4-20-2016 12:00 AM

A Corpus-based Comparison between the Academic Word List and the Academic Vocabulary List

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Graduate Program in Education
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Arts

Abstract

This study was a corpus-based comparison between two lists of academic words: Coxhead's (2000) Academic Word List (AWL) and Gardner and Davies' (2014) Academic Vocabulary List (AVL). Comparisons were made between different types of lexical coverage provided by the AWL and the AVL in the University Academic Corpus (72-million tokens). The findings indicated that the performance of the AWL and the AVL was different when different evaluation criteria were adopted and learners with different lexical sizes were considered. For learners without English vocabulary knowledge, the most frequent 570 word families of the AVL outperformed the AWL, while the AWL could provide more support for learners with lexical sizes of the most frequent 1,000-5,000 word families. The decisive factors for academic wordlist coverage were concluded to be the number and the lexical frequency of academic wordlist items. Implications, limitations, and suggestions are listed for future research.

Key words: the AWL, the AVL, corpus, lexical coverage, lexical frequency, lexical size

Acknowledgements

There are many people I would like to thank who have helped me through this thesis-writing journey.

My sincerest gratitude goes to my supervisors, Dr. Farahnaz Faez and Dr. Stuart Webb, for their enlightening guidance, great kindness, and considerate support, which have been always inspiring and encouraging me to be better with determination. My sincerest gratitude also goes to Dr. Stephen Bird who served as a committee member supported me generously and kindly when I was in need.

I would like to thank all the professors who have instructed me: Dr. Rosamund Stooke, Dr. Shelley Taylor, Dr. Julie Byrd Clark, Dr. Rachel Heydon, and Dr. Elizabeth Nowicki, whose kindness, knowledge, research insights, and wisdom have led me to a brand new world of research, and will continue to positively influence me in my future pursuit of professional development.

I am very grateful to the librarians, Graduate Office staff, and secretaries of each faculty, who have supported me during my thesis writing with warm, kind, and generous professionalism: Thomas, Alyson, Melanie, Amanda, Christena, Nadija, Katrina, Denise, and Chris. I will always remember your kind assistance. Sincerely, thank you!

I would also like to thank the Faculty of Education for the thesis-writing award.

Last but not least, I would like to thank the important people in my life for their constant accompaniment through difficult and trying times. Thank you for always being here!

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Chapter One Introduction

1.1 Background

English vocabulary falls into four categories (Nation, 2001): high-frequency words, academic words, technical words and low-frequency words. Academic vocabulary is a group of lexical items occurring commonly in academic texts across academic disciplines but less commonly in non-academic texts (Coxhead, 2000; Nation, 2001; Schmitt & Schmitt, 2005; Xue & Nation, 1984). Compared to general high-frequency and technical categories, academic vocabulary is more difficult for learners to acquire because it is neither like general high-frequency words which are commonly used in general texts, nor like technical vocabulary which is densely distributed in subject-specific discourses and often explicitly taught by subject teachers (Nation, 2001; Shaw, 1991). Consequently, academic vocabulary needs more direct pedagogical attention.

Academic vocabulary is important for academic study for two reasons. First, as academic vocabulary is high-frequency in academic texts, students' academic vocabulary knowledge can decrease the burden of unknown words in academic texts (Nation, 2001), which may result in better comprehension of academic English (Townsend, Filippini, Collins, & Biancarosa, 2012). Second, previous studies have tended to suggest that academic vocabulary knowledge might positively impact students' academic writing (Li & Pemberton, 1994), discipline-specific learning (Khani & Tazik, 2013), and academic achievements (Townsend et al., 2012).

Since academic vocabulary requires direct pedagogical attention and is crucial for academic success, efficient learning and teaching of academic vocabulary becomes

significant. A list of academic words provides an inventory of high-frequency lexical terms viewed as most valuable and helpful for students' academic study in English (Nation, 2013; Nation & Webb, 2011). The assumption behind compiling and using a list of academic words is that the words selected in the list are the most useful ones due to their frequent occurrence in academic texts. The purpose of learning lists of academic words is to improve efficiency in academic vocabulary education. The theoretical basis is Zipf's law (1949), which states that a small group of high-frequency words account for a large portion of the texts. Thus, prioritizing high-frequency academic vocabulary in the teaching and learning of academic English should have a positive impact and improve efficiency. Therefore, creating lists of the high-frequency academic words is encouraged, necessary and meaningful.

Historically, several lists of academic words have been compiled (Campion & Elley, 1971; Coxhead, 2000; Gardner & Davies, 2014; Ghadessy, 1979; Lynn, 1973; Praninskas, 1972; Xue & Nation, 1984), among which, Coxhead's (2000) Academic Word List (AWL) and Gardner and Davies' (2014) Academic vocabulary List (AVL) are the two most recently published lists. The AWL is a list of 570 word families derived from a 3.5-million-token academic corpus. It provided 10% coverage in Coxhead's (2000) academic corpus. The AVL (3,015 lemma-headwords; 1,991 word families) was developed from a 120-million-token corpus and covered around 14% of the Corpus of Contemporary American English (COCA) academic sub-corpus and the British National Corpus (BNC) academic sub-corpus.

1.2 Purpose and Rationale

This study aims to compare the lexical coverage provided by the AWL and the AVL in the University Academic Corpus (72-million tokens) that was independently developed by me. The purpose is to investigate which list has higher lexical coverage in order to determine which list is more appropriate for undergraduates' academic vocabulary learning across disciplines.

The reasons for comparing the AWL and the AVL are as follows. First, the AWL has been widely used in the EAP (English for Academic Purposes) and ESP (English for Specific Purposes) education, and has been recognized as the yardstick list in many previous wordlist studies in the past decade (Coxhead, 2011). Hence, the AWL deserves more attention compared to the previously-developed lists. Second, the compilation of the AVL was quite different from all its predecessor lists, and the most frequent 570 AVL word families achieved impressively higher lexical coverage than the AWL in academic corpora (Gardner & Davies, 2014). Based on this higher lexical coverage, the AVL has been claimed to be a better list than the AWL by its authors. Thus, the value of the AVL might deserve being further explored.

This corpus-based study is important because it addresses a gap in the research. To date, there has not been an independent corpus-based comparison study focused on evaluating different academic wordlists. Most comparisons were made when developing and promoting a new academic wordlist (e.g., Coxhead, 2000; Gardner & Davies, 2014). Moreover, as the AVL was newly published, very few comparative evaluation efforts have been made between the AWL and the AVL (Gardner & Davies, 2014; Hart & Hartshorn, 2015). The only previous corpus-based comparison (i.e., Gardner & Davies,

2014) of the lexical coverage provided by the AWL and the AVL neglected some critical features of the two lists such as their different lengths, and consequently favoured the AVL to some degree. Therefore, a new and independent corpus-based comparison which is expected to more precisely display the lexical coverage difference between the AWL and the AVL is useful and necessary.

Lexical coverage is the comparison criterion in this corpus-based study because the lexical coverage of a wordlist is the percentage of words in a text covered by the items of a particular wordlist (Waring & Nation, 1997). The amount of lexical coverage can explicitly indicate to what extent learners' knowledge of a particular wordlist can help them to comprehend a text. Therefore, lexical coverage is adopted as the criterion for evaluating how helpful the AWL and the AVL may be for students' comprehending academic texts.

When comparing the lexical coverage of different wordlists, it is important to carefully select the academic texts. To discover which list is more supportive for academic vocabulary learning, the corpus, which is the comparison basis, should be made up of texts that their shared target audience encounter. Since the AWL and the AVL were made for academic English learners, especially undergraduates involved in English-medium instruction, comparing the lexical coverage provided by the AWL and the AVL in a corpus made up of university undergraduate-level academic texts is appropriate.

To provide a valid comparison, the University Academic Corpus was independently made to reflect the picture of the ongoing academic English used by undergraduates. It was derived from 850 university course texts listed in the most recently published course outlines of English-medium universities. The texts were from

ten different academic disciplines and were varied in genres. The corpus size is much larger than the previous corpora made up of course materials used for evaluating lists of academic words (e.g., Coxhead, 2000; Hyland & Tse, 2007). Moreover, to ensure more validity of comparison, the present study evaluated the two lists in a number of ways. To check the AWL and the AVL more comprehensively, several kinds of lexical coverage provided by the two lists in the University Academic Corpus were examined: the coverage they provided at their full length, the average coverage provided by each item they contain, and the coverage they provided when they were made of the same number of items. To explore which list could be more helpful for undergraduates in their discipline-specific study, the discipline-specific lexical coverage of the AWL and the AVL was also compared. To find out how much support the AWL and the AVL might provide for learners with different word-frequency levels of lexical sizes, the lexical frequency profiles of the two lists were outlined and their lexical coverage at each word-frequency level was measured.

This study is significant for the following reasons. First, the results should be of value to teachers and learners for revealing how much coverage support each list provides for learners in comprehending university academic texts across disciplines. Second, examining the lexical coverage of the AWL and the AVL in specific disciplines should help teachers and learners decide which list is most appropriate for their discipline-specific academic purposes. Third, the lexical frequency profiles of the AWL and the AVL identified in this study could offer detailed information regarding the distribution of the AWL and the AVL at each 1,000 word-frequency level to learners with different lexical sizes and instructors who are teaching learners with a certain word-frequency

level of lexical size, so that learners and teachers could make the right wordlist choice for setting up learning goals and designing English programs. Lastly, this comparison practice could enrich the research areas of corpus linguistics, wordlist-creation, and wordlist-comparison, and hopefully, will contribute to the establishing of a systematic framework of wordlist development and evaluation.

1.3 Research Questions

This study will address the following research questions:

1. Which list provides higher coverage in university academic texts?

2. Which list provides higher average coverage in university academic texts?

3. Which list provides higher coverage in university academic texts from specific disciplines?

4. Which list provides higher average coverage in university academic texts from specific disciplines?

5. What are the lexical frequency profiles of the two lists?

6. How much coverage do the AWL and the 570 best word families in the AVL provide to learners with different vocabulary sizes?

1.4 Thesis Organization

This thesis contains five parts: Chapter one is an introduction to the background, research purpose, rationale, and research questions of this study. Chapter two is a review of existing literature to justify the comparison between the AWL and the AVL. Chapter three outlines the research methodology, which elaborates on the material wordlists to be compared in the study, the development of the University Academic Corpus, and the analysis procedure. Chapter four discusses the research findings and explicitly addresses

the research questions. Chapter five includes the conclusion together with some tentatively-proposed implications, research limitations, and recommendations indicated for future research in the field.

1.5 Definitions

AWL (Academic Word List): a list of English academic vocabulary containing 570 word families, which was made by Coxhead (2000).

AVL (Academic Vocabulary List): a list of English academic vocabulary containing 1,991 word families and 3,015 lemma-headwords, which was made by Gardner and Davies (2014).

UWL (University Word List): a list of English academic vocabulary containing 836 word families common in academic texts, which was made by Xue and Nation (1984).

GSL (General Service List): a list of 2,000 general high-frequency English words, which was made by West (1953).

BNC/COCA25000: a group of 29 lists of words which contains 25 most frequent 1,000 word family lists and four additional lists of proper nouns, marginal words, transparent compounds, and abbreviations. It was made by Nation (2012).

BNC/COCA2000: a general high-frequency English vocabulary list which contains 2,000 word families common in English texts and was made by Nation (2012). It is composed of the 1st and 2nd BNC/COCA 1,000 word family lists.

Word family: a word counting unit that includes a headword, its inflections, and its derivations (Nation, 2001), e.g., *approach* (headword), *approaches, approaching,* and *approached* (inflections), *approachable* and *unapproachable* (derivations).

Lemma: a word counting unit that contains a headword and its inflections, e.g., *approach* (headword), and *approaches, approaching*, and *approached* (inflections).

Token: one occurrence of a word form in texts. It is also termed as running word.

Corpus: a collection of texts representing an aspect of a language. It is often used by linguists to describe and analyse patterns and frequency of vocabulary.

Lexical coverage: the percentage of known words in a text (Waring & Nation, 1997).

LFP (Lexical Frequency Profile): a system developed by Laufer and Nation (1995) for indicating and assessing learners' vocabulary knowledge according to word-frequency levels.

EAP (English for Academic Purposes): refers to teaching and learning English for the purpose of using English appropriately for academic study in university settings.

ESP (English of Specific Purposes): refers to teaching and learning English for university discipline-specific purposes, such as teaching and learning English for Business, Medicine, and Science, etc.

Chapter Two Literature Review and Theoretical Framework

This chapter provides a literature review on academic wordlists and a theoretical framework appropriate for this comparison study.

2. 1 Literature Review

This section presents a review of the existing literature on academic vocabulary, lists of academic words, the features of the AWL and the AVL, and the previous comparison studies on the AWL and the AVL. The purpose is to justify why a comparison between the AWL and the AVL is necessary and meaningful.

2.1.1 Academic Vocabulary

In English-medium instruction, students' vocabulary knowledge is important for their academic success (Biemiller, 2005; Staehr, 2008). Among the four categories of English words suggested by Nation (2001), academic vocabulary is considered particularly significant for students' academic study (Nation, 2013; Nation & Webb, 2011).

Academic vocabulary is a group of words which occur more frequently in academic texts than in non-academic texts across various disciplines (Coxhead, 2000; Nation, 2001; Schmitt & Schmitt, 2005). It has been also referred to as semi-technical vocabulary (Farrell, 1990), sub-technical vocabulary (Anderson, 1980; Cowan, 1974; Yang, 1986), specialized non-technical lexis (Cohen, Glasman, Rodenbadum-Cohen, Ferrara, & Fine, 1988), general academic words (Nagy & Townsend, 2012) and core academic vocabulary (Gardner & Davies, 2014; Hyland & Tse, 2007). The features of academic vocabulary might be summarized as follows: First, academic vocabulary occurs

more often in academic texts than in general texts, and is particularly useful for academic purposes across different academic disciplines (Nation, 2001). Second, many academic words do not allow for incidental learning (Worthington & Nation, 1996), and require explicit instruction (Nation, 2001). Third, learners tend to be unfamiliar with academic vocabulary because it is neither commonly used in general texts of daily life, nor often focused on in subject-specific instructional discourses (Nation, 2001; Shaw, 1991). Consequently, academic vocabulary is particularly challenging for learners to acquire.

Academic vocabulary knowledge is important to students at various educational levels (e.g., Schmitt, Jiang, & Grabe, 2011; Townsend & Collins, 2009). Primarily, owing to the frequent occurrence of academic words in academic texts, knowledge of academic words can decrease learners' burden of unknown words in academic texts (Nation, 2001), and might result in better academic reading comprehension (Corson, 1997; Lesaux, Kieffer, Faller, & Kelley, 2010; Nagy & Townsend, 2012). Moreover, research tends to suggest that academic vocabulary knowledge positively impacts academic writing quality (Li & Pemberton, 1994), discipline-specific learning (Khani & Tazik, 2013) and students' future achievements (Townsend et al., 2012). Conversely, students' inadequate academic performance has also been found to be related to their insufficient academic vocabulary knowledge (Townsend et al, 2012).

However, learning all academic words can be a huge burden, especially to non-native English speaker students in English-medium universities. For example, the vocabulary size of an average native-English-speaker undergraduate is approximately 17,000 word families (Goulden, Nation, & Read, 1990), but the speed of non-native English speaker undergraduates' lexical growth in an English-medium environment is

quite low: 1,000 words per year (Laufer, 1994). This reality makes efficiently learning and teaching academic vocabulary essential.

Since a small group of high-frequency words cover a large portion of texts (Zipf, 1949), not all words are hence equally important to be learned (Waring & Nation, 1997) and high-frequency words should be learned first for educational efficiency. Prioritizing learning high-frequency academic words can ensure that the focus of instruction is on the academic words students most often encounter in their study (Nation & Webb, 2011; Waring & Nation, 1997), and can avoid students' exhausting themselves with massive burdens of vocabulary learning (Durrant, 2009).

Learning high-frequency academic words first in educational settings has been supported by previous research. In English-medium university settings, it has been found that native English speaker teachers' instructional discourse seldom goes beyond a limited range of high-frequency words (Meara, Lightbown & Halter, 1997). Moreover, research has demonstrated that locating a restricted list of valuable academic words contributed to students' academic writing (Li & Pemberton, 1994). Nation and Webb (2011) stated that lists of academic words could benefit learners and teachers in establishing academic vocabulary learning goals, analyzing text difficulty, testing vocabulary knowledge and growth, creating teaching materials and curricula, and more precisely fulfilling academic requirements. Therefore, locating the high-frequency academic words to compile focused pedagogical lists has been called for to realize academic vocabulary education efficiency.

2.1.2 Lists of Academic Words

A list of academic words is a group of high-frequency academic words viewed as most valuable and helpful for students' academic study in English (Nation, 2013; Nation & Webb, 2011). The items included in the list are selected according to certain criteria (e.g., Coxhead, 2000; Gardner & Davies, 2014). The purpose of compiling a list of academic words is to clearly locate the most commonly-used academic vocabulary for dealing with the daunting task of academic vocabulary learning in a well-organized and efficient way (Coxhead, 2000; Gardner & Davies, 2014). A list of academic words may be regarded as the valuable input (Krashen, 1985) and academic lexical support provided by teachers to learners. Such guidance from knowledgeable teachers in efficient academic vocabulary learning is essential to learners according to Vygotsky's (1978) Zone of Proximal Development; and integrating lists of academic words into EAP curriculum design (Tajino, Dalsky, & Sasao, 2009) and communicative classroom teaching (Foley, 2009) has been made.

Historically, several academic wordlists have been published (Campion & Elley, 1971; Coxhead, 2000; Gardner & Davies, 2014; Ghadessy, 1979; Lynn, 1973; Praninskas, 1972; Xue & Nation, 1984). To better understand what academic wordlists are, the following provides a brief overview of each wordlist.

Campion and Elley (1971) created two academic wordlists (500 word-family list and 3,200 word-family list) based on a 301,800-token corpus across nineteen university disciplines in New Zealand. Likewise, Praniska (1972) created a 507 word-family list based on a 272,466-token corpus made up of undergraduate textbooks across ten disciplines at the American University of Beirut. The word selection criteria used for

these three lists were range, frequency and the exclusion of general high-frequency words. Unlike Campion and Elley (1971) and Praniska (1972), Lynn (1973) and Ghadessy (1979) developed their lists from students' annotations of the unknown words in their textbooks by using frequency as the word selection standard. Lynn's (1973) 197 word-family list was derived from 10,000 annotations in 52 books and four classroom hand-outs. Ghadessy's (1979) two lists (795-item list and 322-item list) involved a 478,700-token corpus composed of 20 textbooks across three academic areas at one of Iran's universities. Due to the technological limitations of corpus-building of the time periods, all of these early-made lists were developed from small collections of texts (Dang, 2013). Little existing literature has reported their lexical coverage in academic texts or their pedagogical use. Thus, their influence on the EAP and ESP education remains unclear and could be limited.

Based on the above lists, Xue and Nation (1984) created the University Word List (UWL) which contains 836 word families. It was not a list compiled with consistent principles but a combined product of the above predecessor lists. Hence, it inherited the limitations of the predecessor lists (Coxhead, 2000; Nation & Webb, 2011). The UWL had achieved high lexical coverage in academic corpora: 8.5% (Xue & Nation, 1984) and 9.8% (Coxhead, 2000), and had been widely used until the emergence of the AWL (Coxhead, 2000).

Coxhead's (2000) AWL is a list of 570 word families developed from a 3.5-million-token academic corpus made up of 414 academic written texts. The corpus was made up of texts across four disciplines (Arts, Commerce, Law, and Science) and 28 subject areas. The text types were textbooks, book chapters, journal articles, and

laboratory manuals from one university of New Zealand. According to Coxhead (2011), four word selection principles were adopted: frequency, range, uniformity, and the exclusion of general high-frequency words. As a result, all the AWL word families occurred 100 times or more in each of the four discipline-specific sub-corpora (frequency), in 15 or more of the 28 subject areas contained in the four disciplines (range), over 10 times in the four discipline-specific sub-corpora (uniformity), and were outside West's (1953) GSL which is a list of 2,000 general high-frequency word families (for more relevance to learners' academic purposes). Furthermore, the AWL 570 word families were divided into 10 sub-lists according to their frequency ranking in the AWL academic corpus: The first sub-list contained the top 60 frequent word families, the second sub-list included the next 60 frequent word families, and so forth. The specialized nature of the AWL as an academic wordlist has been supported by its high coverage (10.0%) in academic corpus and low coverage (1.4%) in non-academic corpus (Coxhead, 2000).

Unlike the previous lists of academic words, the AWL compilation has some impressive features: first, it used consistent and comprehensive word selection principles to ensure the AWL items were the high-frequency ones across different academic disciplines. Second, the AWL was derived from an academic corpus established according to well-justified corpus-building principles such as representativeness and text variety (Biber, 1993), and the corpus was much larger than the previous academic corpora built for developing lists of academic words (e.g., Campion & Elley, 1971; Praninskas, 1972). Probably due to such compilation operations different from its precursors, when compared to the UWL, although the AWL contained fewer items than

the UWL (570 word families and 836 word families, respectively), the AWL provided higher lexical coverage (10.0%) than the UWL (9.8%) in Coxhead's (2000) academic corpus.

The AWL has achieved high lexical coverage in various academic corpora of previous studies. The AWL revealed high lexical coverage in different across-discipline academic corpora: 10% (Coxhead, 2000), 11.6% (Cobb & Horst, 2004), and 10.6% (Hyland & Tse, 2007). In a variety of discipline-specific academic corpora of prior studies, the AWL also provided high discipline-specific coverage: 10.073% (Chen & Ge, 2007), 11.96% (Khani &Tazik, 2013), 10.46% (Li & Qian, 2010), 9.96% (Valipouri & Nassaji, 2013), 11.17% (Vongpumivitch, Huang, & Chang, 2009), 11.3% (Ward, 2009). In the academic corpus made up of ESP and EFL (English as a Foreign Language) academic journal articles, the AWL achieved impressively high coverage: 14.89% (Shabani & Tazik, 2014). Taken together, the AWL continuously achieved around 10% lexical coverage in different academic corpora, which suggests its consistent relevance to (Coxhead, 2011) and validity for academic purposes.

The AWL has been an influential benchmark list of academic words (Coxhead, 2011). It has even been described as the "best list" (Nation, 2001, p.12). Over the past decade, the AWL has been extensively used in many aspects of English education and research: vocabulary testing (Nation, 2001; Schmitt, 2010; Schmitt, Schmitt, & Clapham, 2001), developing English course materials (Schmitt & Schmitt, 2005), creating wordlists for different discipline-specific purposes (e.g., Li & Qian, 2010; Valipouri, & Nassaji, 2013; Ward, 2009), compiling dictionaries (e.g., Longman Dictionary of Contemporary

English), developing corpus analysis software (Nation & Heatley, 2002; Anthony, 2014), and implementing academic English speech research (Murphy & Kandil, 2004).

Despite its well-recognized value, the AWL has its own limitations and has been criticized recently. Coxhead (2000) used West's (1953) GSL as the benchmark list to exclude general high-frequency words in the AWL compilation process. This exclusion operation was viewed as one limitation of the AWL compilation by some researchers (e.g., Cobb, 2010; Nation & Webb, 2011); even Coxhead (2011) herself admitted this operation might arouse controversies. Since the GSL is limited in range (Engels, 1968) and old in age (Richards, 1974), it may no longer represent the contemporary vocabulary (Dang, 2013; Nation & Webb, 2011; Richards, 1974). The AWL was inherently affected by the outdated state of the GSL, and whether the AWL can represent the current academic vocabulary becomes a question. For example, some studies noted that some AWL items occurred in recently-published general high-frequency wordlists (Cobb, 2010; Dang & Webb, 2014; Nation, 2004), which means these AWL items might be current general high-frequency words. In addition, the uneven distribution of the AWL across different disciplines has been recently pointed out by some researchers (Cobb & Horst, 2004; Hyland & Tse, 2007). For example, the AWL was criticized for not fully representing the medical discipline due to its low coverage (6.72%) in medical texts (Cobb & Horst, 2004), and for its bias towards commerce-oriented disciplines by reason of its rather high lexical coverage (12.0%) of commerce texts (Coxhead, 2000).Therefore, there has been a call for compiling wordlists for more precisely representing discipline-specific academic words to better satisfy discipline-specific learning purposes (e.g., Chen & Ge, 2007; Martinez, Beck, & Panza, 2009).

Over a decade after Coxhead, Gardner and Davies (2014) developed the AVL from a 120-million-token corpus across nine disciplines. The word selection principles were range, frequency, and dispersion. The AVL contains 3,015 lemma headwords and was later converted into 1,991 word families. The relevance of the AVL to academic purposes was argued due to the high coverage of its most frequent 570 word families in the COCA academic sub-corpus (13.8%) and in the BNC academic sub-corpus (13.7%), and relatively low coverage in non-academic corpora which are COCA newspaper sub-corpus (8.0%), COCA fiction sub-corpus (3.4%), BNC newspaper sub-corpus (7.0%), and BNC fiction sub-corpus (3.4%) (Gardner & Davies, 2014).

The AVL has some notable characteristics. Different from the AWL and all the other earlier predecessor lists, the AVL development corpus was far larger in size than all the previous corpora built for wordlist-compiling, which might imply the AVL has more validity and can represent academic English better. Second, both the lemma-headword AVL list and the word-family AVL list were compiled and freely available for learners' convenient uses. Third, according to Gardner and Davies (2014), in the COCA academic sub-corpus and in the BNC academic sub-corpus, the most frequent 570 AVL word families achieved much higher coverage (13.8% and 13.7%, respectively) than the AWL (7.2% and 6.9%, respectively), which was almost double the lexical coverage the AWL achieved.

The developing history of the academic wordlists revealed several points:

First, the above published lists of academic words demonstrated some similar features: the wordlists were compiled from a collection of academic texts; the wordlist items were selected according to certain principles, with frequency being the most often-

used criterion; the items were often organized into certain counting units, with word family being the most often adopted counting unit; and most of the lists excluded general high-frequency words with the help of certain general high-frequency wordlists such as the GSL for ensuring more relevance to academic purposes.

Second, the reported lexical coverage of the UWL, AWL, and the AVL in previous literature proved the significance of academic wordlists for academic study. In prior studies, on average, the UWL, AWL, and the AVL achieved around 9%, 10%, and 13% coverage respectively across various academic corpora (e.g., Chen & Ge, 2007; Coxhead, 2000; Gardner & Davies, 2014). Research has suggested that, generally, to understand an academic text demands 95%-98% lexical coverage (Laufer & Ravenhorst-Kalovski, 2010), which means a learner needs to know 95-98% of running words in the text. To meet this lexical coverage requirement, knowledge of the most frequent general service words such as the 2000 word families in the GSL may account for 80% (Nation, 2013), knowledge of technical words and infrequent words may account for 5% (Nation, 2013). The remaining 10-13% is very likely to be achieved by knowing an academic wordlist such as the UWL, AWL or the AVL because of the reported coverage of the three academic wordlists in academic texts.

Third, among all the published lists of academic words, the AWL and the AVL deserve further comparison. Primarily, it is because the early-made lists of academic words are currently out-dated and seldom in use; while the AVL was recently published and showed some promising compilation features, and the AWL has been the most influential list and is still widely used. Moreover, the AWL and the AVL have achieved higher lexical coverage (on average around 10% to 13%) in different academic corpora

than their predecessor (the UWL). Their high lexical coverage might imply they could be better lists of academic words and more valuable for in-depth research. As academic wordlists are important for academic success, a comparison between these two well-performing wordlists in order to reveal which list is more helpful for learners in academic study is very useful.

2.1.3 The AWL & the AVL

A comparative overview of the AWL and the AVL is presented below to display their specific features (as shown in Table 1).

Table 1. A Comparative Overview of the AWL and the AVL

Wordlists	AWL (Coxhead, 2000)	AVL (Gardner & Davies, 2014)
Publication Time	Published in 2000	Published in 2013
Counting Units	Word family	Lemma headword and word family
Number of Items	570 word families	3,015 lemma headwords and 1,991 word families
Academic Disciplines	4 disciplines: Arts; Commerce; Law; and Science.	9 disciplines: Education; Humanities; History; Social science; Law and political science; Science and technology; Medicine and health; Business and finance; Philosophy, religion, and psychology.

Corpus	3.5-million-token corpus	120-million-token corpus
Corpus Texts	Textbooks, laboratory tutorials, lecture notes, journal articles.	Academic journals, magazines, newspapers.
Target Audience	Academic English learners, especially, undergraduates.	Academic English learners.
General High-frequency Words	The GSL was eliminated from the list; some AWL words appeared in the recently-compiled general high-frequency wordlists (Cobb, 2010; Dang & Webb, 2014).	Some GSL items appeared in the list (p.317-320).
Word Selection Principle	Range, frequency, and specialized occurrence: at least 10 occurrences in each of the 4 disciplines and in at least 15 of the 28 subject areas, at least 100 times of occurrence in the corpus, and the exclusion of the GSL (Coxhead, 2000, p.221).	Range, frequency and dispersion: at least 50% higher in frequency in academic corpus than in non-academic corpus; at least 20% of the expected frequency in at least 7 of the 9 academic disciplines; a dispersion of at least 0.80 (Gardner & Davies, 2014, p.313-316).

Illustrated by the above table, the two lists share some similarities such as being developed from across-discipline corpora, being intended for academic English learners,

and the occurrence of general high-frequency words in the lists. However, differences between the AWL and the AVL are also conspicuous: First, they contain different numbers of items in different counting units. The AWL used word family as counting unit and contains 570 word families, while the AVL was primarily lemma-based (3,015 lemma headwords) and was later converted to word families (1,991 word families) by its authors. The AVL is 2.49 times longer than the AWL. Second, the AVL was based on a larger corpus (120-million-token) than the AWL (3.5-million-token corpus). Third, the AWL development corpus was across four disciplines, whereas the AVL development corpus was across nine disciplines. Fourth, The AWL excluded the GSL words at the outset; the AVL did not exclude the GSL and some GSL items appeared in the AVL (e.g., *above, account,* and *active*).

2.1.4 Previous Comparisons

To the best of my knowledge, there have been only two previous comparisons between the AWL and the AVL.

The most recent comparison study between the AWL and the AVL was made by Hartshorn and Hart (2015), which did not examine the lexical coverage of the two lists in any corpus, but focused on ESL (English as Second Language) learners' feedback on using the two lists and found a 31.05% overlap shared by the AWL and the AVL. Thus, no lexical coverage information concerning the AWL and the AVL was provided by their comparison study.

The only previous corpus-based comparison of the lexical coverage provided by the AWL and the AVL was made by Gardner and Davies (2014), which was part of the development study of the AVL. They compared the top 570 AVL word families with

Coxhead's (2000) AWL 570 word families in the COCA academic sub-corpus and the BNC academic sub-corpus. The result was that the top AVL 570 word families achieved higher lexical coverage (13.8% and 13.7%, respectively) than the AWL 570 word families (6.9% and 7.2%, respectively) in the two corpora. Therefore, the AVL was claimed to be better.

However, such lexical coverage resulting from Gardner and Davies' (2014) comparison study may not be valid enough because the higher lexical coverage of the top 570 AVL word families might be due to their containing some GSL words that the AWL had excluded. According to the AVL word family list (Gardner & Davies, 2014), the top 570 AVL word families included 220 GSL word families that accounted for 38.60% of the top 570 AVL word families, while the AWL excluded those GSL words at the outset. The GSL words included in the top 570 AVL word families contributed to the high lexical coverage of the top 570 AVL word families because the GSL words are general high-frequency words occurring most frequently in texts (Nation, 2001) and can achieve higher lexical coverage in the corpora than the same number of academic words. As a result, the higher lexical coverage of the top AVL 570 word families compared to the AWL 570 word families could be owing to the inclusion of these GSL words, and the comparison result hence became unfair to the AWL.

Besides, some basic features of the AWL and the AVL seem to have been neglected in Gardner and Davies' (2014) comparison study.

First, the target audience of the AWL and the AVL are academic English learners, especially undergraduates involved in English-medium instruction. Determined by this feature, the corpus which serves as the comparison basis for checking the lexical

coverage of the AWL and the AVL should be made up of academic texts used for the shared target audience (undergraduates). However, Gardner and Davies used the already available online corpora (the BNC academic sub-corpus and the COCA academic sub-corpus) to compare the lexical coverage of the AWL and the AVL. The source texts of these two corpora had not been ensured to be the ones definitely encountered by the intended academic English learners of the AWL and the AVL. Therefore, the comparison result might be inadequate to display which list more validly works for their target audience in real educational settings.

Second, the AWL and the AVL were compiled from academic texts across different disciplines. The discipline-specific coverage of the AWL and the AVL might also need to be compared to reveal the distribution of the AWL and the AVL across disciplines, and how helpful they could be for students' academic study in different disciplines. However, the discipline-specific coverage of the AWL and the AVL were not presented in Gardner and Davies' (2014) comparison.

Third, the AWL and the AVL are different in size. The AVL contains 1,991 word families, and the AWL contains 570 word families. Since the lexical coverage of a wordlist is closely related to the number of items it contains (Dang & Webb, 2015), the different list-lengths of the AWL and the AVL raise one problem in academic wordlist comparison: What kind of lexical coverage provided by the two academic wordlists is to be compared? To date, several kinds of lexical coverage have been used as criteria to compare various wordlists (Dang & Webb, 2015), such as coverage provided by all the items contained in the wordlists (e.g., Brezina & Gablasova, 2013; Coxhead, 2000; Li & Qian, 2010), and average coverage of different wordlists (Dang & Webb, 2015; Nation &

Hwang, 1995). Dang and Webb (2015) noted the longer list could be favoured when coverage of all the wordlist items was the evaluation criterion, and the shorter list could be favoured when average coverage was the evaluation criterion. In the previous wordlist evaluations involving academic wordlists, most studies used coverage of all the wordlist items as the comparison criterion (e.g., Coxhead, 2000; Hyland & Tse, 2007); and to the best of my knowledge, no prior studies used average coverage. In addition, only one previous study (Gardner & Davies, 2014) used coverage provided by the same number of items in different wordlists as the evaluation criterion. In the present study, if the sum of the lexical coverage achieved by all the wordlist items contained in the AWL and the AVL were used as the comparison criterion, the general picture of the two lists would be displayed, but the longer list (the AVL) would be favoured. If average coverage which would be obtained by averaging the coverage achieved by the AWL and the AVL with the number of items the AWL and the AVL respectively contain were the comparison criterion, the value of each item of the lists would be demonstrated, but the shorter list (the AWL) could be favoured. Moreover, Gardner and Davies (2014) only compared the most frequent 570 AVL word families with the AWL 570 word families, which realized an evaluation of the two lists in their same number of items. However, only using the best part of the AVL to compare with the AWL might not be able to reflect a whole picture of the AVL and might not be fair to the AWL. Thus, owing to the features of different kinds of lexical coverage, in addition to comparing the AWL and the AVL in the way that Gardner and Davies (2014) did, the coverage provided by the AWL and the AVL at their full length and the average coverage provided by each word family of the two lists might also need to be compared for more validity of comparison.

Fourth, both the AWL and the AVL used frequency as the major word selection criterion (Coxhead, 2000; Gardner & Davies, 2014); however, no previous comparison including Gardner and Davies' (2014) evaluation study has ever investigated the distribution of the AWL and the AVL at different word-frequency levels. For precisely comparing the lexical coverage of the AWL and the AVL, it should be necessary to identify how many items of the AWL and the AVL are contained at each word-frequency level, because the more high-frequency items a wordlist contains, the higher coverage this wordlist may achieve; the more items at a certain word-frequency level a wordlist includes, the higher coverage this wordlist accomplishes at this particular word-frequency level. For example, if there are two 100-item wordlists for comparison: the first list has 80 items at the 1st 1,000 word frequency level and the remaining 20 items at the 2nd 1,000 word-frequency level, while the second list has 50 items at the 1st 1,000 word-frequency level and the rest 50 items at the 2nd 1,000 word-frequency level, the first list will achieve higher lexical coverage than the second list at the 1st 1,000 word-frequency level, but the second list will provide higher lexical coverage than the first list at the 2nd 1,000 word-frequency level, however, the coverage of the first list at the two 1,000 word-frequency levels will be higher than that of the second list. Thus, the number of wordlist items at each word-frequency level is assumed to impact the comparison result of the AWL and the AVL in lexical coverage. Identifying the AWL and the AVL items at each word-frequency level should contribute to the accurate examination of their lexical coverage difference. The resulting picture on the distribution of the AWL and the AVL items at different word-frequency levels is the lexical frequency profiles of the AWL and the

AVL. Lexical frequency profile (Laufer & Nation, 1995) has been viewed as a valid way to discriminate various texts at different word-frequency levels.

Fifth, the target audience of the AWL and the AVL could be varied in their lexical size; however, Gardner and Davies (2014) did not indicate how well the AWL and the AVL worked for learners with different word-frequency levels of lexical sizes. This aspect of comparison should be made because some AWL items have been found appearing at the 1st 1,000 and the 2nd 1,000 word-frequency levels of some recently-published wordlists (Cobb, 2010; Dang & Webb, 2014). The same issue could also happen to the AVL since it contains some GSL words and the GSL words are usually distributed at the 1st 1,000 and the 2nd 1,000 word-frequency levels. The occurrence of a certain number of the AWL items and the AVL items at the 1st 1,000 and the 2nd 1,000 word-frequency levels could mean learners with these two frequency levels of lexical sizes, might only need part of the AWL and the AVL, in other words, they might not need the full support from the AWL and the AVL. For example, Cobb (2010) reported 82 AWL word families occurred at the 1st 1,000 word-frequency level of Nation's (2006) BNC word family list. This means learners with the lexical size of the BNC 1st 1,000 word families have already mastered these 82 AWL word families and the actual support provided by the AWL to these learners is from the remaining 488 (570 − 82 =488) AWL items. However, to date, no previous study has exactly clarified the distribution of the AWL and the AVL at each 1,000 word-frequency level and how much support the AWL and the AVL can provide for learners with different word-frequency levels of lexical sizes. Therefore, based on the lexical frequency profiles of the AWL and the AVL, it is essential to investigate how much lexical coverage the AWL and the AVL provide at

each 1,000 word-frequency level, especially when the AWL and the AVL are made of the same number of items. The purpose is to reveal how helpful the AWL and the AVL can actually be to learners with different word-frequency levels of lexical sizes.

In short, in terms of using an independent comparison corpus, various types of lexical coverage, and the items distributed at different word-frequency levels, no previous corpus-based study has ever done a valid and comprehensive enough comparison between the AWL and the AVL.

2.1.5 Summary

To sum up, based on the above literature review, lists of academic words are important for academic success and comparing different academic wordlists to figure out a better list should be meaningful. The comparison between the AWL and the AVL is significant because of the long-term influence of the AWL and the promisingly innovative features of the AVL. Since the previous comparisons between the AWL and the AVL were inadequate to demonstrate which list provided higher lexical coverage in academic texts, it is still not clear which list could provide more support for learners' comprehending academic texts. Since no previous comparison corpora were made up of university academic texts, it is unclear which list could provide more support for undergraduates' comprehending university academic texts in real educational settings. Therefore, the present comparison study that aims to exhibit which list achieves higher lexical coverage in university academic texts and how much lexical coverage these two lists provide for learners with different vocabulary sizes should be significant to be carried out.

2.2 Theoretical Framework

The above Literature Review section indicates the necessity of a new comparison between the AWL and the AVL. This section describes the theoretical framework for this comparison study. To date, there has been no established theoretical framework specially oriented for wordlist evaluation. However, two vocabulary research paradigms informed and supported this comparison study as conceptual tools: computer-assisted vocabulary load analysis (Webb & Nation, 2013) and lexical frequency profile (Laufer & Nation, 1995).

2.2.1 Computer-assisted Vocabulary Load Analysis

Computer-assisted vocabulary load analysis refers to using computer software "to determine the representation and frequency of words in text" (Webb & Nation, 2013, p.844). It can provide information about the nature of the vocabulary in the text, the useful words in a text for comprehension, and the lexical size of learners (Webb & Nation, 2013).

Previous studies used this conceptual tool to analyze different types of texts to determine the lexical size required for comprehension (Hirsh & Nation, 1992; Nation, 2006; Webb & Rodgers, 2009), to determine the value of a group of words for comprehension of certain texts (Webb, 2010), and to examine the coverage provided by different wordlists in different corpora (e.g., Brezina & Gablasova, 2013; Coxhead, 2000; Gardner & Davies, 2014).

This conceptual tool is applicable to the present study. The purpose of this study is to compare the usefulness of the AWL and the AVL for learners' comprehending university academic texts. To realize this research purpose, two perspectives are

necessary to be examined concerning the two wordlists. One is to what extent the AWL and the AVL represent the university texts, another is to what extent the two wordlists can support learners with different lexical sizes in comprehending university academic texts. The first examination is focused on comparing the representation (i.e., coverage) of the two wordlists in university academic texts. Since computer-assisted vocabulary load analysis can provide coverage of wordlists in texts for wordlist-assessment, it is the appropriate paradigm in which this wordlist comparison study could be situated. Examining the second research perspective needs profiling the lexical frequency of the AWL and the AVL items to check their suitability for learners with different lexical sizes. The conceptual framework used for profiling the lexical frequency of words in the AWL and the AVL is explained below.

2.2.2 Lexical Frequency Profile

Lexical Frequency Profile (LFP) is a system developed by Laufer and Nation (1995) to evaluate students' vocabulary knowledge through analyzing texts with the help of computer technology. It can show how many words a learner uses at different word-frequency levels. Thus, it can indicate learners' lexical size and to what extent learners use their vocabulary knowledge (Laufer & Nation, 1995). It clarifies the relationship between lexical size and lexical frequency by categorizing words contained in a learner's text into different lexical frequency layers. Hence, the LFP can illustrate the lexical content of a text with lexical frequency labels and can evaluate to what extent the text reflects learners' lexical knowledge and suits learners with a specific frequency level of lexical size (Laufer & Nation, 1995). Previous studies have supported its value as a

theoretical tool for lexical analysis (e.g., Laufer, 2005) which can provide an objective and detailed word-frequency picture of different words in a text (Laufer & Nation, 1995).

Following the LFP system, another perspective of examining the AWL and the AVL is to investigate to what extent the two wordlists can support learners with different lexical sizes in comprehending university academic texts. The focus is placed on word frequency. To fulfill this examination, the distribution of the AWL and the AVL items at each word-frequency level needs to be profiled, so that the support the AWL and the AVL contribute to learners who have different frequency levels of lexical sizes could be analyzed.

Since lexical frequency profiling can classify all the words in a text into categories of frequency, conceptualized in the system of the LFP, the AWL and the AVL can be viewed as texts in the LFP. Therefore, lexical items in the AWL and the AVL can be sorted into different frequency categories and each individual item of the AWL and the AVL will be given its own word-frequency label. Moreover, since the LFP can measure students' lexical knowledge reflected in a text (Laufer & Nation, 1995), the assumption for following the LFP system to evaluate the AWL and the AVL is that it should be able to show the impact of learners' AWL and AVL knowledge on their comprehension of texts. Together with the theoretical tool of the computer-assisted vocabulary load analysis which can indicate the coverage of a group of words, the coverage of the AWL and the AVL items distributed at each frequency level could be illustrated. As a result, to what extent the items of the AWL and the AVL distributed at different frequency levels can support learners with different frequency levels of lexical sizes can be decided.

2.2.3 Summary

To sum up, the computer-assisted vocabulary load analysis and the LFP are used as conceptual tools for this study. Since these two theoretical tools were not directly related to evaluating different wordlists, they need necessary development and adjustment to satisfy the research needs of this study. Combining these two theoretical tools together into a computer-assisted vocabulary analysis framework should be meaningful to the purpose of comparing the AWL and the AVL in this study, because, based on this combined framework, the following information necessary for evaluating the AWL and the AVL could be obtained and analyzed: the word frequency of the AWL and the AVL items, the representation of the AWL and the AVL in university academic texts, and the supportive coverage the AWL and the AVL provide for learners with different frequency levels of lexical sizes. The advantage of this computer-assisted vocabulary analysis framework is that it can allow researchers to analyze a large number of lexical items and texts within a short time (Webb & Nation, 2013) and it can ensure more objectivity of research results (Laufer & Nation, 1995). In the next chapter, specific methodological details are described.

Chapter Three Methodology

This chapter starts with a description of the corpus-based research design, and then presents an account of the specifics for conducting the study.

3.1 Corpus-based Approach

This study followed a corpus-based approach. The corpus-based approach has been taken by many previous wordlist comparison studies to examine the lexical coverage of different wordlists (e.g., Coxhead, 2000; Gardner & Davies, 2014; Nation, 2004). A corpus is a collection of authentic academic texts to represent aspects of a language (Sinclair, 2004). It is a valuable empirical basis for investigating language features (Biber, Conrad, & Reppen, 1994). Lexical coverage, a percentage of known words in a text (Waring & Nation, 1997), can indicate the vocabulary size necessary for textual comprehension (Schmitt et al., 2011). In a corpus-based approach for wordlist comparison, the lexical coverage a particular wordlist achieves in a corpus is the proportion of words in the corpus covered by the items of a given wordlist. This wordlist lexical coverage can demonstrate to what extent the knowledge of a particular word list contributes to comprehension of the texts included in the corpus. The benefit of a corpus-based approach is that it allows for more reliable and empirical linguistic investigations, and can provide more generalizable and valid research results (Biber, 2012).

Conventionally, two main parts comprised the corpus-based approach used in previous comparison studies (e.g., Coxhead, 2000; Gardner & Davies, 2014; Nation, 2004): What corpus was used as the comparison basis? And what type of lexical coverage was used as comparison criterion? With regards to the specific features of the AWL and

the AVL, the corpus-based approach in the present study was designed in the following way for the validity of comparison.

First, coverage provided by all the items of the AWL and the AVL, coverage provided by each item of the AWL and the AVL, and coverage provided by the AWL and the AVL when they were made of the same number of items, were the comparison criteria in the present study. Comparing the coverage of the AWL and the AVL at their full length in the whole corpus and in each discipline-specific sub-corpus was intended to acquire a general picture of their performance in academic texts and discipline-specific academic texts. Comparing the average coverage of the AWL and the AVL in the whole corpus and each discipline-specific sub-corpus was done in order to check the value of each word family they contained for comprehending academic texts and discipline-specific academic texts. Comparing the coverage provided by the AWL and the AVL when they were made of the same number of items was to ensure more fairness in the comparison result because these two lists were originally in different lengths.

Second, an independent corpus has been developed as the comparison basis. Many previous wordlist comparison studies used online already-available corpora (e.g., Brezina & Gablasova, 2013; Gardner & Davies, 2014) or the development corpora of the wordlists (e.g., Coxhead, 2000) to evaluate different wordlists. However, for a more valid and more objective assessment of different wordlists, an independent corpus might need to be compiled as the comparison basis, since Dang and Webb (2015) suggested the corpus used for wordlist-evaluation should not be the corpora the wordlists were derived from. Moreover, in the present study, it is proposed that the comparison corpus should be developed from the texts the target audience of the wordlists use. Thus, considering that

the shared target audience of the AWL and the AVL are undergraduates of English-speaking universities, the independent corpus in this study would be made up of university academic course texts undergraduates encounter so that more validity of comparison could be warranted. The corpus would be also organized into several discipline-specific sub-corpora for checking the coverage of the AWL and the AVL in academic texts from different disciplines.

Third, profiling the AWL and the AVL at different vocabulary frequency levels is useful. Since both the AWL and the AVL were compiled according to word frequency, illustrating the distribution items of the AWL and the AVL at each lexical frequency level, and the coverage of the AWL and the AVL items distributed at each lexical frequency level in the corpus should enable the study to more precisely display the performance of the two lists in detail. Based on these profiles, further comparing the lexical coverage provided by the same number of the AWL and the AVL items at different word-frequency levels would become possible. The comparison results should be able to answer which list could be more helpful for learners with different frequency levels of lexical sizes.

In short, the corpus-based research approach for the present study entailed examining multiple types of lexical coverage provided by the AWL and the AVL in an independently-created corpus, and forming the lexical frequency profiles of the two lists to check how much support the lists could provide for learners with various lexical sizes.

3.2 Materials

This section describes the material components involved in this study and how they have been developed for this study.

3.2.1 The Wordlists

The source wordlists used in this study were the AWL (570 word families) and the AVL (1,991 word families). The AVL also has its lemma-headword version provided by its authors. However, since the AWL does not have a lemma-based version, and the comparison of wordlists should be carried out between lists in the same counting unit to ensure valid results (Schmitt, 2010), the present study chose the word-family AWL and the word-family AVL to compare.

To compare the lexical coverage provided by the AWL and the AVL when they contain the same number of word families, the AVL570 list was identified through selecting the most frequent 570 AVL word families from the whole-length AVL (1,991 word families) according to the word-family frequency ranking information provided by Gardner and Davies (2014). These 570 word families should be able to represent the most valuable part of the AVL because they are the most frequent ones.

3.2.2 The University Academic Corpus

The University Academic Corpus (see Table 2) was independently developed from 850 academic written texts across ten disciplines in English-medium universities by me. It contained approximately 72-million tokens in total, with 67 million tokens derived from 476 textbooks and 4.7 million tokens derived from 374 non-textbook texts (e.g., lecture notes, professional standards, academic journal articles, governmental and organizational documents, and legal cases and acts). All the texts were listed in the recently-published university course outlines from eight Canada's universities (i.e., UWO, McMaster, Carleton, UBC, Waterloo, York, Calgary, and Lakehead). The corpus included ten discipline-specific sub-corpora. The number of tokens in each discipline-

specific sub-corpus ranged from 2 million to 18 million tokens. All the source texts were deleted once the corpus was built up.

Table 2. The University Academic Corpus

Disciplines	Size (token)	Content			
		Textbooks		Non-textbook Texts	
		Size (token)	Number of Texts	Size (token)	Number of Texts
Arts and Humanities	9,090,864	8,934,242	91	156,622	25
Business	6,603,953	6,400,281	24	203,672	15
Education	4,238,149	2,059,511	19	2,178,638	97
Engineering	10,808,397	10,570,878	54	237,519	34
Health and Medicine	5,578,689	5,523,187	24	55,502	11
Law	3,794,916	3,146,191	19	648,725	55
Information and Media Studies (IMS)	2,705,275	2,593,538	19	111,737	13
Music	2,095,189	2,095,189	18	N/A	N/A
Science	8,353,771	8,257,446	39	96,325	10
Social science	18,761,539	17,758,518	169	1,003,021	114
Total	72,030,742	67,338,981	476	4,691,761	374

Table legend: N/A means there is no such information available.

This corpus was built according to corpus-building principles. The main details of developing this corpus are presented below.

Representativeness

Representativeness determines the generalizability of research findings and is defined by what aspect of a language the corpus will represent and what target audience the corpus will suit (Biber, 1993). The texts used for compiling the corpus should represent the varieties of texts encountered by the target audience (Atkins, Clear, & Ostler, 1992; Biber, 1993) such as different lengths or genres of texts. Following these principles, to represent the academic vocabulary encountered by the target audience (undergraduates) of the AWL and the AVL, the corpus in this study was made up of course texts listed in the recently-published university course outlines. All the texts were in different genres and in different lengths (ranging from 449 tokens to 256,378 tokens).

Size

The size of the corpus is important (Coxhead & White, 2012) because a large enough corpus guarantees the frequent occurrences of words (Coxhead, 2000). The issue of size in corpus design relates to not only the number of tokens but also the number of texts from diverse categories (Biber, 1993). The well-accepted minimum size of a valid corpus is one million tokens (Brysbaert & New, 2009). However, the corpora built for recent wordlist studies tend to be large in size for more representativeness and in-depth examination (e.g., Brezina & Gablasova, 2013; Gardner & Davies, 2014). Biber (1990) suggested that ten texts represented one genre or category well for many grammatical features. Thus, in this study, the corpus contained 72 million tokens from 850 different texts across ten disciplines. The size of each discipline-specific sub-corpus was at least

two million tokens. Each discipline-specific sub-corpus included at least ten texts for each genre and all the texts were written by different authors.

Organization

Since the AWL and the AVL are both lists of academic words across different disciplines, the corpus should be composed of academic texts from different disciplines. However, it is hard to absolutely define academic disciplines since they are ever-developing and ever-changing in their content and classification. In fact, different corpus-developers defined their disciplines included in their corpora differently (e.g., Coxhead, 2000; Gardner & Davies, 2014; Hyland & Tse, 2007). Although some classification efforts of subject matters have been attempted by researchers (e.g., Chismore & Hill, 1978) or national offices (e.g., Statistics Canada, 2011) to suggest a standardized categorization of academic disciplines, in reality, few universities completely follow these discipline categorizations because of their own developing histories, high autonomy and research foci (Jones, 2002; Tudiver, 1999). In the present study, since the research purpose was to check the distribution of the AWL and the AVL in real university instructional discourses across different disciplines, the key factor for the discipline structure of the corpus was to ensure its current authenticity. Therefore, the existing discipline-structure of one English-medium university (i.e, Western University in Canada) was sampled as an empirical basis for organizing the texts to compile the corpus. The reason for choosing Western University was due to the familiarity with its discipline set-up and the ensured accessibility of instructional e-texts (Barnbrook, 1996) for corpus-building.

Comparing the University Academic Corpus with Previous Corpora

To further check the validity of the University Academic Corpus as a comparison basis for the AWL and the AVL, comparing the University Academic Corpus with the previous academic corpora became necessary. To date, no independent corpus made up of university course materials has been used for comparing the AWL and the AVL or evaluating the AVL, thus, the comparison could only be made with the previous corpora which were compiled from university-level course materials for evaluating the AWL (as shown in Table 3).

Table 3. Previous Corpora Composed of University-level Course Materials for Evaluating the AWL

Author	Disciplines	Size (token)	Texts	Source
Coxhead (2000)	Arts, Commerce, Law, and Science.	3.5 million	Textbooks, laboratory tutorials, lecture notes, journal articles.	one university of New Zealand.
Hyland & Tse (2007)	Science, Engineering, and Social sciences.	3.3 million	210 research articles, 49 textbook chapters, 140 academic book reviews, 45 scientific letters, 8 master's theses, 6 doctoral Dissertations, 8 undergraduate project theses.	N/A
Ward (2009)	Engineering	271,000	25 undergraduate engineering textbooks	N/A
Hsu (2013)	Medicine	15 million	155 medical textbooks	medical e-book databases

Table legend: N/A means there is no such information clearly provided by the authors of these publications.

As shown in Table 3, in the last fifteen years, two academic corpora were purely derived from textbooks (Hsu, 2013; Ward, 2009), but were limited to the engineering discipline (Ward, 2009) and the medicine discipline (Hsu, 2013). The textbooks of Hsu's (2013) corpus were not guaranteed to be the ones undergraduates used. Ward's (2009) corpus was made up of textbooks used by undergraduates, but was small in size. Unlike Hsu's (2013) and Ward's (2009) corpora, Coxhead's (2000) corpus and Hyland and Tse' (2007) corpus were across different disciplines and varied in text genres. The corpus size was fairly large. However, their discipline set-up of the corpus seemed rather random because no theoretical or empirical basis was stated regarding their discipline set-up. Besides, whether the material texts used for their corpus-building were the ones undergraduates used in their academic study remained inexplicit (Coxhead, 2000; Hyland & Tse, 2007).

In short, compared with the previous academic corpora made up of university-level course materials for researching the AWL, this corpus was larger in size, more varied in text genres, and across more academic disciplines, hence, it might be able to provide a broad and reliable basis for representing current university academic English, and for comparing the AWL and the AVL.

3.3 Analysis

3.3.1 The Range Program

The Range program (Nation & Heatley, 2002) is a freely downloadable computer program (http://www.victoria.ac.nz/lals/about/staff/paul-nation) and was used for analysis in this study. It can list the words occurring in a text according to word frequency. For this study, the latest version of the Range program incorporated with Nation's (2012)

BNC/COCA25000 lists as baseword lists was downloaded for analyzing the AWL and the AVL in the corpus. Nation' s (2012) BNC/COCA25000 lists contain 29 lists in total: 25 word-family lists compiled based on frequency and range of occurrence of words, and four additional lists of proper nouns, marginal words, transparent compounds, and abbreviations.

Together with Nation's (2012) BNC/COCA25000 lists as baseword lists, Range can display at each 1,000 word frequency level (ranging from the 1st 1,000 to the 25th 1,000) how many items of the AWL and the AVL occur. In other words, Range can provide lexical frequency profiles of the AWL and the AVL from the 1st 1,000 word-frequency level to the 25th 1,000 word-frequency level within the standardized framework of the BNC/COCA25000. The AWL and AVL items that are proper nouns, marginal words (e.g., interjections and exclamations), transparent compounds (e.g., *afterthought*) and abbreviations would be displayed in the four additional BNC/COCA wordlists. The AWL and AVL items that do not belong to any of the 29 BNC/COCA wordlists could be demonstrated in the section of 'Not in the lists' of the Range output. Through replacing these BNC/COCA baseword lists with the AWL and the AVL in the Range program, and then running the University Academic Corpus through Range, the lexical coverage of the AWL and the AVL in the University Academic Corpus can be obtained. In addition to lexical coverage, Range output can also provide information of frequency, word families, tokens, and word types in each wordlist.

Two reasons accounted for choosing Range as the analysis program in this study. First, it was due to the stable performance of Range in many previous wordlist studies (e.g., Coxhead, 2000; Gardner & Davies, 2014). In these studies, Range has been used to

provide information on lexical coverage and lexical frequency of academic wordlists in different corpora (e.g., Cobb, 2010; Coxhead, 2000; Dang, & Webb, 2014; Gardner & Davies, 2014). Second, the corpus compiled for the present study was fairly large (72-million tokens) and the analysis speed needed to be fast. After checking the processing speed of Range against that of another program named AntWord (Anthony, 2014), Range was chosen in the end.

3.3.2 Procedure

To obtain the coverage provided by the AWL and the AVL in the University Academic Corpus, the corpus was run through Range with the AWL and the AVL in turn serving as the baseword list in the Range program. To calculate the average coverage provided by the AWL and the AVL in the University Academic Corpus, the coverage of the AWL and the AVL was divided by the number of items contained in each list. For example, the coverage provided by the AWL in the corpus was 9.15% after running the corpus through Range with the AWL as the baseword list; and the average coverage of the AWL was obtained by averaging its achieved coverage (9.15%) with its number of word families (570): 9.15% ÷ 570 = 0.0161%.

Likewise, to obtain the coverage provided by the AWL and the AVL in each discipline-specific sub-corpus of the University Academic Corpus, each discipline-specific sub-corpus was run through Range with the AWL and the AVL in turn serving as the baseword list. To calculate the average coverage provided by the AWL and the AVL in each discipline-specific sub-corpus, the coverage of the AWL and the AVL in each discipline-specific sub-corpus was divided by the number of items contained in each list. For example, the coverage provided by the AWL in the Business sub-corpus was 12.06%

after running the Business sub-corpus through Range with the AWL as the baseword list; and the average coverage of the AWL in the Business sub-corpus was obtained by dividing the AWL Business-specific coverage (12.06%) by its number of word families (570): 12.06% ÷ 570 = 0.021162%.

To profile the AWL and the AVL at each lexical frequency level, the AWL and the AVL were run through Range as the texts with Nation's (2012) BNC/COCA25000 lists (totally 29 lists) as the baseword lists in the Range program. The Range output would indicate how many word families of the AWL and the AVL were distributed at different 1,000-word lexical frequency levels defined by the 25 BNC/COCA 1,000 word family lists. This distribution information formed the lexical frequency profiles of the AWL and the AVL. Besides, the Range output would also show how many word families of the AWL and the AVL were distributed in each of the BNC/COCA additional lists and in the 'Not in the list' section of the Range output.

To obtain the coverage achieved by the AWL and the AVL at each lexical frequency level, the word families of the AWL identified at the same lexical frequency level were reorganized into an individual sub-list. The same would be also done with the AVL word families identified at the same lexical frequency level. Then, the University Academic Corpus was run through Range as text with the above obtained AWL sub-lists and AVL sub-lists in turn serving as the baseword lists in the Range program. The Range output would display the lexical coverage provided by every frequency-specific sub-list of the AWL and the AVL. For example, at the 1st 1,000 word frequency level, there were 197 AVL items, these 197 AVL items were collected into a sub-list of the AVL for the 1st 1,000 frequency level, and served as the baseword list in the Range program. The Range

output showed this AVL sub-list achieved 10.94146% coverage in the University Academic Corpus. Just in the same way, the coverage information of each AVL sub-lists and each AWL sub-list ranging from the 1st 1,000 word-frequency level to the 25th 1,000 word-frequency level was obtained.

To attain the coverage achieved by the AWL and the AVL570 at each lexical frequency level needed three steps. First, the AWL and the AVL570 were run through Range as the texts with Nation's (2012) BNC/COCA25000 lists (totally 29 lists) as baseword lists in the Range program. The Range output would indicate how many word families of the AWL and the AVL570 were distributed at different 1,000-word lexical frequency levels. As a result, the lexical frequency profiles of the AWL and the AVL570 were formed. Second, the word families of the AWL identified at the same lexical frequency level were reorganized into an individual sub-list, and the same would be also done with the AVL570 word families identified at the same lexical frequency level. Third, the University Academic Corpus was run through Range as text with each AWL frequency-specific sub-list and each AVL570 frequency-specific sub-list in turn serving as the baseword list in the Range program. The lexical coverage provided by the AWL sub-lists and the AVL570 sub-lists at different word-frequency levels in the University Academic Corpus would be illustrated by the Range output.

With regards to the AWL items, AVL items, and the AVL570 items occurring in the four BNC/COCA additional lists and in the 'Not in the lists' section of the Range output, their coverage in the University Academic Corpus was obtained in the same way.

Finally, all the results obtained from the Range program in the above procedures would be further compared to answer the corresponding research questions.

Chapter Four Results and Discussion

This chapter presents the research results and discussion in response to each research question.

4.1 Results

Table 4 shows the coverage provided by the AVL and the AWL in the University Academic Corpus and in each discipline-specific sub-corpus. The coverage provided by the AVL was higher than the AWL. Coverage ranged from 18.12% to 26.17% in the different disciplines for the AVL and from 5.78% to 12.06% for the AWL. In the whole University Academic Corpus, the coverage provided by the AVL (23.06%) was 2.52 times as high as the coverage provided by the AWL (9.15%). In each discipline-specific sub-corpus, the AVL also provided higher coverage than the AWL. The biggest gap in discipline-specific coverage between the AWL and AVL occurred in the Arts and Humanities sub-corpus: the Arts and Humanities coverage of the AVL (18.23%) was 3.15 times as high as that of the AWL (5.78%). The smallest gap in discipline-specific coverage between the AVL and AWL occurred in the Business sub-corpus: the Business coverage of the AVL (26.11%) was 2.17 times as high as that of the AWL (12.06%).

The AWL achieved its highest discipline-specific coverage in the Business sub-corpus (12.06%), its second highest discipline-specific coverage in the Engineering sub-corpus (11.06%), and its third highest discipline-specific coverage in the Education sub-corpus (10.75%). The AVL also achieved its top discipline-specific coverage in these three sub-corpora, but its Education coverage (26.17%) ranked first, its Engineering coverage (26.13%) ranked second, and its Business coverage (26.11%) ranked third.

Interestingly, both the AWL and the AVL achieved low discipline-specific coverage in the same sub-corpora: Information and Media Studies (6.67% and 18.12%, respectively), Music (6.92% and 20.38%, respectively), and Arts and Humanities (5.78% and 18.23%, respectively), although the AWL achieved its lowest discipline-specific coverage in the Arts and Humanities sub-corpus (5.78%), while the AVL achieved its lowest discipline-specific coverage in the IMS sub-corpus (18.12%).

Table 4. Coverage of the AVL and the AWL.

Disciplines	AVL coverage	AWL coverage	AVL coverage/AWL coverage
Arts and Humanities	18.23%	5.78%	3.15
Business	26.11%	12.06%	2.17
Education	26.17%	10.75%	2.43
Engineering	26.13%	11.06%	2.36
Health and Medicine	23.14%	9.17%	2.52
Law	23.18%	9.02%	2.57
Information and Media Studies (IMS)	18.12%	6.67%	2.72
Music	20.38%	6.92%	2.95
Science	22.59%	8.80%	2.57
Social science	22.85%	9.00%	2.54
Complete University Academic Corpus	23.06%	9.15%	2.52

Table 5 presents the average coverage provided by the AWL and the AVL in the University Academic Corpus and in each discipline-specific sub-corpus. In the University Academic Corpus, the average coverage provided by the AWL (0.0161%) was 1.39 times as high as the average coverage provided by the AVL (0.0116%). In each discipline-specific sub-corpus, the AWL also provided higher average coverage than the AVL. Average coverage ranged from 0.010147% to 0.021162% in the different disciplines for the AWL and from 0.009101% to 0.013146% for the AVL. The biggest gap in average coverage between the AVL and AWL occurred in the Business sub-corpus in which the average coverage of the AWL (0.021162%) was 1.61 times as high as that of the AVL (0.013116%). The smallest gap in average coverage between the AVL and AWL occurred in the Arts and Humanities sub-corpus in which the average coverage of the AWL (0.010147%) was 1.11 times as high as that of the AVL (0.009157%). The AWL achieved its highest discipline-specific average coverage (0.021162%) in the Business sub-corpus, its second highest discipline-specific average coverage in the Engineering sub-corpus (0.019410%), and its third highest average coverage in the Education sub-corpus (0.018860%). Similarly, in these three sub-corpora, the AVL achieved its top discipline-specific average coverage: its Education average coverage ranked first (0.013146%), its Engineering average coverage ranked second (0.013123%) and its Business average coverage ranked third (0.013116%). Both the AWL and the AVL achieved low discipline-specific average coverage in the IMS sub-corpus (0.011700% and 0.009101%, respectively), the Music sub-corpus (0.012133% and 0.010235%, respectively) and the Arts and Humanities sub-corpus (0.010147% and 0.009157%, respectively). However, the AWL achieved its lowest discipline-specific average

coverage in the Arts and Humanities sub-corpus (0.010147%), while the AVL achieved its lowest discipline-specific average coverage in the IMS sub-corpus (0.009101%).

Table 5. Average Coverage of the AWL and the AVL.

Disciplines	AWL average coverage	AVL average coverage	AWL average coverage /AVL average coverage
Arts and Humanities	0.010147%	0.009157%	1.11
Business	0.021162%	0.013116%	1.61
Education	0.018860%	0.013146%	1.43
Engineering	0.019410%	0.013123%	1.48
Health and Medicine	0.016085%	0.011624%	1.38
Law	0.015816%	0.011642%	1.36
Information and Media Studies (IMS)	0.011700%	0.009101%	1.29
Music	0.012133%	0.010235%	1.19
Science	0.015438%	0.011346%	1.36
Social science	0.015788%	0.011478%	1.38
Complete University Academic Corpus	0.0161%	0.0116%	1.39

Table 6 shows the lexical frequency profiles of the AWL and the AVL from the 1st 1,000-word frequency level to the 25th 1,000-word frequency level defined by the BNC/COCA 1st-25th 1,000 word-family lists. It was found that 21 AWL word families occurred in the first BNC/COCA 1,000-word list, and accounted for 0.52026% coverage of the University Academic Corpus. 133 AWL word families were in the 2nd BNC/COCA 1,000-word list, which provided 3.30274% coverage of the University Academic Corpus.

318 AWL word families occurred in the 3rd BNC/COCA 1,000-word list, providing 4.71359% coverage of the University Academic Corpus. The number of AWL word families in the 4th, 5th, 6th, 7th and 8th BNC/COCA 1,000-word lists was 63, 20, 8, 3, and 1, respectively. These word families provided 0.34319%, 0.12496%, 0.08095%, 0.03554%, and 0.01222% coverage at their corresponding 4th, 5th, 6th, 7th and 8th 1,000-word frequency levels, respectively. From the 9th to the 25th 1,000-word frequency level, no AWL word families occurred.

In contrast, 197 AVL word families were in the BNC/COCA 1,000-word list, which accounted for 10.94146% coverage of the University Academic Corpus. 265 AVL word families were in the 2nd BNC/COCA 1,000-word list, which provided 5.93279% coverage of the University Academic Corpus. 476 AVL word families occurred in the 3rd BNC/COCA 1,000-word list, accounting for 4.66942% coverage of the University Academic Corpus. In the 4th, 5th , 6th, 7th , and 8th BNC/COCA 1,000-word lists, 224, 147, 139, 118, and 104 AVL word families occurred and provided 0.72561%, 0.34342%, 0.15057%, 0.09639%, and 0.05317% coverage in the University Academic Corpus, respectively. From the 9th to the 17th 1,000-word frequency level, unlike the AWL, some AVL word families still appeared (76, 68, 53, 33, 22, 13, 5, 8, and 2, respectively) and provided the corresponding coverage in the University Academic Corpus: 0.03130%, 0.01948%, 0.01416%, 0.00398%, 0.00226%, 0.00132%, 0.00124%, 0.00065%, and 0.00015%. At the 18th 1,000 word-frequency level, no AVL word families occurred. At the 19th 1,000 word-frequency level, 1 AVL word family appeared and provided 0.00001% coverage. Similar to the AWL, from the 20th to the 25th 1,000 word-frequency level, none of the AVL word families occurred.

Table 6. Lexical Frequency Profiles of the AWL and the AVL

Lexical frequency level	AWL		AVL	
	Word family	Coverage	Word family	Coverage
1st 1,000	21	0.52026%	197	10.94146%
2nd 1,000	133	3.30274%	265	5.93279%
3rd 1,000	318	4.71359%	476	4.66942%
4th 1,000	63	0.34319%	224	0.72561%
5th 1,000	20	0.12496%	147	0.34342%
6th 1,000	8	0.08095%	139	0.15057%
7th 1,000	3	0.03554%	118	0.09639%
8th 1,000	1	0.01222%	104	0.05317%
9th 1,000			76	0.03130%
10th 1,000			68	0.01948%
11th 1,000			53	0.01416%
12th 1,000			33	0.00398%
13th 1,000			22	0.00226%
14th 1,000			13	0.00132%
15th 1,000			5	0.00124%
16th 1,000			8	0.00065%
17th 1,000			2	0.00015%
19th 1,000			1	0.00001%

In addition to the distribution of items in the 25 word-frequency lists, as shown in Table 7, some of the AWL and the AVL items occurred in the additional BNC/COCA

wordlists of proper nouns, transparent compounds, and abbreviations. In the University Academic Corpus, the coverage provided by these AWL and AVL items was different: proper nouns (0.0% and 0.04153%, respectively), transparent compounds (0.00329% and 0.01778%, respectively), and abbreviations (0.0% and 0.00176%, respectively). Besides, Table 8 indicates that several word families of the AWL and the AVL were found in the 'Not in the lists' section of the Range output, which means they did not belong to any of the BNC/COCA25000 wordlists. However, these AWL and AVL word families provided coverage (0.01652% and 0.01288%, respectively) in the University Academic Corpus. Since the above AWL and AVL words were beyond any of the 25 BNC/COCA 1,000-word frequency lists, they were to be counted as unknown words to learners with the lexical sizes ranging from the most frequent BNC/COCA 1,000 to 25,000 word families. The coverage of these AWL and AVL items was correspondingly included in the total coverage provided by the AWL (9.15%) and the AVL (23.06%) in the University Academic Corpus.

Table 7. Coverage of the AWL Items and the AVL Items Occurring in the BNC/COCA Additional Lists

BNC/COCA Wordlists	AWL		AVL	
	Word family	Coverage	Word family	Coverage
Proper nouns			12	0.04153%
Transparent compounds	1	0.00329%	21	0.01778%
Abbreviations			2	0.00176%

Table 8. Coverage of the AWL Items and the AVL Items outside the BNC/COCA Lists

BNC/COCA Wordlists	AWL		AVL	
	Word family	Coverage	Word family	Coverage
Not in the lists	2	0.01652%	2	0.01288%

Table 9 shows the support provided by the AWL and the AVL for learners with different vocabulary sizes defined by the 25 BNC/COCA 1,000 word family lists. The second column of Table 9 indicates the cumulative coverage of the AWL items in the University Academic Corpus at each 1,000 word-frequency level represented by each 1,000-word BNC/COCA list. The way of calculating this cumulative coverage is illustrated by the following: according to Table 6, the coverage provided by the AWL at the 1st 1,000 word-frequency level was 0.52026%, the coverage provided by the AWL at the 2nd 1,000 word-frequency level was 3.30274%, and the coverage provided by the AWL at the 3rd 1,000 word-frequency level was 4.71359%, thus, the cumulative coverage of the AWL for the 2nd 1,000 word-frequency level was 3.82300% (0.52026% + 3.30274% = 3.82300%), and the cumulative coverage of the AWL for the 3rd 1,000 word-frequency level was 8.53659% (0.52026% + 3.30274% + 4.71359% = 8.53659%). This cumulative coverage of the AWL reflected the portion of the AWL words included in the most frequent 1,000 to 25,000 BNC/COCA word families. The third column of Table 9 shows the coverage provided by the remaining AWL items outside the current BNC/COCA 1,000 word-frequency list in the University Academic Corpus, in other words, the supportive coverage provided by the AWL items to learners at the next frequency level. This was calculated by subtracting the cumulative coverage the AWL

items provided at each BNC/COCA 1,000-word frequency level from the coverage the AWL provided in the University Academic Corpus (9.15326%). For example, for learners who knew the 1st 1,000 BNC/COCA word families, since 21 AWL word-families have already occurred at the 1st 1,000 BNC/COCA word frequency-level list, the additional knowledge provided by the AWL would be 8.63300% (9.15326% – 0.52026% = 8.63300%) coverage in the academic texts. This is the support the AWL would provide for learners who knew the 1st 1,000 BNC/COCA word families. In the same way, at the 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th 1,000 BNC/COCA word-frequency levels, the supportive coverage provided by the AWL for learners with the knowledge of the corresponding 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th 1,000 BNC/COCA word families, was 5.33026%, 0.61667%, 0.27348%, 0.14852%, 0.06757%, 0.03203%, and 0.01981%, respectively.

Similarly, the fourth column of Table 9 shows the cumulative coverage of the AVL word families in the University Academic Corpus at each 1,000 word-frequency level defined by each 1,000 BNC/COCA word list. The cumulative coverage of the AVL was calculated in the same way as that of the AWL. The fifth column of Table 9 shows the coverage provided by the remaining AVL items outside the current BNC/COCA 1,000-word list in the University Academic Corpus. For example, for learners who knew the 1st 1,000 BNC/COCA word families, since 197 AVL word-families have already occurred at the 1st 1,000 BNC/COCA word-frequency list, their knowledge of the AVL would actually provide 12.11987% (23.06133% – 10.94146% = 12.11987%) coverage of the academic written texts. In the same way, at the following 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th 1,000 BNC/COCA word-frequency levels, the supportive coverage provided by the AVL for learners with the knowledge of the corresponding 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th

1,000 BNC/COCA word families, was 6.18708%, 1.51766%, 0.79205%, 0.44863%, 0.29806%, 0.20167%, and 0.14850%, respectively. From the 9th to the 19th 1,000 BNC/COCA word-frequency level, the supportive coverage provided by the AVL was less than 0.12%.

To find out which list provided more support for learners with different lexical sizes, it was necessary to compare the AWL supportive coverage shown in the third column of Table 9 and the AVL supportive coverage shown in the fifth column of Table 9 at each 1,000-word frequency level. For example, for learners with a vocabulary of the most frequent BNC/COCA 1,000 word families, learners' knowledge of the AWL could provide additional coverage of 8.63300% as support, while the knowledge of the AVL could provide additional coverage of 12.11987% as support. Evidently, knowledge of the AVL was more supportive than knowledge of the AWL, and the gap in coverage was 3.48687% (12.11987% − 8.63300%= 3.48687%). Similarly, for learners with lexical sizes of 2,000-8,000 word families, the AVL consistently provided higher supportive coverage than the AWL. For learners with lexical sizes of 9,000-17,000 word families, the AVL still provided lexical support while the AWL failed to support learners any more, which indicates that the AVL was useful for learners with more varied vocabulary sizes.

Table 9. Supportive Coverage of the AWL and the AVL

Lexical frequency level	AWL		AVL	
	Cumulative coverage	Supportive coverage	Cumulative coverage	Supportive coverage
1st 1,000	0.52026%	8.63300%	10.94146%	12.11987%
2nd 1,000	3.82300%	5.33026%	16.87425%	6.18708%
3rd 1,000	8.53659%	0.61667%	21.54367%	1.51766%
4th 1,000	8.87978%	0.27348%	22.26928%	0.79205%
5th 1,000	9.00474%	0.14852%	22.61270%	0.44863%
6th 1,000	9.08569%	0.06757%	22.76327%	0.29806%
7th 1,000	9.12123%	0.03203%	22.85966%	0.20167%
8th 1,000	9.13345%	0.01981%	22.91283%	0.14850%
9th 1,000			22.94414%	0.11719%
10th 1,000			22.96361%	0.09772%
11th 1,000			22.97777%	0.08356%
12th 1,000			22.98175%	0.07958%
13th 1,000			22.98402%	0.07731%
14th 1,000			22.98534%	0.07599%
15th 1,000			22.98658%	0.07475%
16th 1,000			22.98723%	0.07411%
17th 1,000			22.98737%	0.07396%
19th 1,000			22.98739%	0.07394%

Table 10 presents the coverage provided by the AVL570 (12.76%) in the University Academic Corpus. In different discipline-specific sub-corpora, coverage ranged from 8.69% to 15.44% for the AVL570. In the sub-corpora of Engineering, Business, and Education, the AVL570 achieved its highest coverage: 15.44%, 15.26%, and 15.01%, respectively. This result was in line with the performance of the complete AVL (1,991 word families) in these three sub-corpora. The difference was the rankings of the discipline-specific coverage in the three sub-corpora: Unlike the AVL whose Education coverage ranked first, Engineering coverage ranked second, and Business coverage ranked third, the AVL570 Engineering coverage ranked first, the AVL570 Business coverage ranked second, and the AVL570 Education coverage ranked third.

Table 10. Coverage of the AVL570

Disciplines	AVL570 coverage
Arts and Humanities	8.69%
Business	15.26%
Education	15.01%
Engineering	15.44%
Health and Medicine	13.32%
Law	12.56%
Information and Media Studies (IMS)	8.92%
Music	10.52%
Science	12.37%
Social science	12.50%
Complete University Academic Corpus	12.76%

Table 11 illustrates the difference in coverage provided by the AWL and the AVL570 in the University Academic Corpus and in each discipline-specific sub-corpus. The AVL570 provided higher coverage than the AWL in the University Academic Corpus and in each discipline-specific sub-corpus. Since the AWL and the AVL570 contained the same number of word families (570), the average coverage achieved by each word family of the AVL570 should also be higher than that of the AWL in the University Academic Corpus and in each discipline-specific sub-corpus. Hence, the average coverage is not provided.

Table 11. Comparing Coverage of the AWL and the AVL570

Disciplines	AVL570 coverage	AWL coverage	AVL570 coverage/ AWL coverage
Arts and Humanities	8.69%	5.78%	1.50
Business	15.26%	12.06%	1.27
Education	15.01%	10.75%	1.40
Engineering	15.44%	11.06%	1.40
Health and Medicine	13.32%	9.17%	1.45
Law	12.56%	9.02%	1.39
Information and Media Studies (IMS)	8.92%	6.67%	1.34
Music	10.52%	6.92%	1.52
Science	12.37%	8.80%	1.41
Social science	12.50%	9.00%	1.39
Complete University Academic Corpus	12.76%	9.15%	1.39

Table 12 shows the lexical frequency profiles of the AWL and the AVL570 from the 1st 1,000 word-frequency level to the 25th 1,000 word-frequency level defined by the 25 BNC/COCA 1,000 word-family lists. 88 AVL word families were in the 1st BNC/COCA 1,000-word list, which accounted for 4.19987% coverage of the University Academic Corpus. 171 AVL word families appeared in the 2nd BNC/COCA 1,000-word list, which provided 4.86355% coverage of the University Academic Corpus. 292 AVL word families occurred in the 3rd BNC/COCA 1,000-word list, accounting for 3.59940% coverage of the University Academic Corpus. In the 4th and 5th BNC/COCA 1,000-word lists, respectively 11 and 1 AVL570 word families occurred, and provided 0.04049% and 0.00630% coverage, respectively. From the 9th to the 25th 1,000 word-frequency level, no AVL570 items occurred.

Comparing the distribution of items from the AWL and AVL at different word frequency levels, the number of the AVL570 items (88) was larger than that of the AWL items (21) at the 1st 1,000-word frequency level. As a result, the coverage (4.19987%) achieved by the AVL570 word families was 8.07 times as high as the coverage provided by the AWL word families (0.52026%) at the 1st 1,000-word level. At the 2nd 1,000-word frequency level, there were more AVL570 items (171) than AWL items (133), and the coverage (4.86355%) of the 171 AVL570 word families was 0.47 times higher than that of the 133 AWL word families (3.30274%). At the 3rd 1,000 word-frequency level, there were fewer AVL570 items (292) than AWL items (318), and the coverage (3.59940%) achieved by the 292 AVL570 word families was 0.76 times as high as the coverage provided by the 313 AWL word families (4.71359%). At the 4th and 5th 1,000 word-frequency levels, there were still fewer AVL570 word families (11 and 1, respectively)

than AWL word families (63 and 20, respectively), and the coverage provided by these AVL570 word families (0.04049% and 0.00630%, respectively) was much lower than the coverage provided by the AWL word families (0.34319% and 0.12496%, respectively). From the 6th to the 8th 1,000 word-frequency level, no AVL570 word families occurred. Conversely, 8, 3, and 1 AWL word families occurred at the 6th, 7th, and 8th 1,000 word-frequency levels with the coverage of 0.08095%, 0.03554%, and 0.01222%, respectively.

The AWL items were scattered from the 1st 1,000 to the 8th 1,000-word frequency levels. However, the distribution of the AVL570 items was limited to the first five 1,000-word frequency levels. Such distribution might imply that the AWL is more suitable for learners with more varied vocabulary sizes than the AVL570.

Table 12. Lexical Frequency Profiles of the AWL and the AVL570

Lexical frequency level	AWL		AVL570	
	Word family	Coverage	Word family	Coverage
1st 1,000	21	0.52026%	88	4.19987%
2nd 1,000	133	3.30274%	171	4.86355%
3rd 1,000	318	4.71359%	292	3.59940%
4th 1,000	63	0.34319%	11	0.04049%
5th 1,000	20	0.12496%	1	0.00630%
6th 1,000	8	0.08095%		
7th 1,000	3	0.03554%		
8th 1,000	1	0.01222%		

Table 13 shows some of the AWL and the AVL570 items appeared in the BNC/COCA additional lists of proper nouns, transparent compounds and abbreviations. In the University Academic Corpus, the coverage provided by these AWL and AVL570 items occurring in these additional lists was different: proper nouns (0.0% and 0.03434%, respectively), transparent compounds (0.00329% and 0.0%, respectively) and abbreviations (0.0% and 0.00073%, respectively). Table 14 shows that 2 AWL word families and 1 AVL570 word family were found in the 'Not in the lists' section of the Range output, and provided coverage (0.01652% and 0.01141%, respectively) in the University Academic Corpus. Since these AWL and AVL words were beyond any of the 25 BNC/COCA 1,000-word frequency lists, they were to be counted as unknown words to learners with lexical sizes ranging from the most frequent BNC/COCA 1,000 to 25,000 word families. The coverage of these AWL and AVL items was correspondingly included in the total coverage provided by the AWL (9.15%) and the AVL570 (12.76%) in the University Academic Corpus.

Table 13. Coverage of the AWL Items and the AVL570 items Occurring in the BNC/COCA Additional Lists

BNC/COCA Wordlists	AWL		AVL570	
	Word family	Coverage	Word family	Coverage
Proper nouns			4	0.03434%
Transparent compounds	1	0.00329%		
Abbreviations			1	0.00073%

Table 14. Coverage of the AWL Items and the AVL570 Items outside the BNC/COCA Lists

BNC/COCA Wordlists	AWL		AVL570	
	Word family	Coverage	Word family	Coverage
Not in the lists	2	0.01652%	1	0.01141%

Table 15 shows the support provided by the AWL and the AVL570 for learners with different vocabulary sizes defined by the 25 BNC/COCA 1,000 word family lists. The second column of Table 15 indicates the cumulative coverage of the AWL items in the University Academic Corpus at each 1,000 word-frequency level represented by each BNC/COCA 1,000-word list. The third column of Table 15 shows the coverage provided by the AWL items outside the current BNC/COCA 1,000-word list in the University Academic Corpus, that is, the supportive coverage provided by the AVL items at the next lower frequency levels. The fourth column presents the cumulative coverage of the AVL570 and the fifth column shows the supportive coverage provided by the AVL570 at the next lower frequency levels. The calculation is the same as that explained in the earlier description of Table 9. For example, for learners with a vocabulary size of the 1st 1,000 BNC/COCA word families, the AVL570 would provide 8.55622% (12.75610% – 4.19987% = 8.55622%) coverage of university academic texts. At the 2nd, 3rd, 4th, and 5th BNC/COCA 1,000 word-frequency levels, the supportive coverage provided by the AVL570 for learners who knew the most frequent 2,000, 3,000, 4,000, and 5,000 BNC/COCA word families was 3.69268%, 0.09327%, 0.05278%, and 0.04648%, respectively.

Table 15. Supportive Coverage of the AWL and the AVL570

Lexical frequency level	AWL		AVL570	
	AWL cumulative coverage at each 1,000-word frequency level	AWL supportive coverage at each 1,000-word frequency level	AVL570 cumulative coverage at each 1,000-word frequency level	AVL570 supportive coverage at each 1,000-word frequency level
1st 1,000	0.52026%	8.63300%	4.19987%	8.55622%
2nd 1,000	3.82300%	5.33026%	9.06342%	3.69268%
3rd 1,000	8.53659%	0.61667%	12.66282%	0.09327%
4th 1,000	8.87978%	0.27348%	12.70331%	0.05278%
5th 1,000	9.00474%	0.14852%	12.70961%	0.04648%
6th 1,000	9.08569%	0.06757%		
7th 1,000	9.12123%	0.03203%		
8th 1,000	9.13345%	0.01981%		

As shown in Table 15, for the learners with lexical sizes of 1,000-5,000 word families, both the AWL and the AVL570 can provide support. Thus, a further comparison on their performance on these levels of vocabulary sizes was illustrated by Table 16.

Table 16 indicates which list would provide more support to learners with different lexical sizes of 0-5,000 word families defined by the BNC/COCA 1st-5th 1,000 word family lists. For learners who do not know any English vocabulary, the AVL570

(12.75610%) would provide more support than the AWL (9.15326%). For learners whose vocabulary size was the 1st 1,000 BNC/COCA word families, learning the AWL might bring about more lexical support than learning the AVL570, because the AWL provided higher supportive coverage (8.63300%) than the AVL570 (8.55622%), which is 1.009 times (8.63300% ÷ 8.55622% = 1.009) as high as that of the AVL570. For learners whose vocabulary size was the most frequent 2,000 BNC/COCA word families, learning the AWL could also offer more lexical support than learning the AVL570, because the AWL still provided higher supportive coverage (5.33026%) than the AVL570 word families (3.69268%). For learners whose vocabulary size was the most frequent 3,000 BNC/COCA word families, the AWL still provided higher supportive coverage (0.61667%) than the AVL570 (0.09327%), which is 5.612 times higher. For learners with knowledge of the most frequent 4,000 BNC/COCA word families, coverage provided by the AWL in the university academic texts was 0.27348%, which was 5.182 times as high as that provided by the AVL570 (0.05278%). For learners whose lexical size was the most frequent 5,000 BNC/COCA word families, the AWL would provide 0.14852% coverage which was 3.195 times as high as the coverage provided by the AVL570 (0.04648%).

Table 16. Supportive Coverage of the AWL and the AVL570 for Learners with Lexical Sizes of 1,000-5,000 Word Families

Lexical sizes	AWL supportive coverage	AVL570 supportive coverage	AWL supportive coverage/AVL570 supportive coverage
No English lexical knowledge	9.15326%	12.75610%	0.718
1,000	8.63300%	8.55622%	1.009
2,000	5.33026%	3.69268%	1.443
3,000	0.61667%	0.09327%	6.612
4,000	0.27348%	0.05278%	5.182
5,000	0.14852%	0.04648%	3.195

4.2 Discussion

The first research question: Which list provides higher coverage in university academic texts? In answer to the first research question, the AVL provided higher coverage than the AWL in university academic texts (see Table 4). This suggests that, in order to understand university academic texts, learning the entire AVL might be more helpful than learning the entire AWL for learners' comprehending university academic texts. However, the number of word families the AVL contains (1,991) is 2.49 times larger than the number of word families the AWL contains (570), while the coverage of the AVL (23.06%) was only 1.52 times higher than that of the AWL (9.15%). This suggests the higher coverage of the AVL should be due to its length, and the AVL might include more infrequent items than the AWL. The larger length of the AVL might make

it more difficult for students to master than the AWL with regards to Laufer's (1994) findings that the lexical growth rate of undergraduates was 1,000 words per year. Since lists of academic words are made for efficient lexical acquisition, the value of the AVL to learners should not only be determined by its coverage, but also by whether it could save more time and energy for efficient learning. Although the AVL provides greater coverage, it might also take considerably longer time for students to learn.

Since no previous studies have ever reported the coverage achieved by all the items contained in the AVL, the AVL coverage (23.06%) in the present study cannot find any prior counterpart for comparison. However, many previous studies reported the coverage of the AWL. The coverage of the AWL (9.15%) in the present study was consistent with the findings of earlier studies (e.g., Coxhead, 2000; Hyland & Tse, 2007). This supported Coxhead's (2011) statement of the stable relevance of the AWL to academic English and revealed the value of the AWL to EAP learners. Nonetheless, compared with the coverage provided by the AWL in the two previous academic corpora (Coxhead, 2000; Hyland & Tse, 2007) which were also the across-discipline corpora made up of university materials to represent university academic English, the 9.15% coverage of the AWL in the University Academic Corpus was slightly lower. Three reasons might account for this. First, the University Academic Corpus (72 million tokens) was much larger than Coxhead's (2000) corpus (3.5 million tokens) and Hyland and Tse' (2007) corpus (3.3 million tokens). Second, the University Academic Corpus covered ten different disciplines, while Coxhead's (2000) corpus was across four disciplines and Hyland and Tse' (2007) corpus was across three disciplines. Third, the University Academic Corpus was compiled from the course texts recently or currently used by

undergraduates, while the source texts used for compiling Coxhead's (2000) and Hyland and Tse' (2007) corpus were probably not. The difference between the coverage provided by the AWL in the University Academic Corpus and in the above mentioned corpora (Coxhead, 2000; Hyland & Tse, 2007) might imply that the AWL may not fully cover academic vocabulary in current university settings, since the University Academic Corpus represented current university academic texts.

The second research question: Which list provides higher average coverage in university academic texts? In answer to the second research question, the AWL provided higher average coverage than the AVL in university academic texts (see Table 5). Since average coverage reflects the value of each word family included in the AWL and the AVL, this result suggests that learning each word family of the AWL may help students understand a higher percentage of the university academic texts than learning each word family of the AVL. Hence, although the AWL had lower coverage in academic texts, its higher average coverage suggests that each of its word families is more valuable for learners than each word family in the AVL. In this sense, the AWL might be more suitable for efficient academic vocabulary learning. The reason for the higher average coverage achieved by the AWL might be that the length of the AWL is only 2/7 of the AVL, and the AVL contains more infrequent items due to its greater length than the AWL.

The third research question: Which list provides higher coverage in university academic texts from specific disciplines? In answer to the third research question, the AVL provided higher coverage than the AWL in university academic texts

from different disciplines (see Table 4), which is not a surprise because of the aforementioned advantage the AVL has in length.

The discipline-specific coverage of the AWL has been reported by previous studies (e.g., Chen & Ge, 2007), while the discipline-specific coverage of the AVL has never been reported by any previous studies. The discipline-specific coverage provided by the AWL in the University Academic Corpus of the present study was consistent with the discipline-specific coverage provided by the AWL in previous academic corpora (e.g., Chen & Ge, 2007; Coxhead, 2000; Hyland & Tse, 2007; Li & Qian 2010; Ward, 2009). This indicates the stable performance of the AWL in certain discipline-specific academic texts. The following is the detailed comparison of the AWL coverage in different academic corpora made for the similar discipline: the AWL business-oriented discipline-specific coverage was 12.06% (the University Academic Corpus), 12.0% (Coxhead, 2000), and 10.46% (Li & Qian, 2010); the AWL Science coverage, was 8.8% (the University Academic Corpus), 9.1% (Coxhead, 2000), 8.96% (Coxhead & Hirsh, 2007), and 9.3% (Hyland & Tse, 2007); the AWL Law coverage was 9.02% (the University Academic Corpus) and 9.4% (Coxhead, 2000); the AWL Social science coverage was 9.0% (the University Academic Corpus) and 11.0% (Hyland & Tse, 2007); the AWL Medicine coverage was 9.17% (the University Academic Corpus) and 10.073% (Chen & Ge, 2007); and the AWL Engineering coverage was 11.06% (the University Academic Corpus), 11.3% (Ward, 2009), and 11.1% (Hyland & Tse, 2007).

The discipline-specific coverage of the AWL and the AVL in the University Academic Corpus indicates that the AWL and the AVL were not evenly distributed in university academic texts across disciplines. Such uneven distribution means the value of

the AWL and the AVL were different to learners majoring in different disciplines. For example, students majoring in Business, Education, and Engineering might get greater support from the two lists than students in Arts and Humanities, Music, and IMS because the AWL and the AVL provided higher coverage in the former three disciplines than the latter three disciplines. The uneven distribution of the AWL and the AVL in the University Academic Corpus might support the suggestion that discipline-specific academic wordlists need to be compiled to more precisely satisfy learners' specific learning needs in different disciplines (e.g., Chen & Ge, 2007; Hyland & Tse, 2007; Martinez et al., 2009).

No previous studies have examined the discipline-distribution issue of the AVL, hence the discipline-specific coverage of the AVL could not find any counterpart for comparison. However, earlier studies have reported the uneven distribution of the AWL across different disciplines, and the result of the uneven across-discipline distribution of the AWL found in the present study was consistent with the findings of earlier studies (Cobb & Horst, 2004; Hyland & Tse, 2007). Especially, a bias of the AWL towards Business discipline uncovered by this study was in line with the commerce-oriented bias suggested by Hyland and Tse (2007). As suggested by Dang and Webb (2014), this commerce-oriented bias of the AWL might be because Coxhead (2000) included more similar subject areas (e.g., Accounting, Finance, Marketing, and Economics) in the Commerce sub-corpus of the AWL development corpus than in other sub-corpora of the AWL development corpus. Hence, many texts focused on similar Commerce topics might lead to the more frequent occurrence of the commerce-oriented words in the AWL.

Although the AWL and the AVL were made by different authors at different times, in the present study, the two lists provided higher coverage in the same three discipline-specific sub-corpora (Business, Education and Engineering) than in the other sub-corpora, and provided lower coverage in the same three sub-corpora (IMS, Music, and Arts and Humanities) than in the other discipline-specific sub-corpora. Moreover, the ranking order of the AWL discipline-specific coverage found in the present study was in line with the ranking order of the AWL coverage in similar discipline-specific sub-corpora reported by earlier studies (e.g., Coxhead, 2000; Hyland &Tse, 2007) (see Table 17 and Table 18). This might further suggest the consistent performance of the AWL in certain discipline-specific academic texts. As for the AVL, a list compiled in a different way from the AWL, interestingly, the ranking order of its discipline-specific coverage found in the present study was in line with the ranking order of the AWL discipline-specific coverage reported in this study and in earlier studies (Coxhead, 2000; Hyland & Tse, 2007). The reason accounting for this coincidence might be the stable characteristics of certain discipline-specific academic texts regardless of time and methodological differences, which should be considered in future wordlist research. This result suggests the uneven distribution of the AWL and the AVL is more inherent from the different discourse and lexical features of the academic texts in each discipline.

Table 17. Comparison with Coxhead's (2000) Reported Discipline-specific Coverage of the AWL

Ranking order of discipline-specific coverage	Disciplines	AVL in the University Academic Corpus	AWL in the University Academic Corpus	AWL in Coxhead's (2000) corpus
1	Business	26.11%	12.06%	12.0%
2	Law	23.18%	9.02%	9.4%
3	Science	22.59%	8.80%	9.1%
4	Arts and Humanities	18.23%	5.78%	9.3%

Table 18. Comparison with Hyland and Tse' (2007) Reported Discipline-specific Coverage of the AWL

Ranking order of discipline-specific coverage	Disciplines	AVL in the University Academic Corpus	AWL in the University Academic Corpus	AWL in Hyland and Tse' (2007) corpus
1	Engineering	26.13%	11.06%	11.1%
2	Social science	22.85%	9.00%	11.0%
3	Science	22.59%	8.80%	9.3%

Taken together, despite the higher discipline-specific coverage provided by the AVL, it still cannot be argued that the AVL is superior to the AWL in discipline-specific learning, because the AVL is much larger than the AWL in size and hence learning the AVL requires substantially more time and effort. Besides, neither the AWL nor the AVL is evenly distributed across disciplines.

The fourth research question: Which list provides higher average coverage in university academic texts from specific disciplines? In answer to the fourth research question, the AWL provided higher average coverage than the AVL in discipline-specific academic texts (see Table 5), which suggests that learning each word family of the AWL is more helpful to students in each discipline than learning each word family of the AVL, especially to students in Business, Education and Engineering, because the gap in average coverage between the AWL and the AVL in these three discipline-specific sub-corpora was the biggest. In the disciplines of IMS, Music, and Arts and Humanities, learning the AWL and the AVL helps students less than in the other seven disciplines, because both the AWL and the AVL provided rather low average coverage in these three sub-corpora. However, the same issue concerning the wordlist length still remained: the higher discipline-specific average coverage of the AWL might be due to its shorter length compared to the AVL. Therefore, the answer to the fourth research question revealed greater discipline-specific value of each AWL word family than that of each AVL word family, but was still inadequate to ensure the absolute superiority of the AWL over the AVL.

The fifth research question: What are the lexical frequency profiles of the two lists? In answer to the fifth research question, the lexical frequency profiles of the

AWL and the AVL indicate three points: First, the AVL was distributed across more word-frequency levels than the AVL (see Table 6), which suggests the AVL might be useful for learners with more varied lexical sizes. Second, for learners with the lexical sizes of the most frequent BNC/COCA 1,000-8,000 word families, the AVL provides more supportive coverage than the AWL in comprehending university academic texts (see Table 9). At each 1,000-word frequency level ranging from the 1st to the 8th BNC/COCA 1,000-word frequency level, the AVL provided higher coverage than the AWL because the AVL has more items included at each of these word-frequency levels than the AWL. Thus, the greater support provided by the AVL for learners with the lexical sizes of the most frequent BNC/COCA 1,000-8,000 word families is due to the larger number of the AVL items distributed at each 1,000-word frequency level. Therefore, to more accurately determine which list is more useful for academic vocabulary learning, the AWL and the AVL need to be compared when they have the same number of items. The third point uncovered by the lexical frequency profiles of the AWL and the AVL is that some of the AWL and the AVL items occurred at the 1st and 2nd BNC/COCA 1,000-word levels which are viewed as general high-frequency words (Nation, 2012).

The result that many AWL items were distributed at the 1st and 2nd BNC/COCA 1,000-word levels was in line with the findings of previous studies (Cobb, 2010; Dang & Webb, 2014). This result was due to the AWL using the GSL as the baseline list for excluding general high-frequency words. The GSL is outdated (Richards, 1974) and does not represent current general high-frequency vocabulary (Nation & Webb, 2011). Consequently, some AWL items representing current general high-frequency vocabulary

occur in the 1st and 2nd BNC/COCA 1,000-word lists, just because the GSL did not include these AWL items as general high-frequency words (Nation & Webb, 2011). For example, *computer* is a word that is currently common and is included as a general high-frequency word in the 1st 1,000 BNC/COCA wordlist (Nation, 2012). However, *computer* was not included in the GSL because the GSL was compiled in the year 1953 when the word *computer* was not widely-used in general texts. As a result, *computer* was contained in the AWL as an academic word because the GSL did not include it. Therefore, the lexical frequency profile of the AWL defined by the current BNC/COCA wordlists suggests that the AWL needs to be modified to be more relevant to current academic vocabulary by removing the influence of the outdated GSL. In addition, a new list of academic words might need to be compiled with the help of the recently published general high-frequency wordlists, an idea which has also been suggested by previous researchers (Cobb, 2010; Nation & Webb, 2011).

The occurrence of the AVL items at the 1st and 2nd BNC/COCA 1,000 word levels might be due to two reasons: First, although the AVL compilation (Gardner & Davies, 2014) used frequency ratio to ensure the AVL items were the ones that occurred more frequently in academic texts than in general texts, no measures were taken to exclude general high-frequency words. Second, the fact that 1/3 of the source texts used for compiling the AVL development corpus were from magazines and newspapers (Gardner & Davies, 2014) might also contribute to the AVL containing some general high-frequency words because these source texts are more likely to contain general high-frequency words (Nation, 2013).

More AVL items (462 word families) occurred at the 1st and 2nd BNC/COCA 1,000-word levels than the AWL items (154 word families). This should not be too surprising since the AVL contains more items than the AWL. In addition to the impact of the length of the AVL, this could also be the consequence of the AVL compilation (Gardner & Davies, 2014) which did not exclude general high-frequency words as the AWL compilation (Coxhead, 2000) did.

The sixth research question: How much coverage do the AWL and the 570 best word families in the AVL provide to learners with different vocabulary sizes? In answer to the sixth research question, for learners with no knowledge of English vocabulary, the AVL570 (12.76%) would provide more support in coverage than the AWL (9.15%). The coverage of the AVL570 (12.76%) in the University Academic Corpus was close to the coverage of the top 570 AVL word families (13.7% and 13.8%) reported by Gardner and Davies (2014). There is slight difference (around 1%) between the coverage achieved by the AVL570 in the University Academic Corpus and the coverage achieved by the top 570 AVL word families in the corpora used by Gardner and Davies (2014), and the reason might be that the corpora used by Gardner and Davies (2014) were online already-available corpora which were not made up of the recently-used university course texts.

Since the AVL570 and the AWL have the same number of items, the result that the AVL570 (12.76%) achieved higher coverage than the AWL (9.15%) could no longer be due to the length of the two lists. The higher coverage of the AVL570 is due to the greater number of the AVL570 items occurring at the 1st and 2nd BNC/COCA 1,000-word frequency levels. According to the lexical frequency profiles of the AWL and the AVL

(see Table 12), at the 1st and 2nd BNC/COCA 1,000-word frequency levels, a total of 259 AVL570 items appeared and provided 9.06342% coverage. However, only 154 AWL items appeared at these two word-frequency levels and provided 3.82300% coverage. For these two lexical frequency levels, the gap in coverage between the AVL570 and the AWL was 5.24042% (9.06342% − 3.82300% = 5.24042%). Conversely, at the 3rd, 4th, and the 5th BNC/COCA 1,000-word frequency levels, more AWL items (401 items) occurred and provided 5.18174% coverage in total, while fewer AVL570 items (304 items) appeared and provided 3.64619% coverage. For these three lexical frequency levels, the coverage gap between the AWL and the AVL570 was 1.53555% (5.18174% − 3.64619% = 1.53555%), which could not make up for the former coverage gap (5.2042%) between the AVL570 and the AWL at the 1st and 2nd BNC/COCA 1,000 word-frequency levels. Consequently, from the 1st 1,000 word-frequency level to the 5th 1,000 word-frequency level, the AVL570 provided higher coverage than the AWL. Therefore, the higher coverage of the AVL570 than the AWL was because more AVL570 items occurred at the 1st and 2nd BNC/COCA 1,000-word frequency levels than the AWL items. In other words, it is because the AVL570 includes more general high-frequency words, since words of the 1st and 2nd BNC/COCA 1,000-word lists are often viewed as general high-frequency words (Nation, 2012).

For learners with vocabulary sizes of the most frequent BNC/COCA 1,000-5,000 word families, the AWL could provide more support in comprehending university academic texts than the AVL570 (see Table 16). The reason was that more AVL570 items occurred at the 1st and 2nd BNC/COCA 1,000 word-frequency levels than the AWL. For example, since the lexical frequency profile of the AVL570 indicates that there were

88 AVL570 word families occurring at the 1st BNC/COCA 1,000 word-frequency level, for learners who knew the most frequent BNC/COCA 1,000 word families, the actual coverage support the AVL570 provided with such learners was from the remaining 482 word families, which was 8.55622% coverage of the University Academic Corpus. In contrast, the AWL only had 21 word families occurring at the 1st BNC/COCA 1,000 word-frequency level, and the actual coverage support that the remaining 549 word families in the AWL provided for such learners was 8.63300%. Similarly, at the following 2nd to 5th 1,000 word frequency levels, the AWL also provided more supportive coverage than the AVL570. Therefore, although the AWL had lower coverage than the AVL570 in the University Academic Corpus and provided less support for learners without English lexical knowledge than the AVL570, for learners with lexical sizes of the most frequent BNC/COCA 1,000-5,000 word families, the AWL would have more value than the AVL570 in helping learners to comprehend university academic texts.

Moreover, when the AWL and the AVL570 were compared in the aspect of across-discipline distribution, it was found that the AVL570 (SD=2.46) was less evenly distributed across discipline-specific sub-corpora than the AWL (SD=2.02) (as shown in Table 19). This result suggests that, in terms of helping learners' academic vocabulary education across different disciplines, the AWL may be a more supportive list for learners situated in different disciplinary settings.

Table 19. Comparison of the Across-discipline Distribution of the AWL and the AVL570

Disciplines	Coverage provided by the AWL	Coverage provided by the AVL570
Arts and Humanities	5.78%	8.69%
Business	12.06%	15.26%
Education	10.75%	15.01%
Engineering	11.06%	15.44%
Health and Medicine	9.17%	13.32%
Law	9.02%	12.56%
Information and Media Studies (IMS)	6.67%	8.92%
Music	6.92%	10.52%
Science	8.80%	12.37%
Social science	9.00%	12.50%
Mean	8.92%	12.46%
Standard Deviation (SD)	2.02	2.46

4.3 Summary

To sum up, the above results and discussion reveal that comparing the AWL and the AVL with different evaluation criteria could lead to different results. When the coverage provided by all the items of the AWL and the AVL was used as the criterion, the AVL outperformed the AWL. When the average coverage of the AWL and the AVL was the evaluation criterion, the AWL outperformed the AVL. When the coverage provided by the AWL and the AVL at each BNC/COCA 1,000-word frequency level was

the evaluation criterion, the AVL outperformed the AWL. These results show the influence of the wordlist length on the coverage of the two lists. Therefore, it is important to compare the two lists when they are made up of the same number of items (i.e., the AWL and the AVL570), and it has been found that the AVL570 outperformed the AWL in supporting learners without English lexical knowledge, while the AWL outperformed the AVL570 in supporting learners with the lexical sizes of the most frequent 1,000-5,000 BNC/COCA word families, because the AVL570 has more items occurring at the 1st and 2nd most frequent 1,000-word frequency levels than the AWL. These findings reveal the impact of the lexical frequency of each individual item in the AWL and the AVL570 on the coverage of the two lists. Besides, the AVL outperformed the AWL in discipline-specific coverage and the AVL570 outperformed the AWL in discipline-specific coverage and average coverage, which might be also because the AVL has more items and the AVL570 has more high-frequency items than the AWL. In short, the results of this thesis indicate that academic wordlist coverage is greatly impacted by the number and the frequency of the academic wordlist items. The results of this thesis are more comprehensive than and different from the findings reported by the previous corpus-based comparison study (Gardner & Davies, 2014).

Chapter Five Conclusion

This chapter concludes the thesis with a summarized overview of major research findings, the implications derived from these findings, the limitations of this study, and future research suggestions.

5.1 An Overview of Important Findings

The purpose of this study was to examine two academic wordlists (the AWL and the AVL) to find out which list could be more helpful for academic vocabulary learning. After the coverage provided by the AWL and the AVL in the University Academic Corpus have been compared in a number of ways, the main findings are as follows.

For learners who had no lexical knowledge, but were required to comprehend university academic texts, the AVL could provide more support than the AWL. However, learning the AVL might be more time-consuming and energy-consuming since it includes more items than the AWL. Hence, if these learners wanted to save time and effort in acquiring academic vocabulary, learning the AWL could be a better choice because each AWL word family provided more average coverage than each AVL word family. However, when the AWL and AVL were at the same length (570 items), in other words, when the most frequent 570 AVL items (i.e., AVL570) were compared with the AWL, the AVL570 could be a better choice than the AWL for these learners, because the AVL570 provided more coverage than the AWL in university academic texts. Therefore, for learners with zero English vocabulary knowledge, the AVL570 should be prioritized for learning over the AWL and the whole AVL.

For learners with the lexical sizes of the most frequent BNC/COCA 1,000-8,000 word families, the AVL could provide more support than the AWL. However, these learners must be aware of the inefficiency and burden of learning the AVL since the AVL is much longer than the AWL. When the AWL was compared against the AVL570, for learners with the lexical sizes of the most frequent BNC/COCA 1,000-5,000 word families, the AWL was a better choice because it could provide more supportive coverage than the AVL570.

Learners majoring in different disciplines might benefit from the AWL, the AVL, and the AVL570 differently. For example, students specialized in Business, Engineering and Education might get more help from the AWL, the AVL, and the AVL570 than the students majoring in Arts and Humanities, IMS, and Music. For students situated in the ten academic disciplines involved in the present study, the AVL and the AVL570 could provide more discipline-specific coverage than the AWL; the AWL could provide more discipline-specific average coverage than the AVL, but less discipline-specific average coverage than the AVL570. This suggested that the AVL570 could be a better choice than the AWL and the whole AVL if learners wanted both more discipline-specific coverage and more wordlist-learning efficiency. Thus, the AVL570 should be prioritized in academic vocabulary acquisition for discipline-specific learning purposes. However, since none of the AWL, the AVL, and the AVL570 was evenly distributed across discipline, probably, compiling discipline-specific academic wordlists could be useful for learners' discipline-specific academic study (Hyland & Tse, 2007; Martinez et al., 2009). Nonetheless, the value of the AWL should not be denied because its consistent relevance to academic purposes has been proven in this study; and the value of the AVL570 might

be stressed because it provided higher coverage than the AWL for learners majoring in different disciplines. Furthermore, it should be noted that in terms of the cross-discipline value for the learners situated in different academic disciplines, the AWL could be these learners' better choice than the AVL570.

Findings derived from the lexical frequency profiles indicated that the AVL could be useful for learners with more varied lexical sizes, when compared with the AWL; and the AWL could be useful for learners with more varied lexical sizes, when compared with the AVL570. The reason for this was that the AVL was distributed across more BNC/COCA 1,000-word frequency levels than the AWL, and the AWL was distributed across more BNC/COCA 1,000-word frequency levels than the AVL570.

Taken together, it can be inferred from the above findings that the frequency and the number of the academic wordlist items define the lexical coverage of an academic wordlist; and it is noteworthy that the effectiveness of academic wordlists vary with different learners' lexical sizes. Hence, these three key factors should be considered when researchers compile and evaluate academic wordlists.

5.2 Implications

The main findings of this study brought about the following implications for academic English learners, teachers, wordlist makers, and wordlist evaluators.

5.2.1 Implications for EAP Learners and Teachers

As the target audience of the AWL and the AVL, EAP students should make their choice between the AWL and the AVL based on their vocabulary sizes, situated disciplinary settings, and how much time they have to learn a wordlist. To determine their lexical levels, they could use the Vocabulary Levels Test (Webb, Sasao, & Ballance,

2016). EAP teachers should not only help their students determine their vocabulary levels, but take their students' vocabulary sizes, disciplinary background, and available learning time into account before using a certain wordlist in their instruction.

5.2.2 Implications for Academic Wordlist Makers

For academic wordlist compilers, how many items to be included in a list of academic words should be cautiously weighed and decided on, because the present study has proved academic wordlist coverage and the value of each academic wordlist item are closely associated with the wordlist length. If a list is too long, although it might provide more support in comprehending academic texts (e.g., the AVL), its length could be challenging for learners, and the value of each wordlist item would be discounted by its length. Considering the rate of lexical growth of students (Laufer, 1994; Milton & Meara, 1995) and the limited time of EAP classroom instruction in reality, the length of a list of academic words should be restricted, and setting an upper limit of the number of items included in a list of academic words should be realistically considered for educational efficiency. This can ensure that students and teachers' efforts are focused on the most frequent and most valuable academic words.

The appropriate length of a list of academic words might be 500-1,000 items. This suggestion for academic wordlist length is inferred from the findings of this study: the coverage provided by the AVL (1,991 items) was only 1.52 times higher than the coverage provided by the AWL (570 items) which was 2/7 of the AVL length; and with only 2/7 of the total AVL items, the AVL570 (570 items) provided over 1/2 of the coverage achieved by the whole AVL. Such findings indicated several points. First, each of the whole AVL 1,991 items might not need learning attention equally, and the items

beyond the most frequent 570 AVL items could be more infrequent and less valuable. Second, the list length of around 500 items might be an appropriate length for an academic wordlist since both the AWL (570 items) and the AVL570 (570 items) performed better than the AVL (1,991) with regards to the ratio of coverage to wordlist length). However, an appropriate length of the wordlist does not mean a list should be short, because the findings of this study also showed that a short list (e.g., the AWL) provided lower coverage when it was compared with a longer list (e.g., the AVL). Therefore, if an undergraduate could only acquire 1,000 words per year (Laufer, 1994), a list of 500-1,000 items might be a more manageable and useful learning goal for their academic vocabulary development. Moreover, it should be noted that Dang and Webb (2015) have also expressed their concern on wordlist length in their study regarding general high-frequency wordlists and suggested the 1,000 general high-frequency words should be learnt first. Thus, the list length of 1,000 items might deserve more attention from compilers and researchers of different kinds of wordlists.

A further implication was concerned with the frequency of academic wordlist items. The findings of the present study have indicated the frequency of the academic wordlist items impacts the support provided by academic wordlists for comprehension of university academic texts. For academic wordlist compilation, appropriate and effective measures should be taken to ensure the wordlist items are high-frequency academic words rather than general high-frequency words. It is reasonable that Gardner and Davies (2014) used frequency ratio to guarantee the AVL items were higher in word frequency in academic texts than in general texts. However, the occurrence of many AVL items at the 1st and 2nd BNC/COCA 1,000-word frequency levels found in this study proved

setting up a bottom limit to further ensure the wordlist items were not general high-frequency words should also be necessary, such as using a general high-frequency wordlist as a follow-up measure to exclude the possibly contained general high-frequency words. The occurrence of the AWL items at the BNC/COCA 1st and 2nd 1,000-word frequency levels found in this study supported the previous researchers' criticism of Coxhead (2000) using the outdated GSL as a benchmark list (Cobb, 2010; Dang, 2013; Nation & Webb, 2011). Probably a better choice for an exclusion list in the compilation of academic wordlists is the recently compiled general high-frequency lists which are able to represent current vocabulary, such as the BNC/COCA2000 (Nation, 2012) or the new-GSL (Brezina & Gablasova, 2013), since Dang and Webb's (2015) study suggested the impressive performance of these two lists as general high-frequency wordlists. Taken together, it is recommended that both frequency ratio and exclusion lists representing current general high-frequency words should be used in compiling lists of academic words.

The final implication was that different academic wordlists should be compiled to better satisfy learners' different academic vocabulary learning needs, and to more precisely reflect academic wordlist makers' compilation purposes. For discipline-specific learning purposes, wordlist makers' endeavour in developing discipline-specific academic wordlists is necessary because of the uneven distribution of the AWL and the AVL across disciplines revealed by this study. With regards to learners' lexical sizes, if the wordlist makers could provide sub-lists at different lexical frequency levels, it would be more convenient for learners and teachers to make their pedagogical choices, set up learning goals, and save learning time. Moreover, if the wordlist makers would like to

take meaning variations into account when compiling the wordlists as Gardner and Davies (2014) did, it might be better to compile their academic wordlists based on word form and word meaning separately rather than integrating meaning consideration and word-form frequency consideration together. This way may better justify the constitution of the wordlists, and also ensure more research and user convenience. In addition, it should be noted that Dang and Webb (2015) suggested compiling different wordlists in different counting units (i.e., headword, lemma, and word family) for learners of different proficiency levels (i.e., beginner, intermediate, and advanced learners) in their study of general high-frequency lists. Therefore, it might be recommended that wordlist makers should consider a variety of perspectives for their target audience and concrete wordlist compiling purposes.

5.2.3 Implications for Academic Wordlist Evaluators

Since the present study showed that different evaluation criteria could lead to different results, it may be inadequate to evaluate different academic wordlists in a single way. This supported Dang and Webb (2015) who suggested different methods should be used for accurate wordlist evaluation in their general high-frequency wordlist assessment. Based on the findings of this study, the perspectives necessary for consideration in a comparison of academic wordlists might be: what type of lexical coverage to be used as comparison criterion, how many items to be compared, what lexical frequency levels the wordlist items belong to, and what proficiency levels of learners the wordlists are to satisfy. For example, in the present study, if the coverage provided by the whole lists were the criterion, the AVL appeared better than the AWL. If the average coverage were the criterion, the AWL appeared better than the AVL. If the learners with the zero lexical

size were the target audience to support, the AVL and the AVL570 were better than the AWL, however, the AWL performed better for the learners with the lexical sizes of the most frequent BNC/COCA 1,000-5,000 word families. Therefore, it is noteworthy that the evaluation of different academic wordlists should be conducted with different criteria in a number of ways; and it should be borne in mind that the usefulness of the same academic wordlists could be different with different target learners. These recommended perspectives might be also valuable for academic wordlist makers to take into account.

A further implication involves what kind of corpus should be used as the academic wordlist comparison basis. The large gap between the coverage provided by the AWL in the University Academic Corpus (9.15%) and in the online corpora (6.9% and 7.2%) used in Gardner and Davies' (2014) comparison study indicated that the coverage of the academic wordlists was affected by different academic corpora. As the AWL coverage resulted from the independently compiled University Academic Corpus was more in line with the findings of most of the previous studies (e.g., Coxhead, 2000; Hyland & Tse, 2007) than the AWL coverage reported by Gardner and Davies (2014), the University Academic Corpus might be more reliable and more valid as a comparison basis than the online corpora used by Gardner and Davies (2014). Thus, it might be recommended that a better choice of the corpus used for academic wordlist evaluation should be an independently compiled corpus like the University Academic Corpus which was made up of the academic texts that the target audience of the academic wordlists definitely encountered.

5.3 Limitations

The research purpose was to compare the AWL and the AVL to show which list could be more supportive for academic English learners. The research design, corpus-building process, and analysis procedures were all carefully conducted to realize this research goal. Nonetheless, there were several limitations necessary to be indicated as follows.

The first limitation was only using lexical coverage as the evaluation criterion. Acknowledged as the important determinant of textual comprehension (Laufer & Sim, 1985; Schmitt et al., 2011), lexical coverage should be a valid quantitative way to profile how the AWL and the AVL differently contribute to textual comprehension. However, it should be noted that lexical coverage is not the only factor impacting textual comprehension, since there are many other factors influencing students' comprehension, such as learners' syntactic knowledge and metacognitive strategies (Nergis, 2013). High lexical coverage is only an "essential, but insufficient, condition" for students' comprehension (Schmitt et al., 2011, p.39). Therefore, it is noteworthy that the AWL coverage (9.15%) in university academic texts is not equal to all learners' understanding 9.15% of university academic texts with the mastery of the AWL. The same is true for the AVL coverage.

The second limitation was that this study only checked the two lists based on word frequency. Although word frequency was the major word selection principle used for the AWL and the AVL, the value of a word for learners should not merely be defined by its frequency, because some relatively infrequent AWL and AVL items could be meaningful for language education purposes, and because some AWL and AVL items

occurring at the BNC/COCA 1st and 2nd 1,000 word frequency levels might have specialized meanings in academic settings. Thus, the value of the findings of this study should be cautiously limited to the language programs which took word frequency as one constituent.

The third limitation was using lexical frequency levels to indicate learners' vocabulary sizes. Although researchers have suggested the learners' lexical growth tends to follow the hierarchy of lexical frequency levels (Schmitt et al., 2001) and word frequency lists should be an effective way to measure lexical sizes (Nation & Webb, 2011), in pedagogical reality, an individual student's lexical growth could be different from this ideal hierarchy categorized with different 1,000-word lists, and words of lower frequency could also be mastered by learners before their acquiring the words of higher frequency (Webb & Chang, 2012). Thus, the cumulative coverage used to reveal students' lexical sizes and the supportive coverage used to indicate the support from the AWL and the AVL for learners with different lexical sizes might be different from their vocabulary knowledge in reality. As a result, any teaching practitioners who would like to use the findings of this study should check whether their programs were appropriate for adopting lexical frequency levels to measure their students' lexical sizes.

The fourth limitation was the corpus. Reflecting all the features of a language through one corpus is impossible (Sinclair, 2004), and there have been no "clear cut" corpus-building rules (Coxhead, 2000, p. 215) to follow. Thus, even though this University Academic Corpus might be the largest and the most representative corpus made up of university-level course materials, it is difficult to claim that this corpus fully represents university academic English.

The fifth limitation was using the Range program as the analysis instrument. As a computer program, Range can only distinguish words based on word form differences (Nation & Webb, 2011; Webb & Nation, 2013). The meaning variations advocated by Gardner and Davies (2014) in their compiling the AVL could not be indicated by the Range output. Therefore, although some AVL items (e.g., *interest* and *rate*) occurring in the 1st and 2nd 1,000 BNC/COCA lists might have specialized meanings in academic texts different from their meanings in general texts, the Range output still showed them in the 1st and 2nd 1,000 BNC/COCA lists based on the frequency of their word forms.

A final limitation was concerning time and finance. The original goal for the corpus was to collect more university course texts to represent the current university academic English in a more comprehensive way. The original comparison perspectives included examining the two lists in the counting unit of lemma as well. However, time pressure, lack of available texts, and finance factors limited the corpus size and research depth, although some preparation work has been done, such as the lemmatization of the AWL.

Despite these limitations, this study still provided a comprehensive picture regarding the performance of the AWL and the AVL. The following section discusses the future research plans based on the findings and limitations of this study.

5.4 Future Research

To gain a complete picture of the AWL and the AVL, future studies might add the investigation of the AWL and the AVL in lemmas as another dimension, since the AVL was originally created to be a lemma-based wordlist. The challenge would be the

lemmatization of the AWL and the AVL, as neither of them has a lemma version publicly available.

Since academic English education has already become a global concern (Flowerdew & Peacock, 2001), to make future wordlist compilation and wordlist comparison research more applicable to worldwide university academic English education, a corpus representative of global academic English education is needed. Ideally, this corpus should be developed from the course texts from worldwide English-medium universities. Once formed, this corpus will become a sound and solid foundation for lexical research more than wordlist studies. Hopefully, the current University Academic Corpus could be a starting point for this blueprint.

Moreover, a mixed-method approach including both qualitative and quantitative methods is suggested for future comparison research on academic wordlists. The qualitative approach might focus on teachers' and students' comments on using the academic wordlists. As teachers and students are the audience of lists of academic words, their feedback should be decisively important for examining the effects of the pedagogical wordlists. Especially, the experienced teachers' comments should be more valued owing to their professional expertise. A model research practice for reference might be Hartshorn and Hart's (2015) study of the ESL learners' feedback on the AWL and the AVL.

Finally, future research endeavors should be made to explore the basic issues concerning wordlist making and wordlist evaluation, such as what corpora, what counting units, what type of lexical coverage, what focus on word form and word meaning, what target audience, and what lexical frequency levels. The purpose of such efforts is to

establish a systematic framework for compiling and evaluating wordlists. For this purpose, the findings of the present study should be of some value to establishing the framework of academic wordlist compilation and evaluation. Dang and Webb (2015) have probably explored some of the above issues with evaluating general high-frequency wordlists. Thus, building up such a framework should be feasible. Based on such a systematic framework, perhaps, not only better lists of academic words could be compiled, but also better lists of discipline-specific academic words and general high-frequency words could be made.

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