A Reading Text Difficulty Analysis of Senior High School English Textbooks (Version A)

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Abstract: This study researches 3 compulsory volumes and 4 selective compulsory volumes of senior high school English textbooks(version A), using Coh-Metrix and the Compleat Lexical Tutor to analyze the Coh-Metrix L2 readability level, five indices(narrativity, syntactic simplicity, word concreteness, referential cohesion, deep cohesion) in Coh-Metrix and the proportion of academic words of their reading texts. The findings are: Overall the reading texts in the selective compulsory modules are more difficult than those in the compulsory modules, but the progressive relationship between the 2 modules is unclear. Scores of the five indices and the proportion of academic words fluctuate across different volumes, but with a general trend of increasing difficulty from compulsory modules to selective compulsory modules, except for the narrativity scores and AW ratio. This study employs a quantitative method to assess textbook difficulty, with the aim of providing insights for future textbook compilation and the enhancement of English teaching practices.

1. Introduction

As fundamental elements of English education, textbooks are main resources for educators and learners in facilitating teaching and learning processes. Textbook compilation should follow the principle of gradual progression; materials in textbooks should go from easy to difficult and from simple to complex[1]. Meanwhile, with the implementation of *General Senior High School English Curriculum Standards (2017 Edition)(Curriculum Standards)*, the cultivation of core competencies in English has become the central goal of senior high school English education[2], with reading ability being a crucial vehicle for language input and cognitive development. Senior high school English textbooks(version A) are widely used in China, and the difficulty analysis of reading texts in them can provide a reference for textbook optimization and teaching plans. Therefore, this research is necessary.

2. Literature review

Difficulty is a crucial dimension in the research of English textbooks. Zou summarized factors influencing the textbook difficulty: Subjectively, students' motivation, ability, etc. as well as teachers' teaching skills, English proficiency can impact their evaluation of textbook difficulty. Objectively, vocabulary, grammar, and learning activities will influence the textbook difficulty[3].

Textbook difficulty analyses started early abroad. In the 1960s, scholars started to use readability

formulas to evaluate the text difficulty. In China, Yue Meiyun introduced Graph for Estimating Readability in the 1980s and calculated the number of average sentences and word syllables to compare the difficulty of different textbooks. Subsequently, some studies used readability formulas to assess text difficulty. Deng et al. (2002) adopted Flesch Reading Ease to measure the readability of the texts in college English textbooks[4]. However, McNamara et al. thinks that traditional readability formulas ignore some cognitive factors[5]. Coh-Metrix is a computational tool designed by Graesser, McNamara, and colleagues to analyze discourse on multiple levels. Its L2 readability index considers content word overlap, sentence syntactic similarity, word frequency, as well as the cohesion between sentences in the text[5], overcoming the limitation of traditional readability formulas that only account for surface-level features of a text. It can correctly classify 59% of the reading texts by level, which is more accurate than Flesch Reading Ease Formula and Flesch Reading Ease[6]. Coh-Metrix has been applied to analyze language development and discourse features in second language learners. Crossley et al. (2014) investigated syntactic complexity in L2 writing through Coh-Metrix, revealing that syntactic development correlates with time spent in writing lessons[7]. Another strand of research uses Coh-Metrix to examine the difficulty of reading comprehension texts in tests. Jiang and Han (2018) conducted a comparative analysis of 163 reading texts from CET-6, TOEFL, and IELTS by using Coh-Metrix[8]. These studies measure textbook difficulty from indices of Coh-Metrix, while other aspects such as academic vocabulary are paid less attention to.

Up to now, there remains a paucity of studies about the textbook difficulty[9]. Furthermore, textbook studies of higher education predominate, while those of basic education receive less attention[9]. The searching results of "English textbook difficulty of senior high school" in CNKI present that textbooks by People's Education Press(PEP) and Yilin Press are often studied. Chen, S. (2021) researched the text difficulty in textbooks by PEP through lexical level, syntactic level, and the Flesch formula[10]. Chen, X. (2022) compared two editions of textbooks by Yilin Press with regard to lexicon, syntax, cohesion and coherence, and readability[11]. Nevertheless, there is no research of English textbooks(version A).

Based on the above review, this study will extract the reading texts from 7 volumes of version A and analyze their difficulty through Coh-Metrix L2 readability level, five indices in Coh-Metrix and the proportion of academic words, answering the following questions: (1) What are the evolving features of the text difficulty among the 7 volumes in light of seven dimensions? (2) Does text difficulty increase significantly with the progression of textbook volumes? (3) What are the implications of this study's findings for textbook compilation and teacher's instruction?

3. Methodology

3.1. Research data

There are 3 compulsory volumes(C1-C3) and 4 selective compulsory volumes(SC1-SC4) in senior high school English textbooks(version A). Each volume has three units, in which there are 2 lessons for reading. Thus, there are 42 reading texts in the all 7 volumes, which are chosen as research data.

3.2. Instruments and procedures

To evaluate the difficulty of the reading texts, Coh-Metrix and the Compleat Lexical Tutor(CLT) will be used. Coh-Metrix can provide L2 readability score, through which people can have a general and quick review of text difficulty. It can also measure scores of narrativity, syntactic simplicity, word concreteness, referential cohesion, deep cohesion and other indices. The first five indices

account for 54% of the variance[5], which can give deep characteristics of texts. Therefore, the five indices are chosen to analyze. CLT is a large corpus developed by Professor Tom Cobb of the University of Quebec. It has a tool named Vocabprofile, which can measure the proportion of AW. It evaluates AW ratio based on Academic Word List by Coxhead.

The study will measure the texts in each volume through Coh-Metrix to know readability and five indices of them, examining both surface and deep characteristics. Subsequently, CLT will be used to evaluate the proportion of AW. Finally, this study will analyze the reading text difficulty of textbooks in light of the 7 dimensions through the statistics, find out the changing trends and gain some implications.

4. Results and discussion

Table 1: RDL2, Five Indices and the Proportion of AW of Textbooks

(Values are rounded to two decimal places)

Textbook	C1	C2	C3	SC1	SC2	SC3	SC4
RDL2	21.33	19.03	18.80	20.61	19.44	18.13	18.29
Mean		19.72			19.12		
Narrativity	69.5	57.53	57.93	71.23	70.88	51.60	70.54
Mean		61.65			66.06		
Syntactic Simplicity	87.29	69.85	75.80	64.43	62.17	79.10	67.36
Mean		77.65			68.27		
Word Concreteness	59.48	58.71	53.59	46.41	48.40	45.22	57.53
Mean		57.26			49.39		
Referential Cohesion	22.66	26.76	31.92	21.77	33.36	16.11	22.96
Mean		27.11			23.55		
Deep Cohesion	87.29	80.51	76.11	76.73	85.77	85.3	53.6
Mean		81.3			75.35		
The Proportion of AW(%)	1.78	4.1	2.72	2.22	3.21	2.99	3.02
Mean		2.87			2.86		

4.1. Coh-Metrix L2 Readability (RDL2)

Table 1 shows that mean RDL2 of compulsory textbooks is 19.72, greater than that of selective compulsory textbooks(19.12). As a higher RDL2 score indicates lower reading difficulty, it can be concluded that overall selective compulsory parts are more difficult than compulsory ones. All students must take compulsory courses to lay a common foundation for the key literacy of the English subject; selective compulsory courses form a progressive relationship with compulsory courses[2]. This means that selective compulsory courses are at a higher level of difficulty compared to compulsory courses. Therefore, version A textbook comply with the principles in *Curriculum Standards*. Among all 7 volumes, the RDL2 scores present a general downward trend in compulsory parts and selective compulsory parts respectively, indicating an increase in text difficulty, which aligns with the progression of textbook design and students' cognitive development. In the compulsory modules, the RDL2 values indicate a steady increase in difficulty. From SC1 to SC4, the selective compulsory modules present the overall rise of difficulty despite the a slight drop in SC4. SC1 and SC2 are relatively easy, whose difficulty is between C1 and C2. This may cause a lack of a clear progression from the compulsory volumes.

4.2. Five Indices from Coh-Metrix

4.2.1. Narrativity

PCNARp is an important indicator of the level of narrativity in a text. Narrativity scores indicate the extent to which a text is likely to contain more familiar, oral language that is easier to understand[5]. In the compulsory modules, narrativity scores decrease from C1 to C3, meaning that reading materials change from narratives to more abstract and informational texts. This progression aligns with people's cognitive development. As students progress through school, they need the increasingly complex comprehension, reasoning skills, and knowledge[12]. In this regard, those non-narrative texts are suitable for students in higher grades. However, in the selective compulsory modules, despite the low narrativity of SC3(51.60), SC1, SC2, and SC4 exhibit narrativity scores above 70, a relatively high level of narrativity. Mean PCNARp of the selective compulsory courses is higher than that of the compulsory ones, thus generally the selective compulsory courses are easier to understand in terms of the genre. This contradicts the expectation that students in higher grades should be exposed to non-narrative texts.

4.2.2. Syntactic Simplicity

PCSYNp is an index of syntactic simplicity. The higher it is, the simpler the syntactic structures are. While syntactic simplicity fluctuates among some modules, the overall pattern presents an increase in difficulty as the mean score of the selective compulsory textbooks is lower than that of the compulsory ones. Texts at lower grade levels tend to have simpler syntax[5]; therefore, from a syntactic perspective the compilation of version A in the distinction between the compulsory and selective compulsory modules appears generally reasonable. Nevertheless, the values do not show a constantly decreasing trend in sequencing of the volumes; instead, they are unstable. SC1 and SC2 show steadily low scores, yet SC3 dramatically rises to 79.10. According to C. Graesser et al., writers use simpler syntax on the informational texts in which readers have lower prior knowledge to compensate for the more unfamiliar and challenging subject matters in informational texts[13]. As discussed in 2.1, SC3 demonstrates low narrativity. Consequently, the use of simpler sentence structures in C3 may serve as a counterbalance for the less narrative content.

4.2.3. Word Concreteness

PCCNCp indicates word concreteness. Texts containing content words that are concrete and meaningful and evoke mental images are easier to process and understand[5]. Overall, the vocabulary in selective compulsory courses is less concrete than compulsory ones, which demonstrates progressive difficulty. Specifically, the compulsory modules show a continuous decline in word concreteness from C1 to C3, indicating a shift towards more abstract vocabulary. In contrast, the selective compulsory modules fluctuate more markedly: OC1 and OC2 score 46.41 and 48.40, OC3 reaches the lowest at 45.22, reflecting highly abstract vocabulary and increased comprehension load, while OC4 rises sharply to 57.53.

4.2.4. Referential Cohesion

Referential Cohesion can be reflected through PCREFp. A text with high referential cohesion contains words and ideas that overlap across sentences and the entire text, forming explicit threads that connect the text for the reader[5]. Therefore, texts with lower cohesion are commonly more difficult to comprehend. The average referential cohesion for compulsory modules is 27.11, while the average for selective compulsory modules is 23.55. The higher average score in the compulsory

modules suggests that these texts tend to provide stronger referential ties, which support comprehension. Conversely, the average score of the selective compulsory modules mean that these texts are connected with less lexical overlap, which will pose challenges for readers in processing the text. Across volumes, PCREFp fluctuates without a clear trend.

4.2.5. Deep Cohesion

PCDCp represents deep cohesion, indicating the presence of causal and intentional connectives that enhance the reader's understanding of causal events in the text[5]. The average deep cohesion score for compulsory modules is 81.3, while that for optional compulsory modules decreases to 75.35, showing a decline in text cohesion. This follows the principle of progressing from easy to difficult, as higher-grade students typically have stronger comprehension and inference skills. Furthermore, a text that requires gap-filling inferences is beneficial for learning, provided the learner has an appropriate knowledge background[14]. In this respect, the overall downward trend is conducive for students to develop reading capacity. But in SC2 and SC3 the deep cohesion scores are high, which may influence students' reading skill cultivation.

4.3. The Proportion of Academic Words (AW)

Academic vocabulary serves as a reliable criterion for evaluating text difficulty[15]. It causes a great deal of difficulty for learners, because students are comparatively unfamiliar with it and because academic lexical items occur with lower frequency than general-service vocabulary items do[16]. Consequently, selective compulsory modules should have a higher proportion of academic words. The average academic word percentage for compulsory modules is 2.87%, while for selective compulsory modules it is 2.86%. Besides, the proportion of AW does not increase across volumes and it displays fluctuations, which does not align with the expected difficulty progression. Generally, selective compulsory modules own higher proportion of AW, but the great value of C2 leads to high mean score of compulsory volumes. It is reasonable to consider reducing the percentage of AW in C2.

From the above data analyses, the main findings are as follows. In terms of Coh-Metrix L2 readability, reading texts in selective compulsory modules are more challenging than those in compulsory modules, but the inadequate text difficulty in SC1, SC2 could lead to unclear progression between compulsory modules and selective compulsory modules. From the perspective of five indices from Coh-Metrix and the AW ratio, the scores fluctuate across volumes, but mostly go from easy to difficult from compulsory modules to selective compulsory ones. These results can be explained by the fact that various factors account for text difficulty, thus those indices change very often in different kinds of texts. Nevertheless, the scores of narrativity and AW proportion present unexpected trends as they indicate that texts become easier in light of the two dimensions.

This study, on the one hand, could provide references for textbook compilation. It is recommended that textbook developers pay attention to creating a gradient of complexity across different volumes of textbooks. Text difficulty in SC1, SC2 and SC4 can be enhanced, which can result in more apparent difficulty progression. In *Curriculum Standards*, compulsory textbooks encompass narrative writing, expository writing, applied writing, etc. In addition to the text types that compulsory books have, selective compulsory textbooks contain argumentative writing, reports, etc. Textbook developers can increase the proportion of argumentation and other non-narrative texts so that students can better cultivate their reasoning skills. Besides, the proportion of academic vocabulary can be adjusted. As students progress, they should be exposed to more academic words. Selective compulsory textbooks can include more academic words, and academic words in C2 can be reduced. On the other hand, this study can assist teachers in ameliorating teaching. They can

adjust the teaching sequence of the texts based on quantitative analyses of related dimensions to achieve gradual difficulty rise. Furthermore, teachers can understand the text difficulty level and deep text characteristics, and adopt appropriate teaching techniques to help students overcome potential challenges in the texts. For example, when teaching texts with low narrativity, teachers can provide background knowledge for learners. What is more, teachers can offer additional reading materials for some relatively simple texts; for instance, for texts with simple vocabulary, they can supplement articles on the same topic but with more difficult vocabulary.

5. Conclusion

This research evaluates reading text difficulty of version A through Coh-Metrix and CLT. Firstly data are recorded and subsequently analyzed based on different dimensions. It reveals that generally the reading text difficulty in the selective compulsory modules is higher than that in the compulsory modules, but the progressive relationship between the 2 modules is not obvious. The scores of the five indices and the AW ratio show fluctuations across various volumes; there is an overall tendency for difficulty to increase from compulsory modules to selective compulsory modules, with the exception of the narrativity and the AW ratio. These findings can contribute to textbook optimization and teaching improvement. This study only selects several indices to assess text difficulty, but there are diverse factors impacting text difficulty. Future studies can consider other dimensions, such as grammar, learning activities, to make a more comprehensive assessment for textbook difficulty.

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