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Investigation of Vocabulary for ESP Classrooms from Academic Journals in Physical Education and Sports Science

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ABSTRACT

Academic vocabulary is regarded as an important vocabulary set for students at the tertiary to master's levels. Besides academic vocabulary, field-specific vocabulary is another important set that students in different fields of study should be required to explore. The physical education and sports science English word list was created to assist physical education and sports science students in their English courses. This field-specific word list was constructed using the lexical profile, frequency, range, and expert verification as criteria. The final step provides a physical education and sports science English word list with 466 word families, which are later categorized into three groups by consulting dictionaries. This word list could be beneficial to teachers and curriculum designers aiming to create useful materials for courses concerning English for specific purposes, especially English for physical education and sports science.

Keywords: English word list, field-specific word list, corpus-based instruction, technical word list, English vocabulary

Introduction

'Academic vocabulary refers to the lexical items that are distinctively frequent across a wide range of academic texts but are infrequent in other fields' (Coxhead & Nation, 2001; Lei & Liu, 2016). Consequently, many academic word lists have been constructed to assist teaching and learning in different academic fields (Lei & Liu, 2016). Hence, many researchers have developed field-specific word lists, such as the Engineering Academic Word List by Mudraya (2006), boasting 1,200 word families to facilitate students to acquire language for technical and non-technical vocabulary in specialized discourse, the Medical Academic Word List (MAWL) by Wang et al. (2008), registering 623 word families to guide instructors in curriculum preparation, and the Nursing Academic Word List (NAWL) by Yang (2015), containing 676 word families in the nursing discipline to offer helpful lexical support for non-native English learners pursuing the publication of papers in English academic papers related to nursing.

One crucial point worth focusing on regarding these field-specific word lists is that most of them followed Coxhead's (2000) method in constructing AWL by excluding West's (1953) high-frequency word list (GSL) or those in the BNC's first and second 1000 most frequent words. Such a practice seems to suggest that language learners need to acquire high-frequency words before they learn low-frequency words (Lei & Liu, 2016). This assumption has been influenced by Nation's (2001) classification of words into four levels: (1) high-frequency words, (2) academic words, (3) technical words, and (4) low-frequency words. It is essential to recognize the overlap between high-frequency, academic, and technical words. The classification system has been reconsidered by adding mid-frequency vocabulary as well as putting academic and technical vocabulary in the "specialized" category (Lei & Liu, 2016).

Lei and Liu (2016) suggested that vocabulary use is different across academic disciplines, so it is important to develop discipline-specific academic lists. To comply with the suggestion by Lei and Liu (2016), a field-specific word list in physical education and sports science has been constructed in this research. Nevertheless, work on a new academic vocabulary list by Gardner and Davies (2014) has challenged Coxhead's (2000) method because many general high-frequency words have a much higher frequency in academic English than in general English and often have specific meanings in academic English. However, the language in a textbook may be intended for academic purposes rather than occupational or career-oriented purposes. Thus, relying on a textbook alone may lead to students being unaware of how the terms are used in the real world (Tangpijaikul, 2014). Therefore, creating a field-specific word list is another pathway to enhance students' vocabulary in specific contexts.

Vocabulary in English for academic purposes is another language-teaching component that is worth paying attention to, and most EAP teachers would agree it is necessary to include vocabulary as part of their courses (Vongpumivitch et al., 2009). In EAP contexts, Laufer (1994, p. 21, as cited in Khani & Tazik, 2013) found that 'writing progress can be measured through lexical progress since lexical quality and writing quality are interconnected'. He believes that a well-used fruitful vocabulary has a compelling effect on learners' writing ability. Hirsh and Nation (1992) stated that knowledge of vocabulary affects reading comprehension and that the size of a reader's vocabulary also affects reading ability. However, deciding which words are worth teaching has never been easy for teachers (Vongpumivitch et al., 2009). Similarly, Coxhead (2000, p. 213) argues that 'one of the most challenging aspects of vocabulary learning and teaching in English for academic purposes (EAP) programs is making principled decisions about which words are worth focusing on'. Besides West's (1953) GSL and Coxhead's (2000) AWL, different field-specific word lists are needed for various fields of study. Recently, several field-specific word lists have been created. However, none can serve all disciplines with one word list alone.

Technical English or Academic English, which focuses on reading comprehension in physical education and sports science, is a mandatory subject for physical education students at one university in Thailand. Contents from academic journals have been used as authentic sources

to create course materials for this subject. Therefore, vocabulary from academic journals is very important for students to improve their reading comprehension.

The aforementioned students need to conduct research before graduating from the university, and these seven international research journals are the most popular research journals used as resources for their research. Consequently, the vocabulary in these research journals is crucial to enable students to complete their courses and conduct their research. This leads to the necessary creation of a word list to assist students in a field of study for which a word list does not exist.

There have been many word lists constructed to support students from different fields. However, there are few word lists related to physical education and sports science. Though Kongcharoen (2018) created a basic English word list for physical education and sports science students, the coverage of that word list is quite low. Consequently, construction of a new physical education and sports science English word list to make it more effective is needed.

Previous Studies

Many researchers have created specialized word lists to assist students in different fields of study. There are several ways to create these specialized or field-specific word lists. Different disciplines need different word lists. Hence, researchers use a variety of approaches to create distinct word lists. There is no single method that has been deemed ideal for creating a specialized word list. Previous researchers used several techniques ranging from word frequency alone to four or five stages to get the final word lists for their own disciplines.

Word lists for academic purposes gained significant popularity when Coxhead (2000) created the Academic Word List, or AWL. AWL claimed to be useful for academic purposes with coverage of 10% or higher. Coxhead (2000) used frequency and range to create Academic Word List, which has been used until the present. Besides AWL, researchers in different disciplines tried to create their own word lists to facilitate vocabulary learning by their students (Kongcharoen, 2018; Tangpijaikul, 2014; Yang, 2015). These word lists are called field-specific word lists. Several methods have been used to create these word lists, ranging from frequency to dispersion, to keyword analysis, in order to extract field-specific words or technical words (Martínez et al., 2009; Mudraya, 2006; Tangpijaikul, 2014; Wang et al., 2008; Yang, 2015).

To identify technical words and vocabulary, Chung and Nation (2004) proposed a rating scale using 4 steps: step 1 means not semantically related to the subject area, while step 2 means minimally related to the subject area, step 3 means a meaning closely related to the discipline, and step 4 means a specific meaning only for a specific discipline and unknown in general English. Chung and Nation considered words included in steps 3 and 4 as technical words. Nation (2014) also proposed a 4-rating scale for expert verification similar to Chung and Nation (2004). In this research, a 4-rating scale from Nation (2014) was employed, and only words that fell into steps 3 and 4 were included.

Previously, it was believed that technical vocabulary accounted for a very small percentage (about 5%) of the words in academic texts in general (Nation, 2001 as cited in Valipouri & Nassaji, 2013). However, Valipouri and Nassaji (2013) suggested that these words may sometimes account for up to one-third of the text, depending on the discipline. Technical words in this research accounted for 4.15%, which was complied with suggestions from Nation. Though the percentage is quite small, it is still very useful for students to start learning this new word list after they have mastered GSL and AWL.

The small percentage of coverage for the technical words in this corpus is quite worrying. However, the case has been argued by Hyland and Anan (2006) that, in ESP courses, the complexities of disciplinary communication need to be highlighted and must accentuate linguistic and rhetorical instruction to the conventions, values and expectations of the specific disciplinary communities where the communication happens. Hence, having a field-specific word list can successfully assist the communication process in specific disciplinary communities. To support

the claim by Hyland and Anan (2006), several field-specific word lists have been constructed so far. The table below shows the previous word lists in different specific fields, including the programs and methods used and the number of words in each list.

Table 1

Academic and Specialized Word Lists

Researcher(s)	Year	Name of the word list	Number of words in the list	Program used	Method(s)	Examples
Coxhead	2000	A New Academic Word List	570 word families	N/A	Frequency, range	Team, final, series, goal, injury
Mudraya	2006	Engineering English: A lexical frequency instructional model	1,260 word families	Wordsmith Tools	Frequency, Key-keyword comparison	use, force, form, flow, pressure
Wang et al.	2008	Establishment of a Medical Academic Word List	623 word families	N/A	Specialized occurrence, range, frequency	cell, data, muscular, significant, clinic
Ward	2009	A Basic Engineering English Word List for Less Proficient Foundation Engineering Undergraduates	299 words	Range Program	Frequency, distribution	load, stress, current, motor, beam, pressure
Martinez, et al.	2009	Academic Vocabulary in Agriculture Research Articles: A Corpus-Based Study	121 word families for full texts, 129 word families for Introduction, 85 word families for Method, 69 word families for Results, 122 word families for Discussion	Wordsmith Tools	Frequency, coverage, distribution	response, analysis, significantly, similar, significant
Khamphairoh & Tangpijaikul	2012	Collocations of Keywords Found in Insurance Research Articles: A Corpus-Based Analysis	N/A	AntConc	Keyword analysis, collocation	cost of insurance, aggregate mortality risk, insurer stock returns, life insurance market, asset pricing model

Khani & Tazik	2013	Towards the Development of an Academic Word List for Applied Linguistics Research Articles	773 word types	Range Program	Frequency, range	research, text, data, task, participation
Hsu	2013	Bridging the Vocabulary Gap for EFL Medical Undergraduates: The Establishment of a Medical Word List	595 word families	Range Program	Frequency, range	diagnose, tumor, renal, syndrome, liver
Valipouri & Nassaji	2013	A corpus-based study of academic vocabulary in chemistry research articles	1400 word families	Range Program	Frequency, range, specialized occurrence	spectrum, molecule, acid, cell, atom
Gardner & Davies	2014	A New Academic Vocabulary List	Top 3,000 lemmas (2,000 word families)	N/A	Ratio, range, dispersion, discipline measure,	study, group, system, social, provide
Tangpijaikul	2014	Preparing Business Vocabulary for the ESP Classroom	134 technical business keywords	AntConc, AntWordProfiler	Frequency, range, keyness, rating scales	asset, auction, bailout, ban, bancassurance
Mozaffari & Moini	2014	Academic Words in Education Research Articles: A Corpus Study	287 AWL word forms, 356 non-AWL word forms	Wordsmith Tools	Frequency, range	academic, activities, achievements, assessment, behavior
Liu & Han	2015	A Corpus-Based Environmental Academic Word List Building and Its Validity Test	458 word families totaling 2332 words	Range Program	Lexical profile, specialized occurrence, range, word family frequency	concentrate, analyze, vary, environment, data
Yang	2015	An Academic Word List for Nursing	676 word families	Range Program	Frequency, range	antibiotic, baseline, cancer, discharge, emotion
Impong & Vitayapirak	2015	Corpus-Based Vocabulary Analysis of Rock Guitar Lessons and a Sample Dictionary	N/A	Wordsmith Tools, Range Program, AntConc	Frequency, distribution of word types and tokens	guitar, chord, major, blues, scale
Muñoz	2015	The Vocabulary of Agriculture Semi-	277 high-frequency	WordSmith Tools 4.0	Lexical description, analysis of	growers, aphids, beetles,

		Popularization Articles in English: A Corpus-Based Study	word families		high-frequency words	producers, resistance
Esfandiari & Moein	2015	A Corpus-Driven Food Science and Technology Academic Word List	1,090 academic words	Range program	Frequency, range	use, sample, high, show, difference
Esfandiari & Moein	2016	A Corpus-Driven Investigation into Lexical Bundles across Research Articles in Food Science and Technology	153 4-word lexical bundles	AntConc	Frequency, range, length	on the other hand, in the present study, in the presence of, in the case of, as a function of
Lei & Liu	2016	A New Medical Academic Word List: A Corpus-Based Study with Enhanced Methodology	1234 lemmas	Stanford CoreNLP, Python	Frequency, ratio, range, dispersion, discipline measure, special meaning criterion	abdominal, abnormality, absent, absorption, activate
Wang	2017	A Corpus-Based Study of English Vocabulary in Art Research Articles	2287 word families	Range Program	Frequency, distribution, lexical profile	repertoire, obtain, distribution, parameter, aspect
Tongpoon-Patanasorn	2018	Developing A Frequent Technical Words List for Finance: A Hybrid Approach	979 words (569 word families)-classified into 413 GSL and 291 AWL)	WordSmith, Antconc, Technical Word Checklist	Keyness, rating scales	finance, firm, cash, stock, interest
Kongcharoen	2018	Basic Physical Education and Sports Science English Word List for Physical Education Students	472 GSL, 153 AWL, 885 non-GSL and non-AWL word families	AntConc, AntWordProfile, DocCompare	Frequency, range, lexical profile	abdominal, absolute, acceleration, acid, actical, actigraph
Safari	2018	Do University Students Need to Master the GSL And AWL Words: A Psychology Word List	923 GSL, 475 AWL, 189 non-GSL and non-AWL word families	TextStat 1.5, TextAnalys	Frequency, range, non-technicality	cognition, basis, competence, deficit, nerve, coach
Safari	2019	English Vocabulary for Equine Veterans: How Different from	909 GSL, 454 AWL, 214 non-GSL and non-AWL	TextStat 1.5, TextAnalys	Frequency	abuse, addiction, collaboration, cord, dysfunction

		GSL and AWL Words	word families			
Jamalzadeh & Chalak	2019	A Corpus-based Study of Academic Vocabulary in Physiotherapy Research Articles	704 GSL, 340 AWL, 406 non-GSL and non-AWL word families	AntWordProfier	Frequency, range, lexical profile, rating scale	therapy, gait, chronic, baseline, mobility
Chen & Lei	2019	Developing a Technical Words List for Research Articles in Computer Science Discipline	769 technical word types	Range Program, manual refinement	Frequency, range, word types	algorithm, node, query, theorem, database
It-ngam & Phoocharoensil	2019	The Development of Science Academic Word List	432-word families	AntWordProfiler	Lexical profile, rating-scale	protein, species, acid, gene, mathematics
Kruawong & Phoocharoensil	2020	Developing an English Zoology Academic Word List: A Corpus-Based Study	286 words	AntWordProfiler	Frequency, range, lexical profile, validation by experts	species, prey, ecology, conservation, traits
Laosrirattanachai & Ruangjaroon	2020	The Word List of Hospitality Service Review Construction	242 words for Tourism Review Word list, 304 words for Accommodation Review Word List, and 319 words for Airline Review Word List	AntWordProfile, AntConc	Range, frequency, keyword analysis, lexical profiling, expert responses	absolute, abundant, access, accommodate, adult
Heidari et al.	2020	Developing A Corpus-Based Word List in Pharmacy Research Articles: A Focus on Academic Culture	750 word families	WordSmith, AntWordProfiler	Frequency, range, dispersion, specialized occurrence	abandon, abnormal, approach, approximate, buffer, bulk
Xodabande & Xodabande	2020	Academic Vocabulary in Psychology Research Articles: A Corpus-Based Study	472 AWL, 693 non-GSL and non-AWL word types	AntWordProfiler	Frequency, range, specialized occurrence	stimuli, scores, patients, cognitive, emotional
Laosrirattanachai & Ruangjaroon	2021	Corpus-Based Creation of Tourism, Hotel, and Airline	378 words for Tourism Business Word List,	AntWordProfiler	Frequency, range, lexical profile,	accommodate, airport, arrive,

		Business Word Lists	274 words for Hotel Business Word List, 245 words for Airline Business Word List		keyness, feedback from specialists and experts	atmosphere, available
Laosrirattanachai & Laosrirattanachai	2021	Applying Lexical Profiling to Construct Technical Word Lists for Thai Tourist Guides	391 words, 245 words for northern Thai, 264 words for central Thai, 138 words for eastern Thai, 187 words for northeastern Thai, and 176 words for Southern Thai	AntWordProfiler, VocabProfile	Frequency, range, keyword analysis, lexical profiling, expert verification	abbot, antique folklore, gable, homage
Kongcharoen	2021	Sports News Investigation for ESP Classroom: Implication for Physical Education and Sports Science	3,043 non-GSL and non-AWL word families	AntWordProfiler	Lexical profile, text coverage	apprentice, archery, bullpen, bulker, dugout
Khany & Kalantari	2021	Accounting Academic Word List (AAWL): A Corpus-Based Study	354 AWL, 658 Accounting Academic word families	Range Program	Frequency, range, specialized occurrence	research, audit, financial, evidence, analysis, cash, equity
Arungvong Na Ayutthaya, et al.	2022	Making Beverage Service Word List for English for Specific Purposes Classroom	288 words	AntWordProfile, Range Program	Frequency, range, lexical profile, expert consultation	absinthe, acacia, acidic, aftertaste, aguardiente
Rungrueang et al.	2022	Corpus-Based Approach to Generate a Word List for Food Service	261 words	Key-BNC, AntWordProfiler	Keyword analysis, lexical profile, expert viewpoint	allspice, almond, anchovy, anise, basil

From the table above, it can be seen that there are many methods for creating word lists. Each word list has a specialized method. Researchers use frequency, range, lexical profile and expert consultation to create their word lists. However, none of the specialized word lists above categorizes the words according to their meanings. In this research, the method used for creating the word list included frequency, range, lexical profile, rating scales from inter-raters, and consulting dictionaries to categorize the words extracted into groups based on their meanings.

Numerous researchers have also extracted frequent GSL and AWL word families from different specialized corpora. Many of them agree that GSL and AWL should be taught to students first, followed by the word list from the specialized corpora they have created. After mastering the

GSL and AWL as suggested, students should master the field-specific vocabulary in their fields of study. However, technical words might not always be the answer for all students. Therefore, the aim of creating a word list for physical education and sports science is not only to get technical words but also to emphasize the technical words that carry general meanings in general texts and also have specialized meaning in physical education and sports science texts. Students can get confused with these words, so focusing on these words will help students with their reading comprehension. They seem to know specific technical words related to physical education and sports science, such as kinesiology or agility very well since they have had a chance to get exposure to these technical words. Meanwhile, the technical words that carry multiple meanings may be confusing to these students. Hence, this present study aims to investigate the field-specific words from academic journals in physical education and sports science. The research questions are as follows:

1. What are the field-specific words from physical education and sports science academic journals?
2. How many groups can the physical education and sports science field-specific words be classified into and what are they?

Methodology

Data compilation

The physical education and sports science corpus or PESS corpus comprises 560 research articles from 7 high-indexed free-access journals in the field of physical education and sports science, namely the *Journal of Athletic Training, Bone and Joint Journal, International Journal of Sports Science and Coaching, Journal of Sports Science, British Journal of Sports Medicine, Psychology of Sports and Exercise,* and *Journal of Physiology*. These seven journals were selected because they are internationally renowned with high impact factors. They also cover a wide range of topics in the field of physical education and sports science. Moreover, these journals were selected based on popularity from suggestions by physical education students and instructors. They are free to access the SCImago portal, which is available at https://www.scimagojr.com. Since they are free to access, students in physical education and sports science can easily access these journals for research purposes.

The corpus was compiled electronically from 2012-2021 with 2,569,198 running words and 44,999 types. The pictures, graphs, and tables were deleted. The results from AntWordProfiler are as follows:

Table 2

Results of Each File from AntWordProfiler

File name	Number of lines	Number of types	Number of tokens
Journal of Athletic Training 2012-2021	4399	16354	348147
Bone and Joint Journal 2012-2021			
International Journal of Sports Science and Coaching 2012-2021	5450	15608	277283
Journal of Sports Science 2012-2021	4201	14691	295180
British Journal of Sports Medicine 2012-2021	4484	18616	341507
Psychology of Sports and Exercise 2012-2021			
Journal of Physiology 2012-2021	4645	19270	394271
	6413	23292	507163
	4675	23509	405647

Data analysis

In terms of the analysis program, AntWordProfiler software was used to eliminate certain GSL and AWL words from the list. AntWordProfiler is a free lexical program created by Lauren Anthony. From the table below, only 61.86% of the first 1,000 GSL and 6.44% of the second 1,000 GSL appears in the PESS corpus, with the accumulation of 68.3% text coverage for the whole corpus. This is considered very low coverage and far from what has been claimed to be adequate at 80% coverage.

AWL appears to be high coverage at about 12.24%. Coxhead (2000) claimed that AWL should have 10% coverage or higher for academic text. This finding confirmed the suggestion that AWL is another important word list that students need to explore before furthering their knowledge with another high-frequency word list.

Table 3

Results of the Whole Corpus from AntWordProfiler

FILE.	TOKEN	TOKEN%	CUMTOKEN%	TYPE	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1.gsl1st1000.txt	1589355.	61.8	61.86	3307	7.35	7.35	982.	2.49	2.49
2.gsl2nd1000.txt	165438	6.44	68.3	2064	4.59	11.94	820.	2.08	4.57
3. awl_570.txt.	314457	12.24	80.54	2497	5.55	17.49	568.	1.44	6.01
0. -	499948.	19.46	100	37131	82.52.	100.01	37131	94.00	100.01
TOTAL:	2569198			44999			39501		

Source: AntWordProfiler software

The criteria for creating this word list are frequency, range, lexical profile, expert verification, and dictionary consultation.

1. Lexical profile

Words in the first 2,000 GSL and all AWL are excluded from the list for the next criterion. There are 499,948 running words, accounting for 19.46%, that are not GSL and AWL. In this stage, the AntWordProfiler program is used. The results from AntWordProfiler are as follows:

Table 4

Statistics from AntWordProfiler

FILE.	TOKEN	TOKEN%	CUMTOKEN%	TYPE	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1. gsl1st1000.txt	1589355.	61.8	61.86	3307	7.35	7.35	982.	2.49	2.49
2. gsl2nd1000.txt	165438.	6.44	68.3	2064	4.59	11.94	820.	2.08	4.57
3. awl_570.txt	314457.	12.24	80.54	2497	5.55	17.49	568.	1.44	6.01
0. -	499948.	19.46	100	37131	82.52.	100.01	37131	94.00	100.01
TOTAL:	2569198			44999			39501		

Source: AntWordProfiler software

In this stage, GSL and AWL words are excluded since they are always considered as essential word lists that students need to master before the exposure to field-specific word lists. So, the off-list words which can create the field-specific word list are focused for the next stage.

2. Frequency

For frequency, any non-GSL and non-AWL words that appear more than 70 times in the whole corpus are included for the next criterion. To comply with Coxhead (2000) in creating AWL, the same criterion is used. In creating AWL, any words that appear more than 100 times in the whole corpus and appear at least 10 times in each sub-corpus are included. The total number of

words in creating AWL is approximately 3,500,000 words. Meanwhile, there are approximately 2,500,000 words in the PESS corpus. Hence, any words that appear more than 70 times in the whole corpus are included. In this stage, there are 1,300 words which appear more than 70 times and are included for the next stage.

3. Range

Any non-GSL and non-AWL words that appear more than 7 times in each sub-corpus are included for the next criterion. Coxhead's (2000) criterion in creating AWL is followed in this stage as well. For Coxhead's criterion, any words that appear more than 10 times in each sub-corpus are included. Since the corpus size in this research is slightly smaller than Coxhead's, the range is adjusted so that any words that appear at least 7 times in a sub-corpus are included. In this stage, 1,066 words, which are later categorized into 883 word families, are included for the next stage.

4. Expert verification

Words that passed all three criteria are put together into word families. There are 883 word families in this stage. Nation (2014) proposed rating scales for expert verification. In this research, Nation's (2014) rating scale is adopted as follows:

1 Words such as function words or other words that have a meaning that has no particular relationship with the field of physical education or sports science

2 Words that have a meaning that is minimally related to the field of physical education and sports science

3 Words that have a meaning that is closely related to the field of physical education and sports science

4 Words that have a meaning specific to the field of physical education and sports science and are not likely to be generally known

Words that fall into categories 3 and 4 are chosen for inclusion in the word list. There are 883 word families that passed lexical profile, frequency, and range criteria as rated by three experts who are lecturers for Physical Education and Sports Science courses at two universities in Thailand. After the rating criterion, 466 word families appear in the list.

5. Dictionary consultation

After the rating-scale stage, all 466 word families are checked with Macmillan Dictionary (2022) and Oxford University Press (2022) to categorize each word family into groups. The 466 word families can be classified into three groups, which include (1) words with meanings that cannot be found in common dictionaries, (2) words with a single meaning that is related to sports, sports science or health, and (3) words with multiple meanings but only one meaning that is related to sports, sports science or health.

Results

After the four stages of creating the word list, 466 word families passed all criteria. The 466 word families were then categorized into three groups, as shown in the appendix section.

In order to verify the need to create a new English word list for physical education and sports science, the two word lists were compared.

Table 5

Results of the Overlap between the Old PESS Word List and the New PESS Word List

FILE	TOKEN	TOKEN%	CUMTOKEN%	TYPE.	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1. PESS list.txt.	322	29.51	29.51.	322	29.57	29.57	322.	29.57	29.57
0. -	769	70.49	100	767	70.43	100	767.	70.43	100
TOTAL	1091			1089			1089		

Source: AntWordProfiler software

From the table above, only 322 tokens out of 1,091 tokens had overlap with the Basic Physical Education and Sports Science English word list (the previous one). These 322 tokens accounted for 29.51%. Therefore, the new physical education and sports science English word list has more words that are worth considering. The criteria for creating a new physical education and sports science English word list are much clearer and follow many previous researchers. Moreover, the coverage of the previous physical education and sports science English word list is considered very low compared to the new one.

Table 6

Results of the Old PESS Word List

FILE	TOKEN	TOKEN%	CUMTOKEN%	TYPE	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1. PESS old list.txt.	85.	0.00	0	1	0.00	0	1	0.00	0
2. -	2569113	100.00	100	44998	100.00	100	44998	100.00	100
TOTAL.	2569198			44999			44999		

Source: AntWordProfiler software

From the table above, the results from AntWordProfiler software show that there are only 85 words from the previous physical education and sports science English word list in the PESS corpus. It is quite startling to see in this finding that the coverage from the previous word list is very low in this corpus.

When using the new physical education and sports science English word list to verify the coverage, the results of the PESS word list are as follows:

Table 7

Results of New PESS Word List

FILE	TOKEN	TOKEN%	CUMTOKEN%	TYPE	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1. PESS list.txt.	106750	4.15	4.15.	499	1.11.	1.11	499	1.11	1.11
0 -	2462448.	95.85	100	44500	98.89.	100	44500	98.89	100
TOTAL.	2569198			44999					

Source: AntWordProfiler software

The coverage of the new physical education and sports science English word list is higher than the previous one, with a coverage of 106,750 running words, accounting for 4.15% of the whole corpus. The coverage of the PESS word list is 4.15%, and the total coverage is over 80% when combining it with GSL and AWL, which is considered reasonable. This suggests that the new physical education and sports science English word list is useful for creating materials in Technical English or Academic English courses to enhance students' reading ability.

Table 8

Results of Coverage for the New PESS Word List

FILE	TOKEN	TOKEN%	CUMTOKEN%	TYPE	TYPE%	CUMTYPE%	GROUP	GROUP%	CUMGROUP%
1. gsl1st1000.txt.	1589355.	61.86.	61.86	3307	7.35	7.35	982.	2.49	2.49
2. gsl2nd1000.txt	165438.	6.44	68.3	2064	4.59	11.94	820.	2.08	4.57
3. awl_570.txt	314457.	12.24	80.54	2497	5.55	17.49	568.	1.44	6.01
0. -	499948.	19.46	100	37131	82.52	100.01	37131.	94.00	100.01
TOTAL:	2569198			44999			39501		

Source: AntWordProfiler software

The total coverage might be low due to the low coverage of GSL for both the first 1,000 and second 1,000 in this corpus. It may be assumed that GSL might not play an important role in the Physical Education and Sports Science corpus. However, GSL is an important list that students need to master before exploring other word lists. In this case, GSL might be too general for academic research papers in the physical education and sports science field. Hence, GSL can be replaced by other frequent word lists such as the first 2000 frequent words from COCA or BNC.

On the contrary, AWL is very crucial for reading research articles, especially research articles concerning the field of physical education and sports science. Coxhead (2000) suggested that 10% coverage of AWL should be considered high. The AWL convergence in this corpus is 12.24%. Thus, it can be assumed that AWL is another important word list that students should master in order to read physical education and sports science academic research comprehensibly.

From Table 8, the off-list words account for 19.46%. Within this 19.46%, the words can be either technical words or low-frequency words. Hence, the words in this off-list are put into another stage, which is frequency, for creating a physical education and sports science English word list. Any words that appear more than 70 times in the whole corpus passed this criterion. There are 1,300 words which passed this criterion and are ready for the next stage.

After the frequency stage, range analysis is employed. Any words that appear more than 7 times in each sub-corpus are included in the next stage of word list construction. In this stage, there are 1,066 words that pass this criterion. After that, these words are put into word families before being sent to inter-raters for rating-scale criterion.

The rating scale from Nation (2014) is then employed in the final stage of creating the word list. There are 883 word families that passed lexical profile, frequency, and range criteria and were rated by three experts who are lecturers in the physical education and sports science field at two universities in Thailand. After the rating criterion, 466 word families appear in the word list.

Some researchers (Rungrueang et al., 2022) might use a software program for keyword analysis, such as the Key-BNC program. However, the rating scale utilized by the inter-raters is used in this research because there is a need to ensure that certain general words containing specialized meanings are included. Keyword analysis software might eliminate these kinds of words. Therefore, a rating scale is more trustworthy than software programs in terms of being used in this research.

Since the experts for the rating-scale process are Thai lecturers in the field of physical education and sports science only, they may not have expertise in English vocabulary. Though they are trained on how to rate the vocabulary, they may not be aware of any other meanings that might be hidden in the same words, focusing instead on the specialized meanings with which they are familiar. Hence, consulting dictionaries is recommended after the process of rating. After consulting dictionaries, all the words in this research were categorized into three groups including (1) Words with meanings that cannot be found in common dictionaries, (2) Words with a single meaning that is related to sports, sports science or health, and (3) Words with multiple meanings but only one meaning related to sports, sports science or health. The words in the same families are then put into the same group.

In group 1, words such as *acetabular, calorimetry, diaphyseal, fitbit, isokinetic, myofilament, neurocognitive, psychosocial, and tibiofemoral* cannot be found in the Macmillan Dictionary (2022) or

Oxford University Press (2022), likely because they are specific to the physical education and sports science field. Most of the words in this class are technical terms related to health. For example, the word *fitbit* appears in the list only when it is the brand name of a fitness tracker. Therefore, this word cannot be found in common dictionaries. Some words like *isokinetic* normally appear with the word *exercise*. Thus, it cannot be found when trying to find the meaning for the word *isokinetic*. *Isokinetic exercise* refers to movement at a constant speed regardless of the force applied (See Appendix A).

In group 2, words such as *abdominal, agility, basketball, catcher, endurance, fulsal, gait, goalkeepers* are words with single meanings that are related to sports, sports science or health. These words are related to sports or health. Students may not be confused with these words since they carry only one meaning that is directly related to sports, sports science, or health. For example, students are familiar with words like *kinesiology*, which refers to the study of human and non-human movements, performance, and function. Hence, students are likely to be familiar with the word *kinetic*, whose meaning is related to kinesiology (See Appendix B).

In group 3, words such as *acceleration, aerobic, anaerobic, baseline, backcourt, coach, concussion, defender, elite, fasting, intercept, league, marathon, pace, patient, racket, and tackle* have multiple meanings, but only one meaning related to sports, sports science or health. Words in this group are very important since they carry multiple meanings. Students need to know other meanings as well. Besides the specialized meanings, other meanings are also essential. For example, the word *tackle* in rugby football means to take hold of an opponent in a game and stop them from moving forward, usually by forcing them to the ground. For its general meaning, *tackle* can be seen in the context of '*tackle a problem'*, which means to solve an issue. Take the word *coach* as another example. *Coach* means someone who trains a sports player or team. Students might be familiar with this meaning, but a *coach* can also be a vehicle for carrying many passengers, as seen in the statements below.

Sample Statement 1
'Additionally, they indicated that both short- and long-term health consequences influenced and deterred their search for care and that their support systems, including coaches and athletic trainers, played a role in their concussion experience.

Sample Statement 2
'There are daily coach tours from Bangkok to Chiang Mai.'
(See Appendix C)

Conclusion

Word lists are considered essential for facilitating students in English vocabulary teaching and learning. Many researchers have suggested that using word lists in the creation of materials in English for specific purposes is another useful way to assist students with increasing their vocabulary banks (Coxhead & Nation, 2001; Nation, 2001). For this reason, an English word list for physical education and sports science is needed to support physical education and sports science students in English language learning. After the final stage of creating a word list, consulting dictionaries is recommended to categorize the words into sub-groups. PESS word list can be classified into three groups including (1) Words with meanings that cannot be found in common dictionaries, (2) Words with a single meaning that is related to sports, sports science or health, and (3) Words with multiple meanings but only one meaning related to sports, sports science or health. The classified word list can assist students to focus on the words that they should explore and practice frequently. Hence, an improvement in reading comprehension is expected after using this English word list. The word list was constructed based on the methods from previous researchers. However, consulting dictionaries in the last stage of creating a word list has been added to make the list more functional.

Limitations and Recommendations for Further Studies

The word list was created based on the methods followed in previous research. However, some stages can limit the appearance of technical words, such as the lexical profile stage. Some words such as *leg* appear in the second 1000 GSL with the meaning of '*one of the two parts of your body to which your feet are attached*', while the word *leg* can be '*one of the two matches played between the same teams that form part of a competition, especially in football*' as well. In this respect, the lexical profile may limit the appearance of certain technical words in some specialized fields, especially words with multiple meanings. Therefore, the lexical profile stage should be utilized with careful inspection.

The PESS word list has not yet been tested with students. There is a need to try using this word list in classrooms. The word list is useful for teachers and curriculum designers, who could use this word list to create materials for courses regarding English for specific purposes, especially English for physical education and sports science. For example, the word list in Group 3: Words with multiple meanings but only one meaning related to sports, sports science or health, can be focused on a class by creating an activity using this list. Students may be asked to create 15-to-20 word maps from this list. Each word map consists of a part of speech, a definition, and three sentence samples. The activity can be explored further in terms of which definition for the selected words students should use. Subsequently, the definition can be identified to consider whether students could use the meaning related to sports, sports science, or health or general meaning. The teachers can lecture about other meanings regardless of sports, sports science, or health.

Moreover, data compiled in this study originated from seven hi-indexed, open-access journals in the field of physical education and sports science. Other high-indexed journals in the same field that were not free to access were not included in this study.

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Appendices

A New Physical Education and Sports Science English Word List

Group 1 Words with Meanings That Cannot Be Found in Common Dictionaries

Acetabular	endothelial, endothelium	phosphorylation
Actin	ergometer	piriformis
Adduction	eversion	locomortor
Adenosine	exercisers	mets
Adrenergic	humeral	microbiota
afferent, afferents	iliac	modifiable
agonist	fitbit	osteotomy
angiogenic	fixator	pubertal
anova, anovas	intracellular	psychosocial
anteroposterior	isokinetic	submaximal
anthropometric	gluteal	supercompensation
arthroplasties, arthroplasty	haemodynamic	synchrony
autonomic	inhibitory	postprofessional
biomechanical, biomechanics	multivariable, multivariate	potentials
brachial	myofibrillar	prefrontal
calorimetry	myofilament	reperfusion
cohen	myosin	scapular
contralateral	myotubes	sensorimotor
covariate, covariates	neurocognitive	soleus
corticosteroid	neurogenesis	synthase
countermovement	neuromotor	tibial
creatinine	noradrenaline	tibiofemoral
cronbach	kinase	vasculature
diaphyseal	kneeflex	vastus
dynamometer	parasympathetic	

Group 2 Words with A Single Meaning That Is Related to Sports, Sports Science or Health

gait	lipid	pelvic, pelvis
goalkeepers	lipoprotein	phosphate
gymnastics, gymnasts	lumbar	physiotherapy
golf, golfers	lymphatic	plantar
haemoglobin	ischaemia, ischaemic	plasticity
hamstring	kinematic, kinematics	postmenopausal
handball	kinetic, kinetics	prep
healthcare	lacrosse	preseason
heightened	landings	pretest
hockey	ligament	protein, proteins
hormone	maximal	pulmonary
horizontal	medial	puberty
hypertension	medication	racers
hypertrophy	metabolic, metabolism	radial
hypoxia, hypoxic	midfielders	radiation

Group 2 Words with A Single Meaning That Is Related to Sports, Sports Science or Health (cont.)

illness	mitochondrial	rationale
impaired, impairment, impairments	molecular	recreational
indoor	morbidity	rhythm
inflammation, inflammatory	myocardial	rowers
insulin	obsessive	staffing
intention	olympic	stressor
intermittent	opposition	subjective
interpersonal	optimal, optimize, optimise, optimism,	synaptic
intramuscular	orthopaedic	synergies
jogging	osteoarthritis	serotonin
judo	outdoor	softball
lab, laboratory	overuse	synovial
lactate	overgrowth	teammate, teammates
lateral	oxygen	tennis
therapeutic	unilateral	ventilation, ventilatory
tibia	vasoconstriction, vasoconstrictor	ventricular
torque	vasodilation, vasodilator, vasodilatory	yoga
tournament	velocities, velocity	
triathletes	ventral	

Group 3 Words with Multiple Meanings but Only One Meaning Related to Sports, Sports Science or Health

acceleration, accelerations, accelerometer, accelerometers, accelerometry	burnout	defensive
acute	cadence	descriptive
advanced	casual	determination
aerobic	cell, cells, cellular	developmental
align, alignment	chronic	different, difference, differences, differential, differently
amateur	chest	dislocation
anaerobic	circulate, circulating, circulated, circulation	disorder, disordered, disorders
angle, angles	classification	dose, doses
angular, angulation	clinic, clinically, clinician, clinicians	dribbling

Group 3 Words with Multiple Meanings but Only One Meaning Related to Sports, Sports Science or Health (cont.)

aquatic	coach, coaches, coaching	drills
arithmetic	coefficient, coefficients	drug
arousal	collaboration	dehydrate, dehydration
athlete, athletes, athletic, athletics	comparable	dependent, dependence
authentic	competence, competency, competencies, competent	dysfunction eccentric
average, averaged	completion	
axial	complication	elbow
axis	concussion	elevate
backcourt	conditioning	elite
barrier, barriers	confident, confidence	endpoint
baseline	cooling	engage, engaged, engagement, engaging
behavioral, behavioural	continuous, continuously	execution
beep	courses	executive exert, exertion
biological	cues	pathway, pathways
bout, bouts	decelerations	exhaustion
breakdown	decompression	expenditure
built	defenders	
fitness	leisure	positional
frontal	limb, limbs	practiced, practicing
grip	limit, limitation, limitations	prescribed, prescription
gross	liver	profile, profiles
handgrip	longer	pulse
heel	longitudinal	receptor, receptors
height	lower	racket
hip, hips	locomotion	recruit, recruited, recruitment
hop	magnitude	reflex
imbalance	marathon	repetition, repetitions, repetitive
immobilize, immobilized, immobilization	mechanical	score, scored, scores, scoring
immune	measurement, measurements	sedentary
impulse, impulses	membrane	senior, seniors
inactive, inactivity	micro	squash
infant	mobility	stationary
infect, infected, infection	modality	

Group 3 Words with Multiple Meanings but Only One Meaning Related to Sports, Sports Science or Health (cont.)

immobilize, immobilized, immobilization	momentum	storage
strenuous	tackle	umpire
stride	tag	untrained
superficial	talent, talented	vector
supine	tolerance	versus
supplemental, supplementation	trauma, traumatic	vigorous
synchronisation,		