

Word-list-based EAP Vocabulary Teaching to Science Students in China

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Abstract. Since EAP (English for Academic Purposes) teaching is being paid greater attention to in China, a trend appears that EAP courses are becoming the mainstream university EFL (English as a Foreign Language) courses. This paper looks into science-specific college students in China in the pedagogical EAP setting. We analyzed two effective and systematic word lists: Academic Word List and Science Word List, and provided a three-step method to utilize word lists in the EAP vocabulary classroom. We also offered suggestions about EAP vocabulary teaching to Chinese teachers in tertiary education and the future work that needs to be done.

Background: EAP Teaching in Chinese Higher Education

In recent years, a heated debate is going on in China: should EAP (English for Academic Purposes) replace EGP (English for General Purposes) in EFL (English as a Foreign Language) teaching in domestic higher education [1]. It is noted that the English curriculum in Chinese universities should concern students' needs in real life, rendering transition from the college English classroom to the learning environment abroad. The necessity of promoting EAP courses has been emphasized [2].

The publication of *A Framework of Reference for EFL Teaching at Tertiary Level in Shanghai (Trial Implementation)* [3] (shortened as *Framework* in this paper) in 2013 marks the determination of adapting to this imperative trend. In the *Framework*, it is clearly stated that EAP courses are the mainstream of EFL teaching in Chinese universities, and a number of those in Shanghai are serving as pioneers.

Academic Word List

One important aspect of learning a foreign language is to have a good command of the vocabulary. EAP teaching is of no exception. A survey about students' need analysis towards EAP environment has been done in China [4]. 85.1% participants, all undergraduates from four universities in Shanghai, regarded "lacking vocabulary, especially academic and semi-technical vocabulary" as one of the primary difficulties in learning EAP. In dealing with this problem, Academic Word List (AWL) has been proved to be effective and systematic across many countries [5].

AWL was developed by Coxhead [6]. She compiled a 3.5-million-running-word academic corpus including four subcorpora: arts, commerce, law and science, and each subcorpus was divided into 7 subject areas. Three word selection principles were observed: words occur in at least 15 of all 28 subjects, at least 100 times across the four disciplines and at least 10 times in each discipline. 570 word families met the criteria, the number already excluding the 2000 most frequent English words in

General Service List (GSL) [7]. All these 570 word families take up 10.0% of the tokens (total words) in the academic corpus, much higher than that over the same-sized fiction corpus; together with the 2000 words in GSL, they total 86.1% coverage over the academic corpus.

AWL in EAP teaching is mostly applied to setting goals for students' vocabulary learning [8]. For instance, according to the *Framework* the basic-level vocabulary capacity is to “develop a spoken and written productive vocabulary ... of BNC 3000 word families which include very high-frequency academic word families”.

Science Word List

In the past few years, there was argument that undergraduate students specialize in so widely ranged disciplines and subjects that no one general word list fits all [9]. Therefore more specialized academic word lists are called for. In terms of the word list tailored to science-specific students, Science Word List (SWL) is a reliable reference in addition to the widely applicable Academic Word List.

Science Word List was developed by Coxhead and Hirsh [9]. They compiled a corpus of 1.7 million running words consisting of scientific written texts mainly geared towards science-specific undergraduates across 14 subject areas, including the 7 subject areas already contained in the science subcorpus of the academic corpus.

Based on the three word selection criteria – words occur in at least 7 subjects, at least 50 times in sum and at least 35 times in each subject area— 318 word families (already ruling out GSL and AWL) were found to cover 3.79% of all the tokens, which were verified to have a much higher coverage over the other three subcorpora in the academic corpus and the 3.5-million-word fiction corpus. It can be boldly concluded that these 318 word families are specialized in scientific texts. The cumulative coverage of GSL, AWL and SWL over the new science corpus is 84.27%.

Using AWL and SWL in EAP Courses

The combination of AWL and any subject-focused word list in EAP pedagogical setting was encouraged [10]. In this paper, we focus on the application of AWL and SWL in EAP vocabulary instruction to science students in Chinese universities.

Word Highlighting, Frequency and Collocation

One of the major concerns about word-list-based vocabulary learning of EFL is being decontextualized [11]. It is essential for EFL learners to get hold of the lexical bundles or stable word combinations, and consequently their ability of using a word in an authentic way is fostered.

As well, EAP vocabulary learning needs to be in the contextual environment. Compleat Lexical Tutor [12] can be used to identify word use in a science text and highlight all the words which meet the searching criteria. The sample chemistry text [13] in Table 1 contains 151 running words. Of these, 108 tokens (71.52%) are from GSL (in normal text), 29 from AWL (19.20%, in **bold**), 7 in Science Word List (4.64%, in **shaded**), and 7 not in any list (*italics*). In all, the cumulative coverage of GSL, AWL and SWL over the sample chemistry text is 95%.

Table 1. A sample chemistry text

When a **chemical** substance is **transformed** as a result of its **interaction** with another substance or with **energy**, a **chemical reaction** is said to have **occurred**. A **chemical reaction** is therefore a **concept** related to the “**reaction**” of a substance when it comes in close **contact** with another, whether as a mixture or a solution; **exposure** to some form of **energy**, or both. It results in some **energy** exchange between the **constituents** of the **reaction** as well as with the system **environment**, which may be **designed** vessels—often **laboratory glassware**.

Chemical reactions can result in the formation or *dissociation* of **molecules**, that is, **molecules** breaking apart to form two or more smaller **molecules**, or *rearrangement* of atoms within or across **molecules**. **Chemical reactions** usually **involve** the making or breaking of **chemical bonds**. *Oxidation*, reduction, *dissociation*, *acid-base neutralization* and *molecular rearrangement* are some of the commonly used kinds of **chemical reactions**.

As we can see, disregarding words from GSL, *chemical* and *reaction(s)* are of highest frequency in this text, occurring both 7 times. The word *molecules* ranks the third highest frequency word, occurring 5 times if including its adjective form *molecular*.

We also ran concordances on the word *molecule* to check its collocates over the British National Corpus (BNC) [14], a 100-million-word text corpus of samples of written and spoken English from a wide range of sources, and it shows that the word family of *molecule* occur altogether 753 times. Here are some statistics collected.

 Table 2. Frequency-ranked collocates of *molecule* in BNC sorted one word to each side

	CONTEXT	FREQUENCY
1	DNA	25
2	per	16
3	adhesion	14
4	water	14
5	each	13

The word *DNA* tops the list, occurring 25 times out of 753. However, it could not be told whether *DNA* co-occurs with *molecule* one word to its left or right. So we looked into the actual contexts in which the word and its collocations occur. In Table 3, five selected contextual patterns are presented. It can be found that the co-occurrence of these two lexical items is in a fixed order.

 Table 3. Context in which the lexical pair *DNA molecule* occurs

- 1 ... how the information necessary to specify living creatures, which is stored in the *DNA molecule*, was transcribed and its instructions expressed to make living cells. ...
- 2 ... is extended to form a new double stranded molecule. Thus each double stranded *DNA molecule* in the original sample has been melted to form two single stranded ...
- 3 ... that contains a 5-fluorocytosine residue at the substrate position # A duplex *DNA molecule* was constructed by hybridizing oligonucleotides CFUP and CCLO. ...
- 4 ... cleavage, R Eco K is believed to make a single-stranded cut in the *DNA molecule*; therefore, a complete double-stranded cleavage requires two endonuclease ...
- 5 ... translocating enzymes meet. In the case of a *DNA molecule* with only one recognition site the cut would require co-operation between the specifically bound ...

The illustrations above have pictured a clear frame: making full use of the word list—either general academic or discipline-based—is a step-by-step work: 1) highlight the words in need of analysis, 2) run concordances of these words and obtain the frequency-ranked list, and 3) look into the context in which collocations occur.

Suggestions for EAP Teachers

Teaching and learning vocabulary of another language should be highlighted from three aspects: form, meaning and use, both receptively and productively [15]. In the following, we provide suggestions to EAP teachers on how to benefit from word lists in receptive and productive methods. Table 4 presents several examples.

Table 4. Receptive and productive methods of teaching a new word in three aspects

Form	Receptive	- True/ false judgment: identify the correct affixes (e.g. should it be added <i>dis-</i> or <i>un-</i> to the word <i>comfortable</i> to mean the opposite), verb conjugation (past tense, past perfect, etc.), different part of speech (e.g. noun, adjective, adverb), etc.
	Productive	- Dictation: focus on spelling - Reading aloud: focus on pronunciation
Meaning	Receptive	- Categorizing: put synonymic words together - Matching: match the best definition to the same word used in different sentences (See Table 5 below)
	Productive	- Mind map: brainstorm lexical items associated with the core word, either phonetically, morphologically or semantically - Paraphrasing: use learners' own words to explain the target word (<i>suggested for intermediate and advanced learners</i>)
Use	Receptive	- Multiple choices or cloze: recognize fixed expressions and collocational patterns
	Productive	- Writing or translation: use a word correctly from semantic, syntactic and pragmatic perspectives

In learning and teaching vocabulary, it is important to be equally competent of comprehension and production. We cannot ignore the fact that, according to the three steps we have discussed, word lists are inclined to yield receptive fruits more and not valuable for vocabulary learning for productive purposes [16].

Table 5. An example of matching exercise of the word *bond*

<i>bond</i>	A. an official document promising that a government or company will pay back money that it has borrowed, often with interest B. something that unites two or more people or groups, such as love, or a shared interest or idea C. the way in which two surfaces become attached to each other using glue D. the chemical force that holds atoms together in a molecule E. a written agreement to do something, that makes you legally responsible for doing it
	_____ 1) In each methane molecule there are four CH <i>bonds</i> . _____ 2) You should use a glue gun to form a strong <i>bond</i> on wood or china. _____ 3) The <i>bond</i> was signed jointly and severally. _____ 4) My father put all his money into stock market <i>bonds</i> . _____ 5) Common tastes form a <i>bond</i> between the two men.

A pertinent production-oriented approach is using learner corpus. International Corpus of Learner English (ICLE), a large EFL corpus produced by learners from eleven different mother tongue backgrounds, is suggested to be used as “a comparison of learner data with native speaker data or a comparison between different types of learner data” [17]. A research was done on the frequencies of the EAP nouns by comparing this learner corpus with one produced by English native speakers, and some data about underuse, overuse and misuse of certain lexical items and bundles

were collected [16].

Therefore, EAP teachers in Chinese universities should take on this approach and utilize it. The biggest difficulty we meet now is the absence of a reasonable and feasible learner corpus. There is hardly any possibility of using ICLE: those mother tongue backgrounds are all European country languages. Future work is to compile the particular academic corpus produced by science-specific undergraduates in China, and make full use of it towards more targeted and effective EAP courses in return.

Conclusion

Clearly, academic and discipline-based word lists harbor limitations: too much focus is put on the semantic behavior of words and not even proportion of focus is distributed to their syntactic and pragmatic usage. Both receptive and productive approaches to knowing a word are necessary for vocabulary teaching and learning.

Since teaching focus on EFL learners in Chinese tertiary education is undergoing a gradual shift from EGP to EAP setting, more targeted methods for Chinese undergraduates are required. Researchers should establish a science-specific learner corpus in order to apply AWL and SWL to EAP teaching more efficiently.

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References

- [1] Q. Wen, EGP vs. ESP in college English teaching: Problems and solutions, *Foreign Languages and Their Teaching*. 1 (2014) 1-8.
- [2] Y. Du, Z. Wang, P. Du, Adopting blended learning to teaching EAP in Chinese higher education: Challenges and solutions, 3rd International Conference on Advanced Education and Management, Hangzhou, Zhejiang, China, August 6-7, 2016. Lancaster, PA, USA: DEStech Publications, Inc., Electronic product—5 pp.
- [3] Steering Committee of College English Teaching in Colleges and Universities in Shanghai, A Framework of Reference for EFL Teaching at Tertiary Level in Shanghai (Trial Implementation), Higher Education Press, Beijing, 2013.
- [4] J. Cai, Academic English: Needs analysis and teaching methods, *Foreign Language Learning Theory and Practice*. 4 (2012) 30-35+96.
- [5] M. Horst, T. Cobb, I. Nicolae, Expanding academic vocabulary with an interactive on-line database, *Language Learning & Technology*. 9 (2005) 90-110.
- [6] A. Coxhead, A new academic word list, *TESOL Quarterly*. 34 (2000) 213-238.
- [7] M. West, *A General Service List of English Words*, Longman, London, 1953.
- [8] A. Coxhead, The academic word list 10 years on: Research and teaching implications, *TESOL Quarterly*. 45 (2011) 355-362.
- [9] A. Coxhead, D. Hirsch, A pilot science-specific word list, *Revue Française de Linguistique Appliquée*. 2 (2007) 65-78.

- [10] M. Lessard-Clouston, Word lists for vocabulary learning and teaching, *The CATESOL Journal*. 24 (2012/2013) 287-304.
- [11] D. Hirsch, A. Coxhead, Ten ways of focussing on science-specific vocabulary in EAP classrooms, *EA Journal*. 25 (2009) 5-16.
- [12] T. Cobb (n.d.). The Compleat Lexical Tutor. Available at <http://www.lex tutor.ca>
- [13] Adapted from Wikipedia. Downloaded on 5 November 2016 from <https://en.wikipedia.org/wiki/Chemistry#Reaction>
- [14] Available at <http://corpus.byu.edu/bnc/>
- [15] P. Nation, *Learning Vocabulary in Another Language*, Cambridge University Press, Cambridge, 2001.
- [16] M. Paquot, Towards a productively-oriented academic word list, in: J. Walinski, K. Kredens, S. Gozdz-Roszkowski, *Practical Applications in Language and Computers 2005*, Peter Lang: Frankfurt and Main, 2007, pp.127-140.
- [17] S. Granger, The international corpus of learner English: A new resource for foreign language learning and teaching and second language acquisition research, *TESOL Quarterly*. 37 (2003) 538-546.