A Comparative Study of Reading Text Difficulty of CET-6 and IELTS Based on Coh-Metrix

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Abstract: This study aims to compare the text complexity of reading texts from CET-6 and IELTS using Coh-Metrix, SPSS, and Range. The study found that IELTS reading texts are generally more complicated than those of CET-6 in terms of readability, and there are inherent differences between the two sets of texts. Compared with IELTS reading texts, those of CET-6 exhibit higher narrativity, and higher connectivity, while lower word concreteness, and lower referential cohesion. This reflects the nature of the complexity of a text, namely, referential cohesion can help readers better understand the articles with difficult topics; Moreover, there is no positive relationship between word concreteness and lexical resources.

1. Introduction

College English Test Band Six (CET-6) is an English testing system for Chinese undergraduates and post-graduates. This examination system was created 35 years ago and developed continuously since then. It is a national examination used to comprehensively evaluate the English proficiency of candidates and it is held twice a year (usually in June and December respectively). International English Language Testing System (IELTS), the western counterpart of CET-6, not only enjoys enormous popularity in China, but also takes an extremely large proportion of the international English testing market, especially for students who aspire to further their study abroad. Given the experience of participation in various English examinations, be it in the sphere of listening, reading, writing, speaking, grammar and so on, it would be appropriate for the author to analyse the two examinations in comparison and contrast.

2. Relevant Variables

In this part, the research of the following four variables will be mentioned specifically. They are lexical resources, cohesion and coherence, syntactical difficulty and readability.

Lexical resources have a salient influence on comprehension[1]. Both advanced vocabulary and unfamiliarity can contribute to misunderstanding, but even if the readers are familiar with the topic, reading materials with sophisticated vocabulary will not turn out easier for them than for those who are unfamiliar with the topic.

Sentences with complex structures will decrease comprehension significantly. Meanwhile, enhancing syntactic difficulty reduces comprehension. However, coherent texts are more intelligible than incoherent ones.

A coherent text requires some cohesive devices. Chang et al. pointed out that using linear thematic progression can enhance article quality[2]. In most cases, cohesion aids to understand a given text. However, incoherent texts can promote well-informed readers to come up with inferences and explanations.

A set of rules that assess the readability of a text according to sentence length, word length, etc. are called readability formulas. Nevertheless, these formulas have been widely decried for lack of convincing indicators. Readability formulas are also applied to better investigate text difficulty. The three readability indices in Coh-Metrix are Flesch reading ease score (FRES), Flesch-Kincaid grade level (FKGL) and L2 readability index (L2RI).

Since the former two are calculated based on word length and sentence length, this thesis only uses one of them (FRES). The readability module includes the z-scores and percentiles of the main components of readability. The z-score is the standardized data, namely, the characteristic value of each text minus the average number of the text group, and then divided by the standard deviation. The percentile is between 0 and 100%, and 80% means that the text is easier than 80% of the text. Since the focus of this study is not a single text, but two groups of reading texts, we do not use percentiles. And the formula is 206.835 - (1.015 * number of words/number of sentences) - (84.600 * number of syllables/number of words).

The basic idea is that the longer the word or the sentence is, the more advanced and complex it may be. However, word length and sentence length can only reflect a fraction of text difficulty. These formulas wave aside the language representation, structure, processing and other cognitive factors involved in the process of reading comprehension

Based on a variety of automatic analysis technologies, Coh-Metrix improved the previous single readability formulas and developed Coh-Metrix L2 Readability (RDL2). The calculation formula is - 45.032 + (52.23 * the average number of overlapping content words in adjacent sentences) + (61.306 * the average syntactic similarity of sentences) + (22.205 * the lowest logarithmic word frequency average number of content words in CELEX database). This indicator is especially suitable for second-language learners because it reflects the difficulties that second-language readers encounter in terms of vocabulary, sentence and discourse cohesion.

3. Comparative Analysis of Text Readability of CET-6 and IELTS Based on Coh-Metrix, SPSS and Range

Coh-Metrix is capable of analyzing text difficulty precisely and providing 106 indices for second-language learners, encompassing text readability, word length and infinitive density, to name but a few[3][4].

Since traditional formulas of readability fail to measure text complexity accurately, previous research did not have sufficient study and comparison on IELTS and CET-6 on text difficulty with ample quantitative variables. However, with the emergence of Coh-Metrix, a versatile computational tool, we can quantify various text variables precisely and perfect previous research with the aid of updated computational tools[5][6].

By virtue of Coh-Metrix, the study can scrutinize the intrinsic differences of reading materials in CET-6 and IELTS and make a thorough comparison of indices provided by Coh-Metrix.

3.1. Data Collection

There are two groups of texts used in this study, each including 60 texts for reading comprehension of CET-6 and IELTS from 2017 to 2021. They sum up to more than 120 thousand words. In order to make the research results comparable, we have excluded fast reading, information matching and other questions in CET-6, and only include the careful reading part. The author saved each text in one document, and unified the format of the two groups of text: deleting the title of IELTS reading materials, the glossary and the English interpretation after the text, and deleting the Chinese interpretation of the CET-6 reading text.

In general, this part is aimed at demonstrating the statistics in Coh-Metrix and answering the research questions in the former part. As a comparative study to examine text difficulty of the reading texts of CET-6 and IELTS, key indices (narrativity, syntactic simplicity, word concreteness, referential cohesion, deep cohesion, connectivity, temporality, Flesch reading ease and Coh-Metrix L2 readability) have been selected from Coh-Metrix to analyse lexical resources, syntactical complexity, cohesion and coherence as well as readability.

Table 1. Readability differences between CET-6 and IELTS in Coh-Metrix

Indices	CET-6		IELTS		ANOVA	MD
	M	SD	M	SD		
Flesch reading ease	48.97	10.55	43.12	10.26	CET-6＞IELTS	5.85**
Coh-Metrix L2 readability	12.17	3.56	10.34	2.67	CET-6＞IELTS	1.83*
Narrativity	-0.42	0.59	-0.86	0.41	CET-6＞IELTS	0.44**
Syntactic simplicity	-0.34	0.65	-0.48	0.96	CET-6＞IELTS	0.14
Word concreteness	0.03	0.71	0.39	0.88	IELTS＞CET-6	0.36
Referential cohesion	-1.22	0.76	-0.60	1.01	IELTS＞CET-6	0.66**
Deep cohesion	0.39	0.72	0.58	0.77	IELTS＞CET-6	0.19
Connectivity	-1.95	0.92	-2.24	0.88	CET-6＞IELTS	0.29
Verb cohesion	-0.27	0.61	-0.03	0.77	IELTS＞CET-6	0.24
Temporality	-1.96	0.86	-2.22	0.87	CET-6＞IELTS	0.26

Table 1 represents readability differences between CET-6 and IELTS in Coh-Metrix (M=mean, SD=standard deviation, MD=mean deviation, * represents p<0.05, ** represents p<0.01.).

Table 2. The word frequency distribution of reading materials of CET-6 and IELTS in Range

	Word List	Tokens/%	Types/%	Families
CET-6	1	36081/76.14%	1856/37.37%	849
	2	2620/5.53%	664/13.37%	437
	3	3395/7.16%	748/15.06%	415
	Not in the List	5293/11.17%	1698/34.19%	?????
IELTS	1	61796/74.04%	2199/31.13%	911
	2	4916/5.89%	924/13.08%	558
	3	6101/7.31%	1019/14.43%	483
	Not in the List	10654/12.76%	2922/41.36%	?????

Table 2 illustrates the word frequency distribution of reading materials of CET-6 and IELTS in Range. The number of the word families not in the list cannot be calculated because of the emerging of English neologisms, and they are represented by the symbol (?????).

The author combines the 60 reading texts of each test into one document and then uses Range to analyse the word frequency distribution. The first two word lists of Range software contain two thousand word families, which are derived from the A General Service List of English Words. The third list contains 570 word families, which are derived from the Academic Word List. The word family is usually the reliable criteria for determining the difficulty. Because the two groups of texts are different in tokens and types, we use percentage data to determine the lexical difficulty.

3.2. Data Analysis

Based on Coh-Metrix and SPSS, the results (Table 1) show that there are significant differences in the two groups of texts in terms of Flesch Reading Ease ($p<0.01$) and L2 readability index ($p<0.05$). They also reveal that the readability of reading texts of CET-6 is significantly higher than that of IELTS (MD=5.85, 1.83). Meanwhile, the standard deviation of this Flesch Reading Ease in the two tests is large and similar to one another (CET-6=10.55, IELTS=10.26), suggesting that the data is spread far out, with some of it far away from the mean. This indicates that text difficulty is not consistent. Namely, some articles are more complex than others.

Table 1 and Table 2 have shown the differences between the reading texts of CET-6 and IELTS in the following four aspects.

First, from Table 1, it can be seen that the narrativity of reading texts in CET-6 is significantly higher than that of IELTS (MD=0.44). In addition, the standard deviation of this index in the two tests is small and consistent with each other (CET-6=0.59, IELTS=0.41), indicating that the data is clustered near the mean. In other words, the narrativity in each text is stable. Narrative texts often tell a story, including places, people, events, etc., so there are more verbs, adverbs and pronouns. Narrative texts tend to be colloquial, their topics are generally familiar to people, and the sentences are also easy to understand. The familiarity of the topic means that the narrator will use words with shorter syllables and of higher frequency, and these words are acquired by children at an early age. The simple sentence structure indicates that there are fewer modifiers of a noun phrase and less use of the passive voice. On the contrary, there are more nominal terms in the texts that emphasize information transmission. It can be seen that the topic of CET-6 reading is more familiar to readers than that of IELTS.

Second, Table 1 has displayed that the word concreteness of reading texts in CET-6 is slightly lower than that of IELTS (MD=0.36). The higher the proportion of content words in a text, the more mental images will be activated in readers' minds. The higher the value of word concreteness, the easier the text is to process and understand. On the contrary, abstract words usually represent

concepts that are difficult to visualize and are therefore more difficult to understand[7].

Third, from Table 1, it can be seen that the referential cohesion of reading texts in CET-6 is significantly lower than that of IELTS (MD=0.66). Referential cohesion reflects the extent to which words and ideas in the text are connected as the text unfolds[8]. If there is little overlap between the words of the adjacent sentences, there may be a gap, which will make it difficult for the reader to process. Since noun phrases play a crucial role in cohesion and reference, the cohesion of nouns should be paid special attention to in reading texts.

Fourth, Table 2 shows that the percentage of words in the third list of reading texts in CET-6 (15.06%) is slightly lower than that in IELTS (14.43%), while the percentage of the vocabulary not in the list (34.19%) is much lower than that in IELTS (41.36%), indicating that there are more sophisticated words in IELTS reading materials.

There are no significant differences between the two groups of texts in the indices of syntactic simplicity, deep cohesion, temporality, verb cohesion and connectivity. The followings are the explanations for the five indices between the reading texts of CET-6 and IELTS.

First, the fewer words a sentence contains, and the simpler its syntactic structure is, the simpler and easier it is to process. On the contrary, the more nested the sentence structure is, the more words and opinions the reader needs to store in working memory, and the more complex the syntax is. From the perspective of syntax, the reading texts of CET-6 are equivalent to those of IELTS. Besides, the standard deviation of this index in the two tests is small but different from each other (CET-6=0.65, IELTS=0.96). As is shown below, the curve with a low standard deviation has a high peak and a small spread, while the curve with a high standard deviation is more flat and widespread. Namely, the syntactic simplicity in CET-6 is more steady.
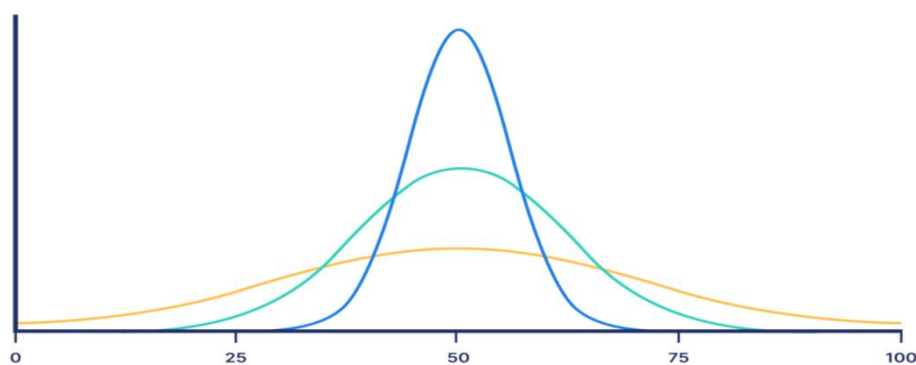

Figure 1. The dispersion of the distribution with different standard deviation

Picture 1 shows the dispersion of the distribution with different standard deviation. The standard deviation of the blue curve is 5, green 10, and yellow 20.

Second, deep cohesion mainly reflects the degree to which the text uses causal and intentional conjunctions in the case of causal or logical relations. These conjunctions can help readers understand events and behaviours, otherwise, readers need to infer causal and logical relationships from the text, which is more difficult to process. The data in Table 1 show that the number of deep cohesion in reading texts of CET-6 is consistent with that of IELTS.

Third, texts with strong temporal coherence contain more temporal cohesion means, and it is more likely that the verb tense and aspect are consistent in a text. Such text helps readers understand the situation pattern and is therefore easier to parse[9]. The data in Table 1 also reveal that the temporality of reading texts of CET-6 is equivalent to those of IELTS.

Fourth, the data in Table 1 suggest that the verb cohesion of IELTS reading texts is similar to that of CET-6 (MD=0.24). This index reflects the degree of verb overlap in the text. If the text uses the

same or similar verbs many times, the event structure may be more coherent, so that readers can better understand the text. This indicator is more effective for narrative texts and readers of low English proficiency[10].

Fifth, the figure in Table 1 represent that the connectivity of reading texts in CET-6 is allied with that of IELTS (MD=0.29). The degree of connectivity reflects the degree to which the text uses explicit coordinating conjunctions (such as and, more, over, etc.), adversative, and comparative conjunctions, and reflects the number of explicit expressions of logical relations in the text.

3.3. Discussions

With the help of Coh-Metrix, SPSS and Range, all the data have been collected and analysed successfully to make a comparative study. Compared to previous research which may use traditional formulas, this study has quantified each index precisely and can provide insights for L2 learners. Based on the data listed above, there are two results that correspond to findings in the previous studies.

First, difficult reading materials may use more implicit cohesive devices than easy ones. The narrativity of reading texts in CET-6 are significantly higher than those of IELTS, while the referential cohesion is significantly lower. Namely, the topic of reading texts of CET-6 is more familiar to readers. Meanwhile, there are more explicit coordinating conjunctions (and, more than, etc.), adversative and comparative conjunctions are used, while there are fewer contextual words (especially nouns) overlap. This inconsistency may be because the IELTS reading texts with low narrativity and difficult themes will use implicit cohesive devices to make up for it. Graesser et al. pointed out that when the topic is difficult and the words and views in the text are not familiar to readers, the author tends to use simpler syntax and more cohesive means to make up for the difficulty and enhance readers' comprehension[8]. McNamara et al. also found that informative texts have simpler syntactic structures and more cohesive devices than other types of texts and that the more cohesive devices are found in reading materials for senior students rather than for junior students[7]. This unexpected phenomenon is due to the author's psychology to compensate for readers' understanding.

Second, word concreteness and lexical difficulty may not be a simple linear relationship. The narrativity of reading texts in CET-6 is significantly higher than that of IELTS, while the word concreteness is slightly lower than that of IELTS. However, even the most basic nouns can be divided into abstract ones (such as thing, person) and concrete ones (such as ball, teacher); Many simple verbs are also abstract (such as do, make). Therefore, the stronger the narrative of the text, the easier the vocabulary may be, but the word concreteness may not be higher. In addition, the data in Table 2 shows that on the whole, the vocabulary of CET-6 reading texts is easier than IELTS, which is contrary to the conclusion of word concreteness. It can be seen that the relationship between word concreteness and lexical difficulty is relatively complex. Graesser et al. also found that the relationship between word concreteness and the grade of students is nonlinear[9]. Specifically, in natural science books for students from kindergarten to grade 12 in the United States, vocabulary becomes more and more abstract with the increase of grade; the reading materials of art and language use more specific vocabulary; the reading materials of social research use more and more specific vocabulary for students who are under grade 5, and that trend reversed afterwards . It can be seen that the subject type is an important variable that affects the specific degree of vocabulary, which needs to be further explored in the future.

4. Conclusion

There are three major findings in this thesis.

First, this study shows that the text difficulty of CET-6 reading materials is lower than that of IELTS. Specifically, the narrative of reading texts in CET-6 is significantly higher than that in IELTS, which shows that the topic is more familiar to candidates. The connectivity of the reading text of CET-6 is similar to that of ILETS, indicating that two groups of texts use explicit coordinating conjunctions (such as and, more than, etc.), adversative, and comparative conjunctions, which are helpful for understanding. However, the word concreteness of reading texts in the CET-6 is slightly lower than that of IELTS, which demonstrates that the meaning of words is more abstract and it is more difficult to stimulate visual images in the reader's brain. The referential cohesion of CET-6 reading texts is also significantly lower than that of IELTS, suggesting that there is less overlap of contextual words (especially nouns) in the text, and the difficulty of readers' processing is greater.

Second, the differences among readability indices in the two tests are not consistent, reflecting the complex nature of a text. For example, the narrative of reading texts in CET-6 are higher than those of IELTS, while the referential cohesion is lower, because more implicit cohesive devices may be used to compensate for the understanding of subjects with difficult themes. For another example, the narrative of reading texts in CET-6 is higher than that in IELTS, and the vocabulary is also easier than that of IELTS, while word concreteness is lower than that in IELTS, indicating that the relationship between word concreteness and the difficulty of vocabulary may be a complex curve, but this needs further research and verification.

Third, there is no significant difference between CET-6 and IELTS in the other readability indices (syntactic simplicity, deep cohesion, verb cohesion, connectivity, and temporality).

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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