GRAMMATICAL VARIATION OF POPULAR SCIENCE.

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ABSTRACT

Due to the growth of popular science, the interest in popular science texts has grown in many fields of studies, especially in English language learning. Popular science texts have received a great interest in English language learning and teaching because it is believed that popular science texts can serve as fruitful material. Popular science texts comprise content words related to science and grammatical words which are also essential for English langue learning. The purposes of this study is to identify types of grammatical words that are frequently used in popular science texts and to investigate a variation of grammatical words found among various sources of popular science texts. The data was retrieved from five sources *(Wikinews, New Scientist, Science news, Nature, Wikipedia*) with 100 texts from each sources and five subject areas (biology, earth, medicine, space, and technology), giving a total of 500 texts to analyze. The data was analyzed by AntConc program to reveal frequent words. The study found a variation of function words among different sources. The teaching implication is also discussed.

Keywords: AntConc, Function words, Grammatical features, Popular science

INTRODUCTION

Due to the increasing concerns about the public understanding of science [1], popularization of science has grown considerably with the expansion of popular texts, especially popular magazines and columns in newspapers [2]. Popular science have been defined by many scholars. For example, Mayers (2003) defines popular science as texts about science that are not addressed to other specialist scientists. More specifically, Hyland (2009) defines popular science as the reporting of scientific facts representing phenomena in different ways to achieve different purposes and is concerned with establishing the novelty of the topics to attract a lay audience [3]. Nwogu (1991) classifies popular science according to the media channels in which popular science takes places, that is, in print media like newspapers and magazines and in the electronic one like radio and television. These definitions are fairly clear and reflect the same goal which is to bring science to the public to make it more publicly available and accessible by communicating lay versions of scientific knowledge as well as opinions of scholars among the public at large [4].

Based on these definitions, several texts can be categorized as popular science texts. For instances, popular science texts can be scientific news reports in newspapers, popular scientific magazines such as Scientific American and New Scientist, and television documentaries as popular science [5]. Hyland (2010) added that popular science includes popular science books written by scientists for an elite educated audience, specialized magazines like New Scientist and Scientific American, daily newspapers that now have specialized science sections and the number of science articles in the press [6]. Since all such texts may be thought of as popular science, it can be seen now that this broad ranging domain can be presented in many formats (e.g. books, television documentaries, magazine articles,

news, web pages, etc.) which are dominated by a range of sources of popular science texts. These examples illustrate that popular science can be referred to various topics and numerous types of texts ranging from scientific articles to TV science documentaries. This also suggests further types of texts that can be referred to as popular science genre such as television program about science, in-depth current science information, biographies of important people in the history of science, science encyclopedia, tips for taking advantage of the new technologies, and articles in Scientific American, best-sellers on cosmology, and books and journals for the general readers discussing science and technology.

These several kinds of popular texts suggest a growth of popular science. Due to the growth of popular science texts, the interest in popular science has grown in many fields of studies. Especially in education, popular science texts have received a great interest because it is believed that popular science texts can serve as fruitful reading material used for teaching scientific literacy (e.g. [7]). For EFL students, learning science in English or learning English through popular science texts could be difficult for them since they are unfamiliar with technical words. On the other hand, popular science texts can make science more accessible to students, and they can play a useful role in the teaching of scientific writing as well as in the teaching of science.

Popular science texts comprise English language that falls into two broad components: the technical and non-technical. The technical words are likely to be content words while the non-technical tend to be function words. Content words carry real meaning such as nouns (Sophie, chair, computer etc.), verbs (hit, swim, eat etc.), adverbs (wrongly, frequently, generally etc.) and adjectives (beautiful, green, fantastic etc.). Function words carry only grammatical meaning such as prepositions (in, on, at etc.), auxiliaries (are, was, do etc.), quantifiers (some, any, all etc.) and pronouns (he, we, this etc.).

Content and function words can be investigated by corpus-based approach which seems to be fruitful not only for language ability but also for profession and learning skills [8]. Since function words are basic to English language learning, this study specifically aims to investigate function words in popular science texts by using corpus-based approach.

OBJECTIVE

1. To identify types of frequent grammatical words of popular science texts
2. To investigate a variation of function words in different sources

METHODOLOGY

The corpus in this study is a principled collection of texts which has been put together for studying grammatical variation of popular science texts. The actual texts selected for the present study must generally be varied but comparable, and be competence examples of this kind of texts. The first step is that the concept of popular science was defined following Hyland (2009) to limit the population of possible texts for analysis. After that, sampling criteria for the study were defined. Only written texts were focused on for practical purposes and to further limit the population. Texts must be not only written by English native-speaking authors but should also entirely be accessible through the internet. It is also worth noting that popular science involves a range of texts that can be characterized as a spectrum reaching from upstream‘ texts close to the site of production of the science, to downstream‘ texts addressed to wider audiences [9], especially the non-scientist or non-specialist. This suggests that the decision on the selection of sources should be firstly based on the assumption that some sources tend to be more popularised than others. Therefore, texts for the investigation must be taken from upstream texts (close to the site of production of the science) to

downstream ones (intentionally addressed to wider audiences). To strengthen the comparability, texts must be of a similar length, within the same period of publication, and cover similar subject areas. 100 texts from each of the five sources shown in Table 1 were selected with an equal coverage of the five subject areas (biology, earth, medicine, space, and technology) giving a total of 500 texts to analyze. To fulfill the purposes of this study, the data was analyzed by AntConc which is a freeware concordance program allowing a quick identification for frequent words in a corpus.

Table 1
Data selection from five sources

Sources	***Wikinews***	***New Scientist***	***Science***	***Nature***	***Wikipedia***
Texts selected for analysis	news stories	news upfront	news of the week	research highlights	featured articles
Description	Science news in news reports	Science news in popular science magazine	Science news in scientific journal	Scientific articles in journals for general scientists	Science encyclopedia

RESULTS

Based on the use of AntConc, frequent words in each source can be identified. Table 2 shows the frequency of top 20 words found in each source. As we can see from Table 2, it is found that grammatical words of all sources tend to be similar.

Table 2
Frequency of top 20 words of five sources

Wikinews		**New Scientist**		**Science news**		**Nature**		**Wikipedia**	
#Word Types: 4667		#Word Types: 4176		#Word Types: 4442		#Word Types: 3353		#Word Types: 4245	
#Word Tokens: 23967		#Word Tokens: 18605		#Word Tokens: 18585		#Word Tokens: 12946		#Word Tokens: 19197	
frequency %	word	frequency %	word	frequency %	word	frequency %	word	frequency %	word
76.48	the	62.30	the	64.25	the	68.59	the	71.99	the
34.92	of	34.56	of	33.58	of	38.39	of	43.91	of
24.83	to	27.09	to	26.69	a	27.81	in	34.69	and
23.82	a	24.29	a	25.13	in	26.34	and	25.68	in
22.24	and	22.95	in	22.55	to	25.10	a	22.19	a
21.78	in	19.51	and	20.45	and	22.40	to	19.27	to
16.11	that	15.16	that	14.42	that	15.60	that	17.61	is
13.02	is	9.84	is	10.33	s	11.05	at	10.84	as
9.60	s	8.01	at	8.56	for	8.03	by	9.12	by
7.22	it	7.90	for	6.46	from	7.57	with	8.75	are
6.88	for	7.74	s	6.30	on	5.87	is	7.92	that

Wikinews		New Scientist		Science news		Nature		Wikipedia	
6.80	have	7.26	it	6.19	at	5.79	for	7.08	with
6.43	on	6.88	with	6.19	with	5.79	from	6.30	from
6.26	are	6.66	be	5.97	as	5.56	as	6.25	it
6.22	as	6.07	as	5.81	is	5.56	s	6.09	s
6.22	from	6.02	by	5.76	it	5.25	his	5.63	for
6.09	this	6.02	from	5.49	have	4.94	university	5.21	an
5.97	by	6.02	says	5.00	by	4.71	they	4.69	was
5.92	be	5.43	are	4.79	says	4.63	colleagues	4.06	on
5.80	at	5.37	they	4.68	they	4.56	be	4.01	its

To identify types of grammatical features of popular science texts, top 100 frequent words of each source were focused. Only function words were clustered and classified. Function words that can be frequently found in every source are shown in Table 3.

Table 3
Types of function words found in all sources

Types	Function words found
Determiners (articles, quantifiers, demonstratives)	a, an, the, other, more, this, that, these, other
Prepositions	at, by, for, in, into, of, on, from, with, to
Conjunctions	and, but, or, as
Auxiliary verbs (Verb to be, verb to have, modal verbs)	be, been, is, are, was, were, has, have, can, may
Pronouns	it, its, they, their, which

In addition, a variation of function words used in different sources can be found in Table 4. From Table 4, it seems that quantifiers and conjunctions are likely to be used in Wikipedia while prepositions are usually used in Nature. Quantity words play a role in highly informational discourse. The higher values make it easier for readers to understand. Coordinating conjunctions are commonly used to show formality in highly informational genres (e.g. academic pose, official documents, and professional letters) [10]. Moreover, modal verbs are heavily used in New Scientist, suggesting that teachers should use New Scientist as a teaching materials for teaching modal verbs and hedging.

Table 4
A variation of function words found in each source

Grammatical Words		Wikinews	New Scientist	Science news	Nature	Wikipedia
Quantifiers	all	1.04	1.45	1.02	0.93	2.19
	some	1.46	1.56	1.83	1.31	0.99
	less	0.63	0.54	0.65	1.16	0.36
	each	0.42	0.75	1.18	0.7	0.36

Grammatical Words		Wikinews	New Scientist	Science news	Nature	Wikipedia
	much	0.42	1.18	0.97	0.31	0.89
	many	0.79	0.81	0.91	0.93	2.14
	most	0.58	1.13	1.02	0.85	3.54
	Average	0.76	1.06	1.08	0.88	**1.50**
Prepositions	up	1.13	2.04	2.37	1.85	0.83
	around	1.29	1.45	0.81	1.62	0.99
	about	1.79	0.91	2.37	1.16	1.88
	between	1.13	1.02	1.29	2.32	1.72
	over	1.46	0.86	0.54	0.31	1.3
	of	34.92	34.56	33.58	38.38	43.91
	in	21.78	22.95	25.13	27.81	25.68
	on	6.43	5.16	6.30	4.02	4.06
	at	5.80	8.01	6.19	11.05	3.54
	by	5.97	6.02	5.00	8.03	9.12
	during	1.00	0.64	0.65	1.24	1.41
	Average	7.52	7.60	7.66	**8.89**	8.59
Conjunctions	and	22.24	19.51	20.45	26.34	34.69
	while	0.88	0.86	0.65	0.31	1.3
	although	0.38	0.27	0.27	0.31	1.35
	because	0.96	1.24	0.81	0.62	0.36
	since	0.88	0.32	0.65	0.39	1.3
	so	1	1.18	1.56	1.08	0.47
	before	0.67	1.13	0.54	0.46	0.36
	after	0.83	1.02	1.29	1.08	0.73
	if	1.13	1.61	1.13	0.31	0.52
	Average	3.22	3.02	3.04	3.43	**4.56**
Modal verbs	may	2.17	2.26	2.48	2.01	1.72
	might	0.42	1.34	0.48	0.39	0.16
	will	3.13	2.2	2.74	0.7	0.63
	would	1.13	1.83	2.15	0.62	0.26
	can	2.17	2.04	2.37	2.47	2.71
	could	1.96	3.55	1.94	3.17	0.36
	Average	1.83	**2.20**	2.03	1.56	0.97

CONCLUSION AND FUTURE WORK

From the findings, it is noticeable that different sources seem to be varied in terms of function words. Based on function words, popular science texts from five sources, on one hand, are similar as they are likely to exhibit the same characteristics. On the other hand, they also differ from one another as each source seems to have different frequent function words.

This suggests language teachers' awareness in using popular science texts as teaching and learning materials. Since different sources of popular science seems to have different characteristics of grammatical features, language teachers should select the source of popular science that comprise grammatical features that they tend to focus. This study also suggests that some sources tend to be formal than others, meaning that the selection of sources of popular science texts should be carefully considered so that the selection match the teaching objectives and learners' abilities.

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REFERENCES

[1] Myers, G. (2003). Discourse Studies of Scientific Popularization: Questioning the Boundaries. *Discourse Studies*, Vol. 5, Pp. 265-279.

[2] Nwogu, K. N. (1991). Structure of Science Popularizations: A genre-analysis approach to the schema of popularized medical texts, *English for Specific Purposes*, Vol. 10, Pp. 111-123.

[3] Hyland, K. (2009). Academic discourse: English in a global context. *Continuum*, London.

[4] Calsamiglia, H. and van Dijk, T.A., 2004, Popularization Discourse and Knowledge about the Genome, *Discourse & Society*, Vol. 15, No. 4, Pp. 369-389.

[5] Calsamiglia, H., 2003, Popularization Discourse, *Discourse Studies*, Vol. 5, No. 2, Pp. 1-8.

[6] Hyland, K., 2010, Constructing Proximity: Relating to Readers in Popular and Professional Science, *Journal of English for Academic Purposes*, Vol. 9, No. 2, Pp. 116-127.

[7] Parkinson, J. and Adendorff, R., 2004, The Use of Popular Science Articles in Teaching Scientific Literacy, *English for Specific Purpose*s, Vol. 23, No. 4, Pp. 379-396.

[8] Bunchutrakun, C., Lieungnapar, A., Wangsomchok, C., & Aeka, A. (2016). A corpus-based approach to learning a tour guide talk. *International Journal of Humanities, Arts and Social Sciences*, Vol. 2, No. 2, Pp. 58-63.

[9] Hilgartner, S. (1990). The dominant view of popularization: Conceptual problems, political uses. *Social Studies of Science*, Vol. 20, Pp. 5159-5538.

[10] Biber, D., 1995, Dimensions of Register Variation: A Cross-linguistic Comparison. Cambridge University Press, Cambridge, pp. 1-428.