter has a **fr**_____ relation with his co-workers.
26. The president has already given his **fi**_____ approval to the plan.
27. Moving to another country is a **di**_____ adjustment for us.
28. This work demands **gr**_____ concentration.
29. Every employee is paid by **di**_____ transfer to a bank account.
30. If any employee has a financial problem, the company will provide **fi**_____ assistance.



Appendix I-K: The Grammatical Recognition Test (GRT)

Instructions: Please select the correct grammatical sentence.

Examples:

1.
 - a. The test is a changed
 - b. *The test is changed*
 - c. The test does not changed

2.
 - a. *She is beautiful*
 - b. She is beautifully
 - c. She beautifuls

1.
 - a. The explosion occurring at 4.00 a.m.
 - b. The explosion occurred at 4.00 a.m.
 - c. The explosion were occurring at 4.00 a.m.

2.
 - a. It is not appropriate to talk about it right now.
 - b. It is not appropriately to talk about it right now.
 - c. It inappropriates to talk about it right now.

3.
 - a. Most houseplants require regular watering.
 - b. Most houseplants requirement regular watering.
 - c. Most houseplants is require regular watering.

4.
 - a. She always participate in classroom activities.
 - b. She always participants in classroom activities.
 - c. She always participates in classroom activities.

5.
 - a. You can purchase goods on credit.
 - b. You can purchases goods on credit.
 - c. You can purchasable goods on credit.

6.
 - a. She awares of the wind in her face.
 - b. She unaware of the wind in her face.
 - c. She is aware of the wind in her face.

7.
 - a. I need to consultant with my lawyer.
 - b. I need to consult with my lawyer.
 - c. I need to consulting with my lawyer.

8.
 - a. The population increases dramatically in the first half of the century.
 - b. The population increasingly dramatically in the first half of the century.
 - c. The population increased dramatically in the first half of the century.

9.
 - a. Education should not be measure purely by examination results.
 - b. Education should not measurable purely by examination results.
 - c. Education should not be measured purely by examination results.
10.
 - a. I have a strong desirable to win this game.
 - b. I have a strong desire to win this game.
 - c. I have a strong desires to win this game.
11.
 - a. The factory employments over 1,000 people.
 - b. The factory unemployed over 1,000 people.
 - c. The factory employs over 1,000 people.
12.
 - a. Dogs are not permitted inside the shop.
 - b. Dogs do not permissible inside the shop.
 - c. Dogs are not permit inside the shop.
13.
 - a. We could hear the neighbors arguing.
 - b. We could hear the neighbors arguably.
 - c. We could hear the neighbors argues.
14.
 - a. Diets are most effective when combination with exercise.
 - b. Diets are most effective when combined with exercise.
 - c. Diets are most effective when is combine with exercise.
15.
 - a. The rules are intended to preventative accidents.
 - b. The rules are intended to preventable accidents.
 - c. The rules are intended to prevent accidents.
16.
 - a. He takes a final examination.
 - b. He takes a final examine.
 - c. He takes a final cross examine.
17.
 - a. She aimless to study medicine.
 - b. She is aimless to study medicine.
 - c. She aim to study medicine.
18.
 - a. She undivided the book into five sections.
 - b. She divide the book into five sections.
 - c. She subdivided the book into five sections.
19.
 - a. The level of investment depends on expectations about future profitability.
 - b. He sold his house at a healthy profitably
 - c. The company's profitless is down this year.
20.
 - a. Many companies will only advertise in the Monday paper.
 - b. The Monday papers are full of advertises for cars.
 - c. The list has no connection with Weekly advertise.

21.
 - a. Nothing I had done would ever satisfy my father.
 - b. I got no satisfactory from the customer complaints department.
 - c. I'm not satisfy with the way she cut my hair.
22.
 - a. I am really admire the way she brings up her kids all on her own.
 - b. We stopped halfway to admire the view.
 - c. He gazed at her in admire.
23.
 - a. At last, he was able to work undisturbed.
 - b. When a helicopter lands, it can cause a disturb to local residents.
 - c. She's always disturb by her children.
24.
 - a. He is accused of murder.
 - b. How can you accusing me without knowing all the facts?
 - c. A lot of serious accuses have been made against her.
25.
 - a. She doesn't approval of cosmetic surgery.
 - b. He doesn't approved of alcohol.
 - c. The boss will give a final approval by Thursday.
26.
 - a. I don't understand how the two things relates.
 - b. The program is relatively difficult to use.
 - c. The system is relation easy to use.
27.
 - a. I had no maps to assist them.
 - b. She wants to assistant people to stay in their own homes.
 - c. Everyone has personal assists.
28.
 - a. I tried to read a page of this book, but I found it hard to concentration.
 - b. I need all my powers of concentrates.
 - c. I lost my concentration and fell asleep.
29.
 - a. It just needs a few minor adjusts.
 - b. It's amazing how quickly kids adjusts.
 - c. I don't think the color control on the TV is properly adjusted.
30.
 - a. He is transferred to do the special case.
 - b. He transferences her to do the special case.
 - c. They transferor him to do the special case.

Appendix I-L: The Grammatical Production Test (GPT)

Instructions: Please write a sentence with grammatical accuracy by using the given word.

Examples:

Target words

Sentence

1. understandable

Your idea is understandable.

2. studying

I am studying English.

Target words

Sentence

1. aim

2. divide

3. profits

4. advertise

5. satisfied

6. admire

7. disturb

8. accuse

9. increase

10. measure

11. desire

12. employees

13. permission

14. argues

15. combine

16. prevent

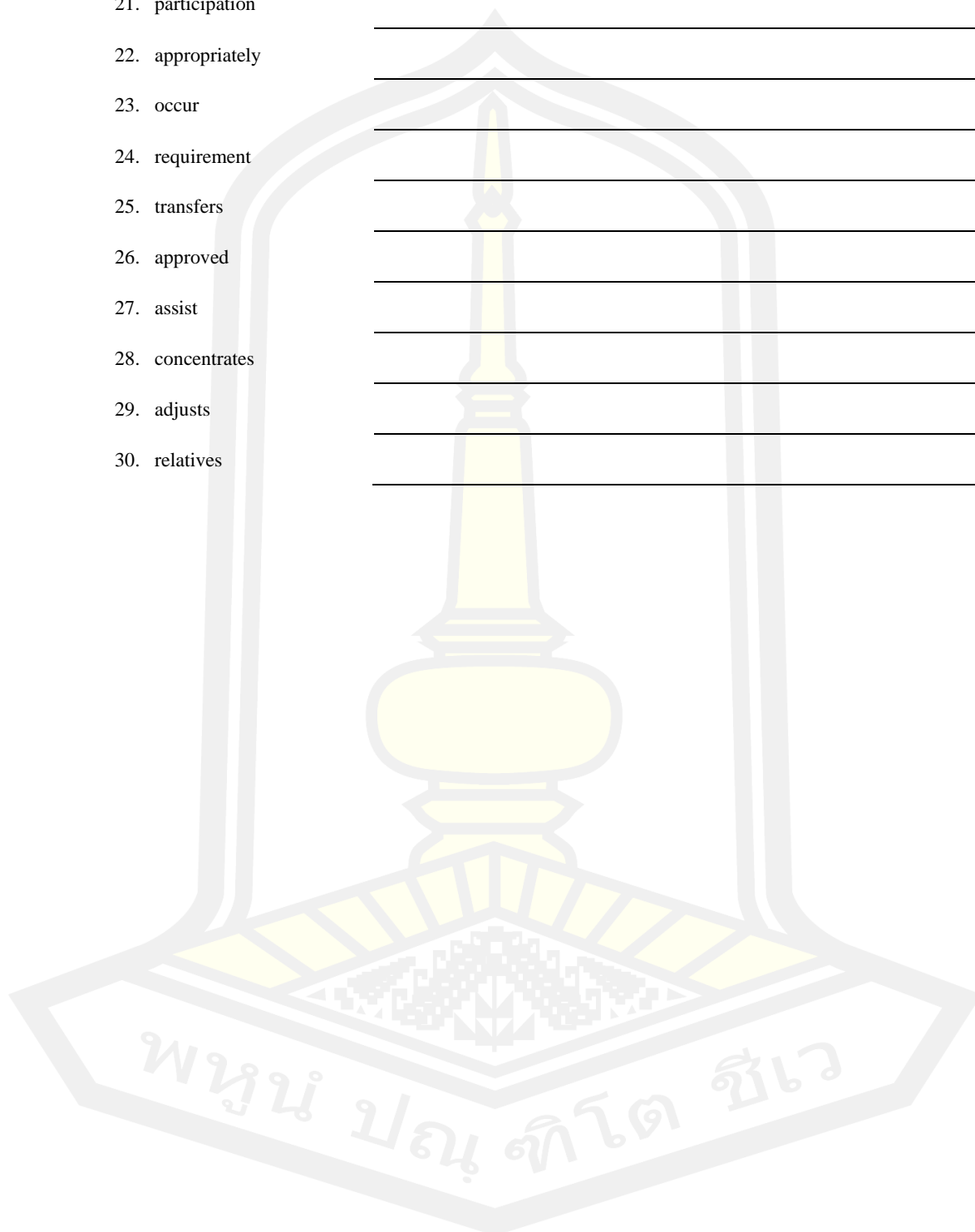
17. examines

18. consults

19. awareness

20. purchase

Target words	Sentence
21. participation	
22. appropriately	
23. occur	
24. requirement	
25. transfers	
26. approved	
27. assist	
28. concentrates	
29. adjusts	
30. relatives	



Appendix II-A: Ethics Approval (English Version)



MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 010-450/2022

Title : Vocabulary Knowledge Aspects: The Acquisition Order and the Relationships in Thai EFL High School Learners.

Principal Investigator : Mr. Worakrit Nontasee

Responsible Department : Faculty of Humanities and Social Sciences

Research site : Maharakham University Demonstration School (Secondary)

Review Method : Exemption Review

Date of Manufacture : 18 January 2022

expire : 17 January 2023

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Maharakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

Ratree S.

(Asst. Prof. Ratree Sawangjit)

Chairman





Approval is granted subject to the following conditions: (see back of this Certificate)

All approved investigators must comply with the following conditions:

1. Strictly conduct the research as required by the protocol;
2. Use only the information sheet, consent form (and recruitment materials, if any), interview outlines and/or questionnaires bearing the Institutional Review Board's seal of approval ; and return one copy of such documents of the first subject recruited to the Institutional Review Board (IRB) for the record (if applicable);
3. Report to the Institutional Review Board any serious adverse event or any changes in the research activity within five working days;
4. Provide reports to the Institutional Review Board concerning the progress of the research upon the specified period of time or when requested;
5. If the study cannot be finished within the expire date of the approval certificate, the investigator is obliged to reapply for approval at least two month before the date of expiration.
6. All the above approved documents are expired on the same date of the previously approved protocol (Protocol Number.....)

* A list of the Institutional Review Board members (names and positions) present at the meeting of Institutional Review Board on the date of approval of this study has been attached (per requested). All approved documents will be forwarded to the principal investigator.

Appendix II-B: Ethics Approval (Thai Version)

	<div style="border: 1px solid black; padding: 5px;"> ฝ่ายวิจัยและบริการวิชาการ เลขที่รับ..... 017 วันที่..... 02 ก.พ. 2565 เวลา..... 12.16 น. </div>	<div style="border: 1px solid black; padding: 5px;"> คณะมนุษยศาสตร์และสังคมศาสตร์ เลขที่รับ..... 498 วันที่..... - 1 ก.พ. 2565 เวลา..... 10.01 </div>
บันทึกขอความ		
<p>ส่วนราชการ กองส่งเสริมการวิจัยและบริการวิชาการ มหาวิทยาลัยมหาสารคาม 1758 ที่ อว 0605.1(9)/ 487 วันที่ ๒๘ มกราคม 2565</p>		
<p>เรื่อง ขอส่งหนังสือรับรองจริยธรรมการวิจัยในคน</p>		
<p>เรียน คณบดีคณะมนุษยศาสตร์และสังคมศาสตร์</p>		
<p>ตามที่นี้สติดในสังกัดของท่านได้ยื่นโครงการวิจัยเพื่อขอรับการพิจารณาจริยธรรมการวิจัยในคน จำนวน 1 เรื่อง ดังนี้</p>		
<p>1. ลักษณะความรู้ค่าศัพท์: ลำดับการเรียนรู้ และความสัมพันธ์การรู้ค่าศัพท์ด้านต่างๆ ของผู้เรียน ภาษาอังกฤษในฐานะภาษาต่างประเทศระดับมัธยมศึกษาตอนปลายชาวไทย : Vocabulary Knowledge Aspects: The Acquisition Order and the Relationships in Thai EFL High School Learners. (No.450/64)</p>		
<p>บัดนี้ คณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม ได้พิจารณาโครงการวิจัยข้างต้นบนพื้นฐานด้านจริยธรรมการวิจัยในคนแล้ว เมื่อวันที่ 18 มกราคม 2565 พร้อมทั้งมีมติอนุมัติรับรองโครงการวิจัยแบบยกเว้น (Exemption Review) ตามเอกสารใบรับรองจริยธรรมการวิจัยในคนที่ส่งมาพร้อมกันนี้ ทั้งนี้หากมีการเปลี่ยนแปลงใดๆ ในโครงการวิจัย ผู้วิจัยจักต้องยื่นขอรับการพิจารณาใหม่</p>		
<p>จึงเรียนมาเพื่อโปรดทราบและดำเนินการต่อไป</p>		
<p>ยน คณบดี ✓ เพื่อโปรดทราบ ๑๖.๑๖.๖๖</p>	<p> (นางฉวีวรรณ อรรถเศรษฐ์รุ่ง) เลขานุการคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม - 1 ก.พ. 2565</p>	
<p> (ผู้ช่วยศาสตราจารย์ ดร.ธีระ รุ่งธีระ) รองคณบดีฝ่ายวิจัยและบริการวิชาการ</p>	<p> (รองศาสตราจารย์ ดร.ภาสกร ทรนภ) รองคณบดีฝ่ายบริหารและสังคมศึกษา ปฏิบัติราชการแทน คณบดีคณะมนุษยศาสตร์และสังคมศาสตร์</p>	



คณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม

เอกสารรับรองโครงการวิจัย

เลขที่การรับรอง : 010-450/2565

ชื่อโครงการวิจัย (ภาษาไทย) ลักษณะความรู้คำศัพท์: ลำดับการเรียนรู้ และความสัมพันธ์การรู้คำศัพท์ด้านต่างๆ
ของผู้เรียนภาษาอังกฤษในฐานะภาษาต่างประเทศระดับมัธยมศึกษาตอนปลายชาวไทย

ชื่อโครงการวิจัย (ภาษาอังกฤษ) Vocabulary Knowledge Aspects: The Acquisition Order and the Relationships in Thai EFL High School Learners

ผู้วิจัย : นายวรภุช นนตะสี

หน่วยงานที่รับผิดชอบ : คณะมนุษยศาสตร์และสังคมศาสตร์

สถานที่ทำการวิจัย : โรงเรียนสาธิตมหาวิทยาลัยมหาสารคาม (ฝ่ายประถม) มหาวิทยาลัยมหาสารคาม

ประเภทการพิจารณาแบบ : แบบยกเว้น

วันที่รับรอง : 18 มกราคม 2565

วันหมดอายุ : 17 มกราคม 2566

ข้อเสนอการวิจัยนี้ ได้รับการพิจารณาและให้ความเห็นชอบจากคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคามแล้ว และอนุมัติในด้านจริยธรรมให้ดำเนินการศึกษาวิจัยเรื่องข้างต้นได้ บนพื้นฐานของโครงการงานวิจัยที่คณะกรรมการฯ ได้รับและพิจารณา เมื่อเสร็จสิ้นโครงการแล้วให้ผู้วิจัยส่งแบบฟอร์มการปิดโครงการและรายงานผลการดำเนินงานมายังคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม หรือ หากมีการเปลี่ยนแปลงใดๆ ในโครงการวิจัย ผู้วิจัยจักต้องยื่นขอรับการพิจารณาใหม่

.....ภทรี.....สว่างจิตร์.....

(ผู้ช่วยศาสตราจารย์ เกษิษฐาหญิงรัตรี สว่างจิตร์)

ประธานคณะกรรมการจริยธรรมการวิจัยในคน

มหาวิทยาลัยมหาสารคาม

ทั้งนี้ การรับรองนี้มีเงื่อนไขดังที่ระบุไว้ด้านหลังทุกข้อ (ดูด้านหลังของเอกสารรับรองโครงการวิจัย)

นักวิจัยทุกท่านที่ผ่านการรับรองจริยธรรมการวิจัยต้องปฏิบัติดังต่อไปนี้

1. ดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
2. ใช้เอกสารแนะนำอาสาสมัคร ใบยินยอม (และเอกสารเชิญเข้าร่วมวิจัยหรือใบโฆษณาถ้ามี) แบบสัมภาษณ์ และหรือ แบบสอบถาม เฉพาะที่มีตราประทับของคณะกรรมการจริยธรรมในคน มหาวิทยาลัยมหาสารคามเท่านั้น และส่งสำเนาเอกสารดังกล่าวที่ใช้กับผู้เข้าร่วมวิจัยจริงรายแรกมาที่คณะกรรมการจริยธรรมการวิจัยในคน เพื่อเก็บไว้เป็นหลักฐาน
3. รายงานเหตุการณ์ไม่พึงประสงค์ร้ายแรงที่เกิดขึ้นหรือการเปลี่ยนแปลงกิจกรรมวิจัยใดๆ ต่อคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม ภายในระยะเวลา 5 วันทำการ
4. ส่งรายงานความก้าวหน้าต่อคณะกรรมการจริยธรรมการวิจัยในคน ตามเวลาที่กำหนดหรือเมื่อได้รับการร้องขอ
5. หากการวิจัยไม่สามารถดำเนินการเสร็จสิ้นภายในกำหนด ผู้วิจัยต้องยื่นขออนุมัติใหม่ก่อน อย่างน้อย 60 วัน
6. หากการวิจัยเสร็จสมบูรณ์ผู้วิจัยต้องแจ้งปิดโครงการตามแบบฟอร์มของคณะกรรมการจริยธรรมในคน มหาวิทยาลัยมหาสารคาม

* รายชื่อของคณะกรรมการจริยธรรมการวิจัยในคน (ชื่อและตำแหน่ง) ที่เข้าร่วมประชุม ณ วันที่พิจารณารับรองโครงการวิจัย (หากร้องขอล่วงหน้า)

ECMSU01-05.02 Update 2021

เอกสารชี้แจงสำหรับผู้ปกครองอาสาสมัครที่ตอบแบบสอบถาม (เด็กอายุ 7-18 ปี)
(สำหรับการตอบแบบสอบถามอายุต่ำกว่า 18 ปี)



เรียน ผู้ปกครองของผู้ตอบแบบสอบถามทุกท่าน

เนื่องด้วยข้าพเจ้า นายวรกฤษ นนตะสี นิสิตปริญญาเอก สาขาการสอนภาษาอังกฤษ คณะมนุษยศาสตร์ และสังคมศาสตร์ มหาวิทยาลัยมหาสารคาม กำลังดำเนินการวิจัย เรื่อง “ลักษณะความรู้คำศัพท์: ลำดับการเรียนรู้และความสัมพันธ์การเรียนรู้คำศัพท์ด้านต่างๆ ของผู้เรียนภาษาอังกฤษในฐานะภาษาต่างประเทศระดับมัธยมศึกษาตอนปลายชาวไทย” ชื่อภาษาอังกฤษ Vocabulary Knowledge Aspects: The Acquisition Order and the Relationships in Thai EFL High School Learners

โดยมีวัตถุประสงค์ของการวิจัยครั้งนี้ เพื่อศึกษาลักษณะความรู้คำศัพท์ ลำดับการเรียนรู้ และความสัมพันธ์การเรียนรู้คำศัพท์ด้านต่างๆ ของผู้เรียนภาษาอังกฤษในฐานะภาษาต่างประเทศระดับมัธยมศึกษาตอนปลายชาวไทย

ประโยชน์ที่ท่านจะได้รับจากการวิจัยนี้ คือ การศึกษานี้จะช่วยให้เข้าใจธรรมชาติของการเรียนรู้และพัฒนาคำศัพท์ได้ดีขึ้น โดยเฉพาะอย่างยิ่งจะให้ข้อมูลเชิงลึกเกี่ยวกับบทบาทของความรู้ด้านคำศัพท์และการพัฒนาคำศัพท์ การศึกษานี้จะรวบรวมหลักฐานเชิงประจักษ์สำหรับโครงสร้างคำศัพท์เชิงทฤษฎีที่เสนอโดย Nation (2013) ผลการวิจัยที่เกี่ยวข้องกับความสัมพันธ์ระหว่างด้านความรู้คำศัพท์จะนำไปสู่คำอธิบายของการสร้างความรู้คำศัพท์เป็นเครือข่ายขององค์ประกอบที่สัมพันธ์กัน และเผยให้เห็นรูปแบบการพัฒนาเบื้องต้นสำหรับแง่มุมต่างๆ ของความรู้คำศัพท์ นอกจากนี้ การศึกษาครั้งนี้จะให้ข้อมูลที่สำคัญเกี่ยวกับรูปแบบแนวคิดของความรู้คำศัพท์ ซึ่งเป็นลำดับขั้นของความรู้คำศัพท์ ผลลัพธ์ที่ได้อาจเป็นแบบจำลองหลักของการเรียนรู้คำศัพท์ ดังนั้น ข้อค้นพบของการศึกษานี้จะช่วยอำนวยความสะดวกในการสอนและการเรียนรู้คำศัพท์ในการสอนภาษาอังกฤษ และจุดประกายให้เกิดการพัฒนากิจกรรมและการออกแบบหลักสูตรใหม่ๆ โดยเฉพาะอย่างยิ่งในบริบทของผู้เรียนชาวไทยที่เรียนภาษาอังกฤษเป็นภาษาต่างประเทศ

หากท่านตัดสินใจให้เด็กในปกครองของท่านเข้าร่วมการวิจัยแล้ว ผู้วิจัยจะขอให้เด็กในปกครองของท่านได้ทำแบบทดสอบวัดความรู้เกี่ยวกับ ความรู้คำศัพท์ (Vocabulary knowledge) จำนวน 12 ชุด โดย แบบทดสอบความสามารถด้านการจำคำศัพท์ (Receptive test) จำนวน 6 ชุดใช้เวลาชุดละ 15 นาทีและแบบทดสอบความสามารถด้านการใช้คำศัพท์ (Productive test) จำนวน 6 ชุดใช้เวลาชุดละ 20 นาที และจะขอรับแบบทดสอบวัดความรู้โดยผู้วิจัยจะไปเก็บด้วยตนเอง

หากเด็กในปกครองของท่านรู้สึกอึดอัด หรือรู้สึกไม่สบายใจกับบางคำถาม เด็กในปกครองของท่านมีสิทธิ์ที่จะไม่ตอบคำถามเหล่านั้นได้ รวมถึงเด็กในปกครองของท่านมีสิทธิ์ถอนตัวออกจากโครงการนี้เมื่อใดก็ได้ โดยไม่ต้องแจ้งให้ทราบล่วงหน้า และการไม่เข้าร่วมวิจัยหรือถอนตัวออกจากโครงการวิจัยนี้ จะไม่มีผลกระทบต่อการเรียนรู้ของเด็กในปกครองของท่านแต่ประการใด ข้อมูลในการตอบแบบทดสอบและแบบสอบถามของเด็กในปกครองของท่านจะถูกเก็บรักษาไว้ ไม่เปิดเผยต่อสาธารณะเป็นรายบุคคล แต่จะรายงานผลการวิจัยในภาพรวมเท่านั้น และจะ

ECMSU01-05.02 Update 2021

ดำเนินการทำลายข้อมูลที่เกี่ยวข้องภายหลังเสร็จสิ้นการวิจัย การวิจัยครั้งนี้เด็กในปกครองท่านจะไม่ได้รับค่าตอบแทนและไม่เสียค่าใช้จ่ายใดๆ ทั้งสิ้น

หากท่านและเด็กในปกครองของท่านมีข้อสงสัยเกี่ยวกับงานวิจัย โปรดติดต่อได้ที่

นายวรฤกษ์...นนตะสี...คณะมนุษยศาสตร์และสังคมศาสตร์...มหาวิทยาลัยมหาสารคาม...หมายเลขโทรศัพท์มือถือ 061-5098519.....และหากท่านและเด็กในปกครองของท่านได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้หรือต้องการทราบสิทธิของท่านและเด็กในปกครองของท่านขณะเข้าร่วมการวิจัยนี้ สามารถติดต่อได้ที่ “คณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม กองส่งเสริมการวิจัยและบริการวิชาการ มหาวิทยาลัยมหาสารคาม” โทรศัพท์ 043-754416 เบอร์ภายใน 1755

ขอขอบพระคุณอย่างสูง



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(นายวรฤกษ์ นนตะสี)

ผู้วิจัย

ECMSU01-06.02

แบบยินยอมให้ทำการวิจัยสำหรับอาสาสมัครอายุ 7-18 ปี

ข้าพเจ้า (นาย /นาง /นางสาว).....นามสกุล.....อายุ.....ปี เกี่ยวข้อง
เป็นบิดา/มารดา/ผู้ปกครองของ (ด.ญ./ด.ช./นาย/นางสาว).....นามสกุล.....อายุ.....ปี

ขอแสดงความยินยอมให้เด็กในปกครองของข้าพเจ้าเข้าร่วมการวิจัย ในโครงการวิจัยเรื่อง “ผลการศึกษาความเข้าใจเรื่องโครงสร้างของคำและความรู้ด้านคำศัพท์ของนักเรียนระดับประถมศึกษาชาวไทยที่เรียนภาษาอังกฤษในฐานะภาษาต่างประเทศ”

ข้าพเจ้าและเด็กในปกครอง/ในความดูแลของข้าพเจ้า ได้รับทราบรายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ ข้าพเจ้าได้อ่านรายละเอียดในรูปแบบชี้แจงสำหรับอาสาสมัครหรือผู้มีส่วนร่วมในการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย จนเข้าใจเป็นอย่างดีแล้ว

ตลอดจนการรับรองจากผู้วิจัยที่จะเก็บรักษาข้อมูลของเด็กในปกครองของข้าพเจ้าไว้เป็นความลับ และจะไม่ระบุชื่อหรือข้อมูลส่วนตัวเป็นรายบุคคลต่อสาธารณชน โดยผลการวิจัยจะนำเสนอในลักษณะภาพรวมที่เป็นการสรุปผลการวิจัยเพื่อประโยชน์ทางวิชาการเท่านั้น

ข้าพเจ้าจึงสมัครใจให้เด็กในปกครอง/ในความดูแลของข้าพเจ้าเข้าร่วมโครงการวิจัยนี้ ภายใต้เงื่อนไขที่ระบุไว้ในแบบชี้แจงอาสาสมัคร โดยข้าพเจ้ายินยอมให้เด็กในปกครอง/ในความดูแลของข้าพเจ้า เข้าร่วมในการวิจัย และเด็กในปกครอง/ในความดูแลของข้าพเจ้าสมัครใจเข้าร่วมการวิจัยนี้ ภายใต้เงื่อนไขที่ระบุไว้ในแบบชี้แจงอาสาสมัคร เด็กจะได้ทำแบบทดสอบวัดความรู้คำศัพท์ (Vocabulary knowledge) จำนวน 1 ครั้ง เมื่อเสร็จสิ้นการวิจัยแล้วข้อมูลที่เกี่ยวข้องกับผู้มีส่วนร่วมในการวิจัยจะถูกทำลาย ได้แก่ ข้อมูลผลการทดสอบวัดความรู้ และรายชื่อเด็กที่เข้าร่วม

ข้าพเจ้ามีสิทธิให้ผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าหรือเป็นความประสงค์ของผู้ที่อยู่ในปกครอง/ในความดูแล ถอนตัวออกจากกรวิจัยเมื่อใดก็ได้ โดยไม่ต้องแจ้งเหตุผล ซึ่งการถอนตัวออกจากกรวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าและตัวข้าพเจ้าทั้งสิ้น จะไม่มีผลกระทบต่อการเรียนของเด็กในปกครองของท่านแต่ประการใด

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้า ตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆที่เกี่ยวข้องกับผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลจากการวิจัยเป็นภาพรวมเท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวผู้ที่อยู่ในปกครอง/ในความดูแลของข้าพเจ้าและตัวข้าพเจ้า

หากข้าพเจ้าและผู้ที่อยู่ในความปกครองของข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย ข้าพเจ้าสามารถติดต่อที่ นายวรฤกษ์ นนตะสี. บ้านเลขที่ 242 หมู่ที่ 4 ตำบลบึงบัว อำเภอมะนัง จังหวัดน่าน โทร. 061-5098519. ได้ตลอด 24 ชั่วโมง

ข้าพเจ้าและผู้ที่อยู่ในปกครองของข้าพเจ้าเข้าใจข้อความในแบบคำชี้แจงอาสาสมัคร และแบบยินยอมโดยตลอดแล้ว จึงลงลายมือชื่อไว้



BIOGRAPHY

NAME	Worakrit Nontasee
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POSITION	A full time student
EDUCATION	2009 Junior High School in Mahasarakham University Demonstration (Secondary) School 2012 Senior High School in Mahasarakham University Demonstration (Secondary) School 2015 Bachelor of Arts (B.A.) in English, Khon Kaen University 2020 Master of Education in English Language Teaching (M.Ed), Mahasarakham University 2023 Doctor of Philosophy (Ph.D.) Program (English Language Teaching), Mahasarakham University
Research output	2020 The Acquisition of Vocabulary Knowledge in Thai EFL High School Students, Journal of Man and Society Faculty of Humanities and Social Sciences 2021 The Learnability of Word Knowledge Aspects in Thai EFL High School Learners, Journal of Language and Linguistic Studies 2022 The Acquisition Order of Vocabulary Knowledge Aspects in Thai EFL Learners, World Journal of English Language

พหุบัณฑิต ชีวะ